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

Contents Themes:

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.
5. Biomechanical and informational tools and technologies in physical education and sport.
6. Management, psychological-educational, sociological and philosophical aspects of physical education and sport.

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CONTENT

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Analysis of the current state of implementation of fitness clubs personnel policy

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The article analyzes the current state of implementation of the personnel policy of fitness clubs in Kharkov. The directions of reforming the system of recreational and motor activity are proposed.

Purpose: *to reveal the main provisions of the mechanism for the implementation of personnel policy in the system of recreational motor activity (for example, fitness clubs).*

Material & Methods: *method of analysis of scientific literature and documentary sources, analysis of advanced domestic experience, method of system analysis, method of sociological survey, methods of mathematical statistics. The survey was conducted in order to analyze the state and prospects of development of the system of health and recreational motor activity of the population at the regional level (in particular, aspects of the implementation of personnel policy by fitness clubs). 53 respondents took part in the survey, among them 10 were representatives of the management of the physical culture and sport bodies and the "Sport for All" system, 12 were scientific and pedagogical workers, 31 were representatives of fitness clubs in Kharkiv.*

Results: *evealed the mechanism for implementing personnel policy by fitness clubs, analyzed the state and prospects of this area of work in the field of fitness.*

Conclusion: *as a result of the study, the functions that are performed by a competent fitness club specialist are summarized. A mechanism for the implementation of personnel policy by the subjects of the fitness industry has been formed and the principles for its implementation have been substantiated. Established priority measures to reform the fitness industry in the context of the implementation of personnel policy.*

Keywords: *personnel policy, fitness club, subjects of the system of recreational motor activity, optimization.*

Introduction

In modern conditions, the issue of creating the necessary conditions for attracting people to the daily and specially organized motor activity of proper duration, intensity and regularity is being actualized. In Ukraine, for a number of objective and subjective reasons, significant reserves remain to be realized to increase people's motivation for physical activity, form relevant interests, use the organizational and management capabilities of various subjects of the recreational motor activity system, determine strategic directions and substantiate innovative technologies to create an environment, encourage the use of recreational and motor activity [1; 7; 9].

The organizations of the fitness industry, namely fitness clubs, and their main active resource, human resources, can make a significant contribution to improving the health of citizens and establishing a healthy lifestyle [3; 5; 6].

The targeting of effective management in the field of fitness should take the vector of optimal personnel policy in all subjects. Meanwhile, factors hindering the development of the fitness industry in our country, lacked personnel and low level of professional training of specialists working in this area [2; 4; 8]. This gives grounds to consider the personnel policy of the subjects of the system of recreational and recreational motor activity of the population (in particular, fitness clubs) as an independent subject of research.

Purpose of study: to reveal the main provisions of the mechanism for the implementation of personnel policy in the system of recreational motor activity (for example, fitness clubs).

Material and Methods of the research

In order to analyze the state and prospects of development of the system of recreational and recreational motor activity of the population at the regional level (in particular, aspects of the implementation of personnel policy by fitness clubs), a survey was conducted. 53 respondents took part in the survey, among them 10 representatives of the management bodies of the physical culture and sport and the "Sport for All" system, 12 scientific and pedagogical workers, 31 representatives of fitness clubs in Kharkov.

Research methods: analysis of special scientific literature and documents, analysis of advanced domestic experience, method of system analysis, organizational analysis, sociological survey method, methods of mathematical statistics.

Results of the research

Personnel policy is a strategic activity with goal-setting, ideological and software formation of the development and use of human, labor, human resources as the main prerequisite for the construction of any economic unit. This activity is systemic and dynamic in nature and is implemented by state and local government bodies, directly by economic actors and other stakeholders. Personnel policy is carried out through

targeted joint actions of all stakeholders in the format of social dialogue.

In a broad sense, the term "state personnel policy in the field of fitness" should be understood as the systemic activity of state authorities aimed at the formation, improvement, implementation of a set of standards, professional requirements for employees, pedagogical and other industry workers, the criteria for their selection, training and retraining, raising the level of qualification, rational use of personnel potential and its preservation on the main quantitative and qualitative forecasts and development prospects of the fitness industry..

As the results of the organizational analysis of the activity of fitness clubs show, the personnel policy is closely connected with all branches of their economic policy. The generalization of the advanced domestic experience in the formation and implementation of personnel policy in the field of fitness has shown that in practice a mechanism is being implemented which is based on fitness clubs, focusing on organizational goals, analyzing the influence of internal and external factors, apply certain principles that determine the personnel policy of an individual subject (Figure 1).

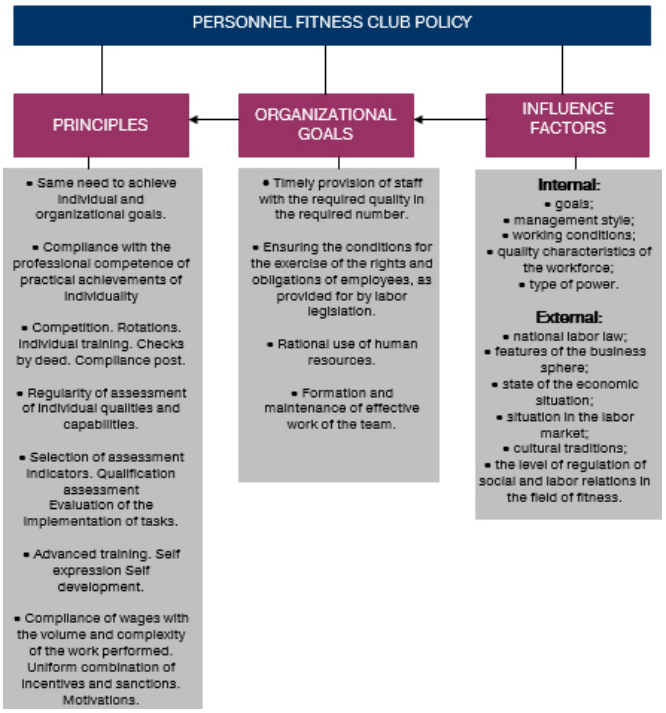

Figure 1. Mechanism for the implementation of personnel policy by the subjects of the fitness industry

Personnel policy provides for the development of specific actions to manage the staff to address the objectives of the fitness club. Competently developed personnel policy allows you to structure all activities with staff into a coherent system, which in future will be aimed at increasing staff productivity and the performance of the club. As you know, the fitness club staff consists of:

– attendants;
– coaching staff;
– specialists of additional services;
– leadership.

In the area of work and staff training, administrative management should solve certain tasks, namely:

- recruitment of employees who will carry out activities within the framework of a fitness project (in accordance with official duties), taking into account the steadily growing demand for specialists in the fitness industry;
- carrying out training work among staff in the development of communication skills (the ability to work a fitness trainer in clubs of different formats and customer requests)
- providing opportunities for productive activities and at the same time reducing the staff turnover rate (building team spirit), taking into account the need to update and diversify services.

The analysis of this work of 15 fitness clubs in Kharkov allowed the following ways to search for personnel to be established:

- placing an ad on the search for instructor group programs on thematic platforms on the Internet and city boards, followed by an interview;
- self-education of future instructors by a specialized specialist in fitness.

And all clubs use both of these ways, because:

- the fitness club teaches future professionals precisely those aspects of work that satisfy the needs of visitors to a particular fitness club;
- an opportunity to learn more about a potential fitness trainer before actual employment (conducting trial workouts, individual examinations, psychological factor assessment);
- increases the level of loyalty and involvement in the activities of the club;
- tuition allows you to increase the income of the club.

Along with this, the disadvantage is that these instructors are not experienced, therefore, it is necessary to carefully monitor the quality of the services provided.

As a result of the study, we found that, according to the respondents, the competent fitness club specialist performs the following functions:

1) recreational and educational;
2) value and health;
3) motivational;
4) social and cultural;
5) educational.

(The degree of consistency of the respondents is W – 0,74)

It was also found that 77,3% of respondents consider the level of provision of domestic fitness clubs with qualified specialists in management, marketing and administration is not high enough. A significant number of specialists surveyed (66,9%) consider the level of provision of domestic fitness clubs with qualified fitness trainers is not high enough. This, in our opinion, is explained by the chosen ways of implementing the personnel policy of the administration of the studied fitness centers, which need to be optimized and coordinated with all the subjects of the system of recreational and physical activity of the population.

This fact is confirmed by the respondents' ranking of the

specified personnel selection criteria in the system of fitness clubs:

1) the level and profile of education;
2) professional skills;
3) the nature of the motivation to work;
4) personal skills;
5) level of motivation;
6) age;
7) appearance;
8) gender.

(The degree of consistency of the respondents is W – 0,71) (Figure 2).

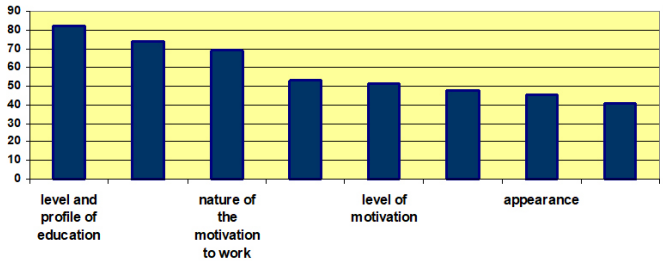

Figure 2. Criteria selection of staff in fitness clubs

It was also found that 87% of respondents are confident that having a higher education diploma cannot be fully considered the final point in the education of a specialist in the field of fitness. Fitness is not a field in which a person, when he has received a certificate or diploma, can work for many years in the same way. Fitness trainer must constantly improve, possess certain personal qualities. This process is creative and requires a search for new approaches.

A certain place in the implementation of the optimal personnel policy is given to the difficulties that exist in the work of a fitness specialist (W – 0,81).

1) Set and acquisition of groups.
2) Most busy social work.
3) Lack of educational materials.
4) Deficiencies in the medical support of the training process.
5) The difficulties associated with the conditions of life and life.
6) Insufficient personal experience of coaching.
7) Lack of a coordinated friendly team.
8) Insufficient development of some personal qualities and character traits.
9) Lack of skills to organize their work rationally.
10) Disadvantages of management and marketing of fitness services.
11) Large workload of economic issues.
12) The difficulties associated with underestimation of recreational and motor activity of the population, in particular, young people.

As shown by the results of the study, personnel policy is closely connected with all branches of the economic policy of the organization. From the main goal of the personnel policy, it is possible to derive sub-goals for personnel management, for example, to provide labor resources of a certain quality and quantity of a fixed term, for a fixed period, for certain jobs. On the basis of such targets, you can determine the content of personnel policy in the organization. The basic principle of personnel policy is that it is still necessary to achieve individual and organizational goals.

Conclusions / Discussion

Summarizing the advanced domestic experience in the formation and implementation of personnel policy in the field of fitness showed that in practice its basic provisions are already implemented in accordance with certain principles, based on the goals of fitness clubs and analyzing the influence of internal and external factors determining the personnel policy of the subject. Analysis of current aspects of the problem of implementation of personnel policy in the field of fitness, based on the results of the study, showed that the priority measures for its reform are: consolidating at the legislative level the issue of working in the fitness clubs of specialists exclusively with specialized physical education (81,7%); expansion of the network of available fitness clubs (64%); development of accessible tools for organizing self-healing and recreational motor activity of the population (58%). Issues of state regulation and control over the functioning and development of the fitness industry, in particular, the implementation of personnel policy by fitness clubs, and representatives of the private sector remain debatable.

Prospects for further research are to develop an optimal model of personnel management in the field of fitness.

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Characteristic differences in the choice of factors of a healthy lifestyle as components of the individual physical culture of modern schoolchildren

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The article describes the factors of a healthy lifestyle, which adhere to schoolchildrens of different ages.

Purpose: *to explore the age-related features of the formation of the factors of a healthy lifestyle as components of individual physical education of schoolchildren of 11–17 years old.*

Material & Methods: *628 people took part in the study (282 young men; 346 women). In order to solve the research problems, a survey was conducted of respondents "Determining the motives and interests of schoolchildren in the field of physical culture and sports".*

Results: *it has been determined that motor activity, as one of the main factors of a healthy lifestyle in boys and girls aged 14–17, remains in the last place, except for sports class schoolchildrens. It is proved that only 34,1% of graduates, 48,9% of schoolchildrens in the 9th grade and 33,3% of ten schoolchildrens do not use alcoholic beverages. The highest percentage among smokers is in the 7th and 8th grades (33,3% and 22,7% respectively). Young men graduates are more likely to have a healthy lifestyle, and the percentage of those who smoke is reduced to 14,6%. Among the girls, it was found that 23,3% of ninth-graders smoke.*

Conclusion: *it is proved that in the age aspect there are quite significant differences between the boys and girls in choosing the priority factors of a healthy lifestyle, which they adhere to during the week. Attitudes towards bad habits are also different and ambiguous. That is, with age, the priorities of the value orientations of young people change, and the gender factor influences the formation of young men and women's views on maintaining a healthy lifestyle.*

Keywords: *schoolchildren, boys, girls, healthy lifestyle, physical education, sports, bad habits.*

Introduction

The deep socio-economic crisis that engulfed all sectors of the economy and the sphere of human life in Ukraine, military operations in the east of the country led to significant irreversible demographic losses.

According to the annual report on the state of health of the population, the sanitary-epidemic situation and the results of the Ukrainian health care system in 2016, alarming figures confirm that a significant part of the population of Ukraine leads an unhealthy lifestyle, in particular, the vast majority of Ukrainians are influenced by such risk factors as smoking, alcohol abuse, unhealthy diet, lack of physical activity and the like. Therefore, the preservation and strengthening of the health of the younger generation today is one of the urgent problems. The solution of this problem is of high social significance and is among the most important tasks of the state, since children's health is a fundamental basis for the formation of public health, the labor potential of the country and is a factor of national security [19].

This problematic has become especially actualized in the second half of the twentieth century both in the world as a whole and in Ukraine. The search for effective ways to form a healthy lifestyle is an interdisciplinary problem. WHO experts have determined the approximate ratio of various factors to ensure the health of modern man. It is believed that about 50% of health is determined by lifestyle – working conditions, habits, nutrition, moral and psychological stress, material and living conditions, relationships in the family, etc. By 20% health depends on the genotype and 20% – on the state of the environment. And only 10% of health is due to the health system [22]. It is easy to understand that it is much more effective to form a healthy lifestyle, value-motivational settings on health than to change the genotype and environment - more conservative and stable components. Therefore, scientists point out that the image of his life is of great importance for the preservation of the health of the younger generation. But, unfortunately, the modern youth in the vast majority of cases do not think about their behavior, carelessly relate to their health, cultivate bad habits. It is known that almost 75% of adult diseases are obtained by them in childhood and adolescence. I. Vorontsov notes that the problem of the formation of the basis of a healthy lifestyle is especially relevant for schoolchildrens of school age, since during this period the development of its own program of life occurs, and the child is included in the complex work on the formation of self-reflection, self-control and self-regulation [5]. At the same time leading scientists [1–3; 6] the main factor of strengthening and preservation of health consider systematic motor activity, is formed in the process of physical education. The problem of the formation of a healthy lifestyle is sufficiently elucidated in many scientific works of modern scholars [8; 9; 13; 16; 22]. Scientists also proved that biological, sexual and psychological differences between boys and girls can, by correcting, influence the pupils 'conscious attitude towards physical education and sports, and develop their healthy lifestyle habits [12; 15; 17; 20]. At the same time, the question of the characteristic differences in the choice of factors of a healthy lifestyle of

schoolchildren in the age aspect and sexual aspects was not the subject of special studies. Given the social significance and relevance of the problem, which involves the educational, recreational and general educational effect in the process of physical education, as a pledge of optimal intellectual, spiritual, social and physical development of schoolchildren, the relevance of this study is determined.

Purpose of the study: to explore the age-related features of the formation of the factors of a healthy lifestyle as components of individual physical education of schoolchildren of 11–17 years old.

Material and Methods of the research

The contingent of schoolchildren of 5–11 grades was investigated with an increase in the representativeness of the sample. The total number of respondents was 628 people (boys – 282; girls – 346). The results of the study stratified according to the age periods of the physiological development of children and biological sex. The reliability of differences between individual results is calculated at the level of reliability $p<0,05$ to $p<0,1$, which indicates the possibility of taking them into account when developing practical recommendations for physical culture teachers, as well as for further interpretations.

Results of the research

The attitude of a person to his own health is determined by many factors. From the place occupied by health in the value system of a young person, his attitude to a healthy lifestyle depends. A healthy lifestyle in the youth environment is becoming more meaningful. In the practice of physical culture, the following main factors of a healthy lifestyle are considered: motor activity, the absence of bad habits and healthy eating. Consider the attitude of young men and women to the value of health through the lifestyle they lead. To determine the preferences of schoolchildren about the factors of a healthy lifestyle, which they adhere to during the week, we asked the question: *"What factors of a healthy lifestyle do you follow during the week?"*. Respondents were given 5 answers: cold water hardening, personal hygiene, sleep, balanced eating, movement and bad habits (that is, their absence) (Tables 1, 2).

The results of the study determined that the children of the 5th and 6th grade (11–12 years old) arranged the factors of a healthy lifestyle as follows: first place - cold water hardening, second – personal hygiene, third – no bad habits and eating patterns (most likely, the guys noted the factors about which the teacher spoke, and not those that they adhere to (Table 1). The 7th grade youths in the priority factors are: the absence of bad habits, personal hygiene and motor regime.

In girls of the 5th and 6th grades, the priority is somewhat different factors of a healthy lifestyle: personal hygiene, sleep patterns, movement patterns and the absence of bad habits (Table 2). Analyzing the answers, it should be noted that among the boys and girls from the 9th to the 11th grades (14–17 years old) the factor "personal hygiene" was determined primarily among other factors of a healthy lifestyle. Then, according to the rating, the guys have no bad habits, the girls have a sleep mode and a meal mode. Unfortunately, the motor mode as one of the main factors of a healthy lifestyle among boys and girls 14–17 years old remains in last place, except for schoolchildrens of sports classes (in this category of respondents the motor mode takes second and third positions, entering the top three). On the absence of bad habits, then only girls of 14–15 years old, the main factor for themselves was determined by the "absence of bad habits".

The value attitude of schoolchildrens to their health is manifested in their method and lifestyle. The study stipulated that

Table 1

Factors of healthy lifestyle, which schoolchildren adhere to during the week (boys, points, rating)

Answer choices	5th class		6th class		7th class		8th class		9th class		10th class		11th class	
	$\bar{x}$	Rating	$\bar{x}$	Rating	$\bar{x}$	Rating	$\bar{x}$	Rating	$\bar{x}$	Rating	$\bar{x}$	Rating	$\bar{x}$	Rating
Cold water hardening	3,00	**1**	2,70	**1**	3,93	5	3,68	4	3,88	2	4,58	6	4,24	**1**
Personal hygiene	3,00	2	3,22	2	3,47	3	3,32	2	2,98	6	2,83	**1**	2,24	6
Sleeping mode	3,67	4	4,13	6	4,33	6	3,59	3	4,31	**1**	3,25	3	3,80	3
Meal Mode	3,56	3	3,78	4	3,87	4	3,00	**1**	3,71	3	3,83	5	3,34	4
Motor mode	3,69	5	3,83	5	2,93	2	3,73	5	3,50	5	3,42	4	3,88	2
No bad habits	4,31	6	3,35	3	2,47	**1**	3,91	6	3,55	4	3,08	2	4,24	**1**

Table 2

Factors of healthy lifestyle, which schoolchildren adhere to during the week (girls, points, rating)

Answer choices	5th class		6th class		7th class		8th class		9th class		10th class		11th class	
	$\bar{x}$	Rating	$\bar{x}$	Rating	$\bar{x}$	Rating	$\bar{x}$		$\bar{x}$	Rating	$\bar{x}$	Rating	$\bar{x}$	Rating
Cold water hardening	4,25	6	4,41	6	4,92	6	2,71	**1**	3,90	3	4,00	4	4,85	**1**
Personal hygiene	2,68	**1**	2,94	2	3,75	4	3,24	2	2,20	6	2,00	**1**	1,83	6
Sleeping mode	3,29	3	3,88	5	4,00	5	3,71	4	3,03	5	4,53	6	3,58	4
Meal Mode	3,79	4	3,76	4	3,50	3	3,86	6	3,33	4	3,47	3	3,65	3
Motor mode	3,79	5	3,59	3	2,75	2	3,71	4	4,00	2	4,27	5	3,71	2
No bad habits	3,21	2	2,41	**1**	2,08	**1**	3,38	3	4,17	1	2,53	2	4,85	**1**

the formation of a healthy lifestyle in the theory and practice of education should be most logical in the process of physical education of schoolchildrens, since the formation of knowledge, skills and abilities of a healthy lifestyle is one of the main tasks of physical education of the younger generation. In our opinion, due to the lack of relevant knowledge and attitudes, schoolchildren do not have well-defined associations with the concept of a "healthy lifestyle". This is confirmed by the fact that such an important factor in a healthy lifestyle as the motor mode was not determined by our respondents in the first place in the same age category of respondents.

Scientists note that the teenage period is considered a period of relatively good health. It is also the time of enormous changes in the physical, mental and social conditions, on the background of which the behavior consists, affects the health. The patterns of behavior that are formed in the early period of life are often preserved in adulthood. The most devastating impact on the health of adolescents today is the spread of harmful habits: smoking, alcohol, drugs and their consequences [4].

Consider bad habits in the life of schoolchildren (Figure 1, 2). The study found that the largest percentage of young people who smoke are in the 7th and 8th grades (33,3%, 22,7%, respectively). In the 11th grade, boys are more healthy and the percentage of smokers is reduced to 14,6%. We received alarming data on girls' smoking: 23,3% of ninth-graders smoke constantly, 33,3% of seventh-graders and 28,5% of 8th grade pupils know fashion and sometimes smoke. 25% of high school students previously abused, but subsequently quit smoking. It should be noted that, despite the proclaimed health-improving orientation of physical education, health did not become the main value of physical education in school.

Scientists argue that drinking alcohol is closely linked to the following typical behaviors of older adolescents: the reaction of emancipation and the reaction of grouping with peers.

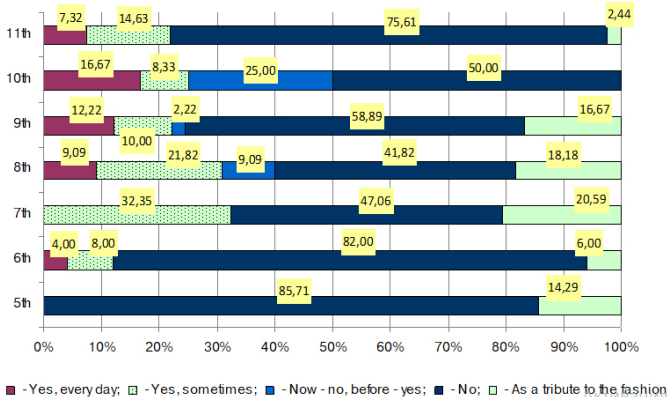

Figure 1. Number of boys who smoke (%)

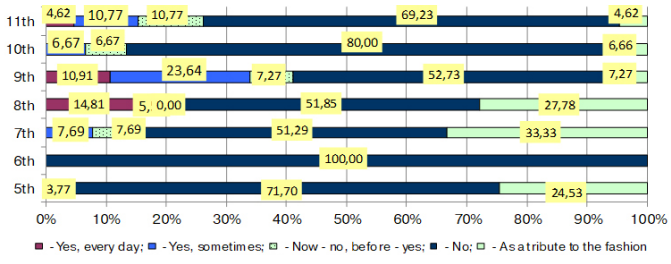

Figure 2. Number of girls who smoke (%)

Drinking can lead to serious and irreversible complications of health, such as brain disorders in adolescents, causing permanent memory problems, persistence of attention and reaction time, increased ability to damage the liver at an early age, hormonal imbalance, necessary for normal development of organs, muscles and bones – in particular, during puberty [4]. According to the results of our study, 13,33% of fifth-graders, 21,74% of 6th grade students, 33,33% of 7th grade students, 33,6% of eighth-graders gave a positive answer to the question about alcohol consumption among children and boys, 26,5% of 9th grade students, 58,3% of tenth-graders and 56,1% of graduates. Respondents noted that sometimes they drink alcohol on holidays. It was determined that only 34,1% of graduates (grade 11), 33,3% of tenth-graders, and 48,9% of 9th grade students do not drink alcoholic beverages. In addition, it has been found that quite a large percentage of girls use alcoholic beverages. It was shocked by the fact that already from the 7th grade, 66,6% of girls were drinking alcohol. Despite the above data, "the absence of bad habits" is in the priority responses to the choice of factors of healthy lifestyle in the 7th grade students. In the 11th grade – 77,7% of girls also noted that they sometimes drink alcohol.

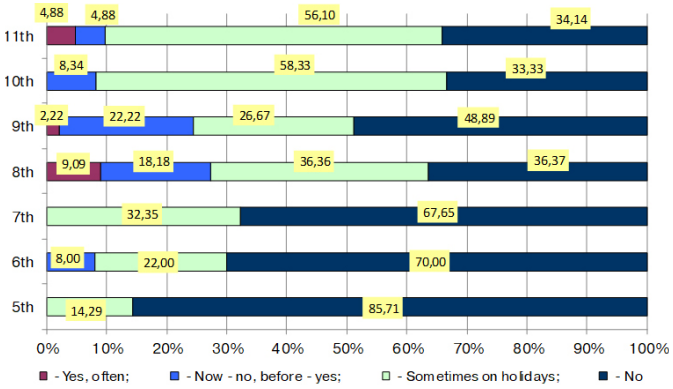

Figure 3. Number of boys who drink alcohol (%)

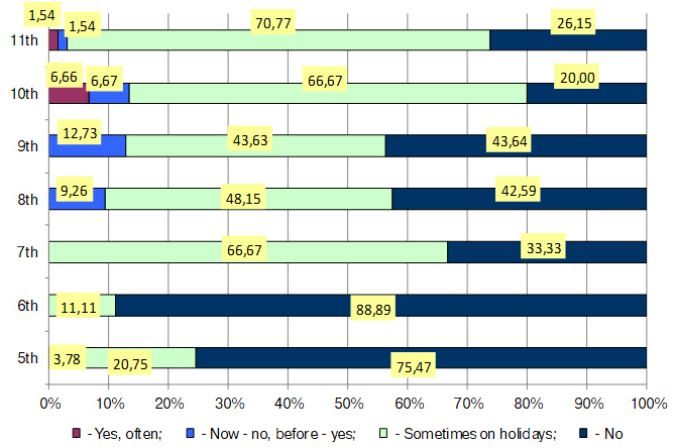

Figure 4. Number of girls who drink alcohol (%)

According to the results of the questionnaire, two pentagrams and six young graduates are using drugs, among them three girls.

Scientists emphasize that the most important distinctive feature of the teenage period are fundamental changes in the field of self-awareness, which are of great importance for the further development and formation of adolescents as individ-

uals. According to one of the major domestic psychologists B. G. Ananyev, it was during this period that consciousness, having passed through most of the objects of relationships, itself becomes an object of self-awareness and, completing the character structure, ensures its integrity, promotes the formation and stabilization of the personality (B. G. Ananyev 1980, p. 89). Therefore, thanks to physical culture and sports, it is necessary to create such conditions that contribute to the formation of students' right attitude to health as a basic human value, which will significantly affect their reflective activity and awareness of personal responsibility for their own health. In addition, you need to teach schoolchildren to master the skills and abilities of a healthy lifestyle, to cultivate in them the need for physical improvement, shaping the values of physical culture and sports.

Conclusions / Discussion

Modern researchers propose to consider "Physical culture" at school as one of the leading disciplines of the curriculum, which aims at the formation of special knowledge, skills and abilities to use physical culture to ensure optimal functioning, physical and intellectual self-improvement. Scientists note the need to provide students with knowledge about the benefits of mastering motor skills and how to apply this knowledge [16]. Along with this, it is necessary to take into account that the specificity of physical education is that conscious information becomes a motivated incentive to perform physical exercises. The criterion of the effectiveness of the process should be the level of health of adolescents, the level of their physical performance and social viability (T. Yu. Krutsevich, 2012). So, based on the situation that exists today in the field of physical culture and sports, there is a problem of forming the value relationships of the younger generation to their health, healthy lifestyles, systematic physical activity through physical culture, that is, improving their natural inclinations for the realization in society, will increase not only personal achievements in their physical corporeality and the results of social activity, but will be a definite contribution to the development of the general culture of society.

Scientific interest was aroused in our studies by I. V. Evstigneev. In a scientific study "Gender education of primary school students in physical education classes," the scientist studied the pedagogical conditions of gender education in primary school students in physical education classes in the university. The author has proven that the main criteria for gender education of primary school students in the process of physical education is cognitive, emotional-value, motivational and behavioral. Scientists have justified and experimentally verified pedagogical conditions aimed at taking into account the age and sex characteristics of children in primary school in physical education classes, the acquisition of knowledge in physical education classes about the essence of gender education; use of interactive teaching methods that promote adolescent gender education; creation of micro and macro environment, aimed at gender adaptation of students of primary school [7].

Also, in our opinion, the study of A. V. Zakin end is interesting: "Preparing future physical education teachers for raising healthy lifestyles for younger schoolchildren on the basis of a gender approach", in which the scientist defined the essence of a gender approach to raising healthy lifestyles for younger schoolchildren as organizing educational process, provides students with the opportunity for self-realization with their inherent individual characteristics and to assimilate social experience, ensures their successful socialization in society and social identification by the gender.

As a result of studying and theoretical analysis of sociological and psychological-pedagogical literature, analyzing the results of our research, which concerns the definition of differences in the choice of healthy lifestyle factors for schoolchildren of different age groups, it is proved that in the age aspect there are quite significant differences in the choice of priority factors of a healthy lifestyle, which they adhere to during the week. Attitudes towards bad habits are also different and ambiguous. That is, with age, the priorities of the value orientations of young people change, and the gender factor influences the formation of the ideas of young men and women on maintaining a healthy lifestyle. The study does not exhaust all the issues of the indicated problem. The research results open up prospects for studying issues related to the influence of physical culture and sports on the gender socialization of schoolchildren, the preparation of individual programs for the gender development of adolescents, and the development of pedagogical foundations for the organic combination of students' gender opportunities with their physical development and self-development.

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Interrelation of the hammer swing technique with the technique of its previous rotation in highly skilled hammer throwers

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The results of studies on the relationship of the parameters of the hammer swing technique with the biomechanical indicators of the previous hammer rotation techniques are presented.

Purpose: *investigate the relationship of the hammer swing technique with the previous hammer rotation technique.*

Material & Methods: *analysis and synthesis of scientific and methodical literature, analysis of video materials, methods of mathematical statistics. 7 qualified hammer throwers, finalists of the World Cup and European Cups during the 2016–2018 seasons were investigated.*

Results: *the closest relationship was recorded between the angle of flexion in the right elbow joint and the angular velocity of the hammer (r=0,868), such studied indicators of the hammer assassination technique, such as: angular speed of the hammer, linear speed of the hammer, the center of the hammer force did not have a significant impact on the biomechanical indicators previous hammer rotation.*

Conclusion: *previous hammer rotation techniques are more dependent on the angle of flexion in the left knee, right elbow joints, the height of the hammer layer rising from the support, the size of the left foot turning outwards and the height of the heel of the left foot rising from the support during the hammer wagging.*

Keywords: *throwers, biomechanical parameters, technique, hammer swing, previous hammer rotations.*

Introduction

Hammer throwing is a complex in the coordination of movements type of athletics throwing. The high level of achievements in the international arena requires the continuous improvement of technical training of hammer throwers.

The work of L. Judge, R. Isele, G. Davila, E. Maslovsky, A. Shahdad [2; 3; 5–7] is devoted to the study of the features of the preliminary rotation of the hammer. A. Maheras, J. Silvester [8; 10] investigated the features of the rotation technique with a hammer. The definition of the linear speed of the hammer during the previous rotations involved S. Brice, K. Ness, D. Rosemond [4]; K. Murofushi [9] determined the acceleration of the hammer. V. Bakatov studied the rhythm of the hammer throw [1].

However, despite the significant amount of work devoted to the hammer throwing technique, the influence of the hammer attempt on the biomechanical indicators of previous hammer rotations is still uncertain.

Purpose of the study: investigate the relationship of the hammer swing technique with the previous hammer rotation technique.

Material and Methods of the research

The technique of seven highly skilled hammer throwers, finalists of the World Cup and European Cups during the 2016–2018 seasons was investigated. During the execution of the work, the following research methods were used: analysis and synthesis of scientific and methodical literature, analysis of video materials, methods of mathematical statistics.

Results of the research

Indicators of the hammer swing technique of highly skilled throwers are presented in Table 1.

An analysis of the hammer backswing technique showed that in the leading modern throwers the angle of the left foot is 22,5±4,9°, the height of the heel of the left foot above the support is 10,3±6,3 cm, the angle of flexion in the left knee joint is 165,3±3,2°, shoulder rotation about the vertical axis – 118,7±8,3, bending angle in the right elbow joint – 122,5±15,1°, in the left joint – 165,3±3,2°, height of the hammer formation – 1,39±0,28 m. The linear speed of the hammer movement reaches 2,99±0,88 $m \cdot s^{-1}$, the angular velocity is 1,91±0,55 $rad \cdot s^{-1}$, in the center the hammer force does not exceed 5,8±3,6 kg.

The biomechanical indicators of highly skilled throwers at the end of previous hammer hits are presented in Table 2.

The data obtained indicate that in highly skilled hammer throwers during the second rotation at the lowest point of the trajectory of the hammer layer movement, the bending angle in the right knee joint is 169,6±5,3°, in the left one – 159,3±6,9°, in the right hip joint – 167,6±3,9, in the left – 166,1±8,7°, in the right elbow – 171,4±5,7°, in the left – 172,3±5,7°. The height of the hammer layer reaches 28,8±17,1 cm.

At the highest point of the movement of the ball of the hammer,

Table 1

Biomechanical features of the hammer swing technique by highly skilled hammer throwers

Indicators	Athletes						
	Pawel Fajdek	Wojciech Nowicki	Ivan Tsikhan	Quentin Bigot	Nick Miller	Diego Del Real	Marcel Lomnicky
	POL	POL	BLR	FRA	GBR	MEX	SVK
Angle of turn of the left foot (deg.)	24,3±4,6	24,8±3,0	13,2±0,8	19,3±4,0	26,2±1,7	27,4±0,9	21,3±3,2
Height of heel of the left foot (cm)	12,5±0,7	14,1±0,5	13,9±0,5	13,3±0,4	12,2±1,2	13,1±1,4	13,8±0,5
Angle of flexion in the left knee (deg.)	158,6±2,8	146,3±0,8	139,8±8,9	138,8±2,8	156,0±5,3	162,8±0,4	145,4±3,1
Rotation of the shoulders about the vertical axis (deg.)	102,5±10,6	122,9±4,1	105,3±1,1	122,8±3,4	124,4±0,8	124,8±1,5	111,8±0,9
Angle of flexion in the right elbow joint (deg.)	128,1±7,5	120,4±13,7	123,5±6,9	131,6±5,2	89,4±3,2	128,5±6,3	127,6±4,8
Angle of flexion in the left elbow joint (deg.)	158,7±2,9	168,9±5,3	165,3±2,3	161,4±4,6	159,7±2,8	170,7±4,7	160,4±13,5
Height of ball of the hammer (m)	1,62±0,25	1,60±0,38	1,2±0,16	1,31±0,19	1,71±0,21	1,4±0,31	0,90±0,27
Hammer angular speed (rad s^{-1})	2,70±0,10	1,71±0,20	1,22±0,11	1,51±0,13	2,34±0,21	1,60±0,20	2,42±0,14
Hammer linear speed (m s^{-1})	4,10±0,14	2,51±0,30	1,91±0,10	2,23±2,01	3,40±0,14	2,63±0,40	4,00±0,10
Magnitude of the centrifugal force of the hammer (kg)	11,2±0,80	3,3±0,11	2,0±0,12	2,7±0,46	7,9±0,42	4,1±1,31	9,3±0,64

Table 2

Biomechanical indicators of hammer throwers at the end of previous hammer spins

Indicators	Athletes						
	Pawel Fajdek	Wojciech Nowicki	Ivan Tsikhan	Quentin Bigot	Nick Miller	Diego Del Rea	Marcel Lomnicky
Angle of flexion in the right knee joint (deg.)	140,9±4,2	147,3±2,1	154,5±11,0	158,6±3,5	134,1±3,6	140,9±3,0	152,0±1,8
Angle of flexion in the left knee (deg.)	142,1±6,0	150,8±3,0	139,4±3,0	164,3±1,3	152,6±3,2	147,8±6,1	143,5±1,5
Height of raising of a heel of the left leg from a support (cm)	13,0±2,8	5,0±1,4	8,0±1,4	9,1±5,7	8,5±5,0	13,2±1,4	10,5±1,0
Leg width (cm)	52,5±3,5	53,5±0,7	43,0±2,8	49,0±1,4	50,5±2,1	42,0±1,4	43,5±3,5
Angle of rotation of the right foot (deg.)	22,3±1,3	18,4±2,0	7,0±1,4	12,2±3,0	15,5±2,8	7,7±0,8	11,9±4,6
Angle of flexion in the right elbow joint (deg.)	114,5±8,0	152,3±0,4	119,6±5,5	117,9±6,6	127,2±7,4	118,9±4,7	121,3±1,1
Angle of flexion in the left elbow joint (deg.)	112,9±6,2	151,4±1,3	120,1±5,1	117,0±6,5	127,0±7,7	117,9±5,3	121,0±1,8
Torso angle (deg.)	20,4±1,6	18,1±0,8	13,1±1,3	19,6±3,0	24,4±5,6	12,3±1,2	13,4±3,0
The height of the raising of the hammer ball from the support (m)	2,07±0,05	2,08±0,02	2,02±0,05	1,92±0,04	2,07±0,08	1,95±0,02	1,98±0,06
Hammer ball linear speed (m s^{-1})	13,94±0,42	13,49±0,64	11,52±1,29	13,99±0,79	10,69±0,73	13,64±2,14	13,11±0,78
Hammer ball angular speed (rad·s^{-1})	8,72±0,27	8,30±0,40	7,58±0,84	9,34±0,53	6,81±0,47	9,00±1,42	8,48±0,51
Magnitude of the centrifugal force of the hammer (kg)	108,8±6,6	101,6±9,7	77,2±7,4	112,1±2,7	63,7±8,7	107,5±3,4	96,1±11,4

the angle of flexion in the right knee joint is 146,9±8,7°, in the left – 148,6±8,4°, the height of the heel of the left foot above the support reaches 9,6±2,9 cm, width leg placement does not exceed 47±4,8 cm, the angle of the right foot outward reversal is 13,6±5,6°, the angle of flexion in the right elbow joint is 124,5±12,8, in the left one – 123,9±12,9°, torso angle does not exceed 17,3±4,5°, the height of the ball of the hammer above the support reaches 2,01±0,06 m. The linear speed of the hammer reaches 12,91±1,29 m·s^{-1}, the angular speed of the hammer is 8,32±0,86 rad·s^{-1}, in the center the strength of the hammer layer reaches 95,3±18,2 kg. To determine the degree of influence of the biomechanical parameters of the hammer technique on the technique of previous rotations, a correlation analysis was carried out using the Pearson pair correlation method (Table 3).

The data obtained indicate a significant relationship between the angle of rotation of the left foot outward during the swing of the hammer and the angle of flexion in the right knee joint at the end of previous hammer rotations (r=–0,783). A negative inverse relationship indicates a decrease in the bending angle in the right knee joint at the end of the second preliminary rotation of the hammer with an increase in the pivot of the left foot outward during its swing.

The height of the heel of the left foot during the hammer swing only affects the flexion angle in the right knee joint (r=0,762) and the torso angle (r=–0,733) during the second preliminary rotation of the hammer, indicating an increase in the flexion angle in the right knee joint and reduce the torso angle with increasing height of the heel of the left foot above the support during the backswing of the hammer.

An analysis of the correlation relationship showed that an increase in the angle of rotation of the shoulders relative to the vertical axis affects the increase in the angle of flexion in the left knee joint (r=0,736).

A rather close relationship was observed between the magnitude of the flexion angle in the right elbow joint and the linear (r=0,786) and angular (r=0,868) speeds of the hammer ball at the end of previous conversions. Also, a close relationship was recorded between the angle of flexion in the right elbow joint and the centrifugal force of the hammer at the end of

Table 3

Interrelation of hammer backswing technique with previous hammer spins in highly skilled throwers (n=7)

Biomechanical indicators at the end of previous hammer spins	Indicators hammer swing technique									
	Angle of turn of the left foot	Height of heel of the left foot	Angle of flexion in the left knee	Rotation of the shoulders about the vertical axis	Angle of flexion in the right elbow joint	Angle of flexion in the left elbow joint	Height of ball of the hammer	Hammer angular speed	Hammer linear speed	Magnitude of the centrifugal force of the hammer
Angle of flexion in the right knee joint	–0,783	0,762	–0,886	–0,198	0,649	0,039	–0,696	–0,544	–0,482	–0,513
Angle of flexion in the left knee	0,185	–0,182	–0,230	0,736	–0,095	–0,050	0,224	–0,218	–0,307	–0,341
Height of raising of a heel of the left leg from a support	0,346	–0,269	0,666	–0,253	0,365	–0,137	–0,086	0,404	0,492	0,515
Leg width	0,347	–0,303	0,060	0,091	–0,302	–0,303	0,735	0,388	0,224	0,250
Angle of rotation of the right foot	0,444	–0,319	0,265	–0,162	–0,181	–0,436	0,609	0,694	0,578	0,599
Angle of flexion in the right elbow joint	0,262	0,272	–0,145	0,433	–0,284	0,443	0,338	–0,145	–0,213	–0,288
Angle of flexion in the left elbow joint	0,228	0,279	–0,171	0,427	–0,302	0,444	0,314	–0,167	–0,232	–0,306
Torso angle	0,341	–0,733	0,145	0,214	–0,637	–0,570	0,728	0,457	0,280	0,337
The height of the raising of the hammer ball from the support	0,228	–0,286	0,247	–0,257	–0,553	–0,148	0,614	0,427	0,320	0,367
Hammer ball linear speed	0,226	0,477	0,031	0,028	0,786	0,233	–0,075	0,011	0,053	–0,009
Hammer ball angular speed	0,073	0,442	–0,028	0,036	0,868	0,185	–0,275	–0,120	–0,047	–0,098
Magnitude of the centrifugal force of the hammer	0,178	0,433	0,051	0,007	0,834	0,206	–0,125	–0,029	0,023	–0,026

Remark. *$R>R_{cr}$, at $R>(0,755)$.*

previous projectile hits. (r=0,834).

The correlation relationship indicates an increase in the centrifugal force of the hammer, it's linear and angular velocity with an increase in the angle of flexion in the right elbow joint during the assassination of the hammer.

A noticeable relationship was observed between the height of the hammer layer during the assassination and such parameters as the width of the legs (r=0,735) and torso angle (r=0,728) with which the thrower ends previous projectile hits. The higher the athlete raises the hammer layer during the assassination, the greater the width of the legs and the angle of the body during previous appeals.

Such indicators of the hammer swing technique, such as the angular velocity and linear velocity of the projectile, as well as the centered force of the hammer, did not have a significant effect on the biomechanical indicators of previous rotations.

Conclusions / Discussion

In most of the works devoted to the hammer throw technique, the biomechanical parameters of its individual phases are considered [5; 7; 8], however, the influence of the hammer wagging technique on the biomechanical parameters of previous hammer rotations remains uncertain. As a result of the study, the extended information of R. Isele, E. Nixdorf [6] on the biomechanical parameters of the techniques of highly skilled hammer throwers.

The results of the study indicate a large value of the angular characteristics of the throwers during the swing of the hammer for the effective performance of its previous rotations.

Our data allow us to increase the efficiency of technical training of hammer throwers. It has been established that in order to increase the speed parameters of the technique of previous hammer hits, the right arm at the elbow should be bent at an obtuse angle. To reduce the inclination during previous rotations of the projectile, reduce the height of the raising of the hammer ball and increase the height of the heel of the left foot above the support during the swing. To reduce the angle of flexion in the left knee joint at the end of previous revolutions of the hammer, it is necessary to increase the angle of flexion in the left knee joint during its swing.

Prospect of further research. It is intended to determine the influence of the hammer wag technique on the rotation with a hammer in highly skilled throwers.

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The functional state of the rowing kayaks (boys) athletes in the simulation of training activities

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Purpose: *to conduct a comprehensive study of the functional status of athletes (boys) of various age groups specializing in rowing, for the possible subsequent determination of prospects in this sport.*

Material & Methods: *athletes of various age groups (11–12 years old, 13–14 years old, 15–16 years old, 17–18 years old) and sports qualifications were surveyed, in total 95 people, according to our method of measuring the effect of a training action, and also visual-motor hearing and motor reactions, the level of musculo-articular sensitivity and coordination of movements, the power of forced inhalation and exhalation.*

Results: *studies have allowed us to study the functional state of athletes. The optimal structure of sports activities contributes to the improvement of all its components, which in the early stages and due to the age characteristics of athletes, as well as the patterns of development of motor skills do not significantly affect the level of results, but have a great impact on the appearance of the corresponding functional basis, especially in the early age periods realization of individual capabilities. Features of the reaction of the body of athletes are a manifestation of effective individual adaptation to intense and complex stimuli of training and competitive activity. The functional state of athletes is determined by the level of development of various physical qualities, coordination abilities, properties of the nervous system, the optimal combination of which is characteristic of each particular sport and allows you to specifically choose sports specialization.*

Conclusion: *the proposed tests for measuring the effect of the training action, electromyoreflexometry, pneumotachometry and reverse dynamometry are sufficiently informative in sports practice and allow us to determine and evaluate the individual prerequisites for sporting achievements. The obtained parameters of the functional state allow you to identify the individual characteristics of the athlete's body, the possibility of their correction and management of the training process. Conducted comprehensive examinations of the psycho-physiological and functional characteristics of the body of athletes rowers allow you to create methods for assessing the prospects of athletes in their chosen sport.*

Keywords: *functional state, measurement of the effect of the training action, electromyoreflexometry, pneumotachometry, reversible dynamometry.*

Introduction

The functional state of a person is defined as the degree of adaptation of an organism to environmental conditions, its physical, mental and social influences, which is especially important for athletes who are constantly exposed to extreme physical, psychological and other stress [1; 2]. Increasing the volume and intensity of training loads, used to train qualified athletes and maximize the overall and special performance, are necessary to assess the functional state of the athlete's body at each moment of the training process [3; 4].

The growth of achievements in sports is mainly due to the improvement of the training process, the alignment of the biological laws of the flow of adaptation processes with the main parameters of training and competitive loads, the correct management of physical condition of athletes. The organization and conduct of the training process can lead to a positive result only if there is an objective assessment of the athlete's functional state [4].

The most important factor in training and competitive activity are functional diagnostics, including testing of physical performance, functional readiness, adaptation reserves and other characteristics of the functional state of athletes [5]. Dynamic monitoring of the functional state of an athlete allows to ensure high physical performance, improve the efficiency of the training process, which contributes to the achievement of high sports results [6].

Violation of the body's ability to adapt to environmental conditions is due to a decrease in its functional capabilities, since adaptation to new conditions occurs due to mobilization of functional reserves and causes a certain tension of regulatory systems [7].

The capacities of functional systems of athletes characterize their professional viability and the possibility of achieving high athletic performance, since the role of body reserves increases with changing environmental conditions in sub-extreme and extreme situations of life, especially during intense training and competitive activities. The effectiveness of the dynamics of adaptation to improve performance, prevent physical overvoltage depends on an objective assessment of the functional state of the body of an athlete [8; 9].

Functional condition of an athlete is a system of stable functioning integrative physiological mechanisms that ensure the constancy of various physiological parameters and adapting all systems of the body to intense physical and psycho-emotional specific effects which constantly changes under the influence of internal and external factors, including the intensive physical and psycho-emotional stresses [10; 11].

To determine the functional state of the body, the capabilities of its main systems are evaluated: cardiorespiratory, nervous and motor [12]. The effectiveness of the process of training and competitive activity improves with the intensification of the use of functional reserves of the body and stimulation of adaptation processes. Improved performance contributes to a balanced system of physical activity, rest, nutrition, rehabilitation facilities; accounting of competitions in different climatic zones, time zones, oxygen level tension (plain, middle mountains); improvement of motor skills based on the use of various instruments and methods [13].

Purpose of the study: to conduct a comprehensive study of the functional status of athletes (boys) of various age groups specializing in rowing, for the possible subsequent determination of prospects in this sport.

Material and Methods of the research

Pupils of sports schools in the city of Mykolaiv and the higher school of physical education, young men specializing in rowing were surveyed. Individual indicators were determined in various age groups: 11–12 years old – 26 people, 13–14 years old – 23 people, 15–16 years old – 25 people, 17–18 years old – 21 people, in total – 95 athletes.

The study of the functional state included a test measuring the effect of a training action (META), created on the basis of a tapping test, which allows determining the complex of kinematic characteristics of movements in an autonomous mode. This technique allows you to study the pace of movements and their accuracy in the sum of points gained, as well as the accuracy of a single movement. The study of movements performed with maximum speed and accuracy was carried out in different conditions, successively in three time periods: for 15 s, 60 s and 15 s. This formulation of the problem provided an objective assessment of the pace and accuracy of movements in various conditions: with an optimal functional state in the first period of time, in the process of long work in the second and after a long and maximum pace of movement of work in the third period.

The change in the number of movements during the first period of time indicates a high mobility of the nervous processes, the second indicates balance, the third indicates strength and, in total, the state of the nervous system as a whole. This physiological justification allows the coach to objectively evaluate the processes occurring in the body, and purposefully conduct the management of training and competitive activities. A detailed methodology for studying the effect of the coaching action was published in the *"Slobozans`kij naukovo-sportivnij visnik"* (2015), No. 4 (48), pp. 19-25 [14].

The latent periods of visual-motor and auditory-motor reactions were determined using an electromyoreflexometer (EMR) using the standard method. These reactions are an indicator of complex psychophysiological processes, reflecting the characteristics of receptor perception, the nervous and muscular systems, which characterizes the mobility of nervous processes, that is, one of the most important indicators of higher nervous activity.

The level of muscular-articular sensitivity and coordination of movements, as well as the diagnostic capabilities of the principle of repeated reproduction of a given load were studied by the method of reverse dynamometry (DM_{rev}), which was modified and adapted for the purposes of our study. The possibility of developing a skill to reproduce a given load without visual correction of each of the ten attempts was determined.

Measurement of the power of forced inspiration and expiration was carried out using a pneumotachometer (PT). Estimated air velocity in $l \cdot s^{-1}$ with the maximum fixed inspiration and expiration. 10 attempts were used with an interval of at least 20 s. Determining the maximum air flow during inhalation and exhalation allows you to indirectly judge the ability of the respiratory muscles to work intensively. With regular sports activities, the power of forced inhalation and exhalation can increase significantly.

The results of observations were processed by methods of variation statistics.

Results of the research

Results of the study of the functional state of boys 11–12 years old, trains in rowing, are presented in Table 1.

In the first period of the test of measuring the effect of the training action, the average rate of movement was 28,5±0,933 strokes, the total accuracy of movement for the sum of points scored was 216,3±7,94, and the accuracy of one movement was 7,59±0,384 points (hereinafter the text indicates the amount of points and accuracy, respectively); maximum: pace – 31 blows, total points – 243, accuracy – 7,89 points; minimum: tempo – 23 beats , total points – 179, accuracy – 7,78 points.

In the second period of the test averages were as follows: the pace – 4,5±4,093 beats, score – 244,5±7,593, accuracy – 7,10±0,459 points, the maximum and minimum, respectively: the rate – 38 strokes and 27 strokes, the amount points – 331 and 213, accuracy – 8,71 points and 7,88 points.

In the third period, the average values were: tempo – 34±1,359 beats, total points – 238,6±13,02, accuracy – 7,02±0,435 points, maximum and minimum, respectively: tempo – 39 beats and 28 shots, total points – 306 and 162, accuracy – 7,85 points and 5,79 points.

The total figure for the three test periods averaged: the pace – 33,42±3,017 shots, the sum of points – 232,65±7,191, the accuracy – 7,16±0,435 points; maximum results: rate – 37 beats , total points – 312, accuracy – 8,43 points; minimum results: tempo – 26,5 beats, total points – 198, accuracy – 7,47 points.

In the second period, compared to the first, the rate increased by 6 beats (21,05%), the amount – by 28,65 points (13,25%), the accuracy on average decreased by 0,49 points (6,91%), the best and worst results were higher, respectively, by 0,82 points (10,39%) and by 0,1 points (1,29%).

Table 1

Survey results (rowing, boys 11–12 years old)

		Indicators	M±m	M_{max}	M_{min}	σ	A
Effect of a training action	First period	Pace (number of beats)	28,5±0,993	31	23	2,81	9,86
		Total points	216,3±7,94	243	179	22,46	10,44
		Accuracy (points)	7,59±0,384	7,89	7,78	1,088	14,33
	Second period	Pace (number of beats)	28,5±0,993	31	23	2,81	9,86
		Total points	216,3±7,94	243	179	22,46	10,44
		Accuracy (points)	7,59±0,384	7,89	7,78	1,088	14,33
	Third period	Pace (number of beats)	138±16,37 (34,5±4,093)	152 (38)	108 (27)	46,32	33,56
		Total points	941±30,37 (244,95±7,593)	1324 (331)	851 (213)	85,96	9,13
		Accuracy (points)	7,10±0,459	8,71	7,88	1,298	18,29
	Total	Pace (number of beats)	34±1,359	39	28	3,86	11,35
		Total points	238,6±13,02	306	162	36,84	15,81
		Accuracy (points)	7,02±0,435	7,85	5,79	1,23	17,49
Tests	EMR (s)	Sound	0,207±0,063	0,236	0,185	0,01789	8,64
		Light	0,232±0,011	0,272	0,189	0,02912	12,55
	PT ($l \cdot s^{-1}$)	Inhale	5,3±0,579	7,67	3,0	1,639	30,91
		Exhale	5,16±0,268	6,16	4,0	0,758	14,69
	DM_{rev} (kg)		1,5±0,248	2,3	0,3	0,702	46,78

Remark. *The data in brackets are given to a single time indicator of 15 s, in particular 138±16,37 (34,5±4,093).*

In the third period, as compared with the first, the pace increased by 5,5 beats (19,29%), the amount of points increased by 22,3 (10,31%), the accuracy decreased by an average of 0,57 points (8,12%), by the maximum indicator – by 0,04 points (0,51%) and by the minimum – by 1,99 points (34,37%); compared to the second period, the pace decreased by an average of 0,5 beats (0,15%), the sum of points by 6,35 (2,66%), the accuracy by 0.08 points (1,14%), that is The indicators studied remained virtually unchanged.

The results of the studies for the three test periods were as follows: the maximum indicators were more than the average values for the pace by 3,58 beats (10,71%), the sum of points was 79,35 (34,11%), the accuracy was 1,27 points (17,74%); the minimum – less than the average in pace by 6,92 beats (26,11%), the total points – by 34,65 (17,50%), but the accuracy was higher than the average by 0,31 points (4,33%).

It should be noted that in the first test period, the accuracy of movements in the maximum indicator was better than the average value by 0,3 points (3,95%) and in the minimum – by 0,19 points (2,50%); in the second period, the maximum value exceeds the average by 1,61 points (22,68%), the minimum – by 0,78 points (10,99%); in the third period, the accuracy of movements in the best indicator was higher than the average by 0,83 points (11,82%), in the minimum – less than the average value by 1,23 points (21,24%).

Sensomotor reactions to a sound stimulus were determined, on average, 0,207±0,063 s; the best result – 0,185 s, less than the average values by 0,022 s (11,89%), the worst – 0,236 s, more than the average by 0,029 s (14,01%); light stimuli were on average 0,232±0,011 s; the best result – 0,189 s, which is less than the average by 0,043 s (22,75%), the worst – 0,272 s, more than the average by 0,04 s (17,24%).

Indicators of pneumotachometry were observed on average during inhalation 5,3±0,579 $l \cdot s^{-1}$, maximum – 7,67 $l \cdot s^{-1}$, which is 2,37 $l \cdot s^{-1}$more than the average value (44.72%), minimum – 3,0 $l \cdot s^{-1}$, less than the average by 2,3 $l \cdot s^{-1}$ (76,67%); on expiration, on average – 5,16±0,268 $l \cdot s^{-1}$, maximum – 6,16 $l \cdot s^{-1}$, which is 1,0 $l \cdot s^{-1}$ more than the average value (19,38%), minimum – 4,0 $l \cdot s^{-1}$, less than the average 1,16 $l \cdot s^{-1}$ (29,00%).

In the test of reverse dynamometry, the task was set: to produce muscular effort of 15 kg on a dynamometer with a leading hand without vision control, an error in performing the task was determined. The error of the exercise performance was on average 1,5±0,248 kg (10,00%), maximum – 2,3 kg (11,5%), minimum – 0,3 kg (1,5%).

The results of a survey of 13–14-year-old boys trains in rowing are presented in Table 2.

In the first period of the test of measuring the effect of the training action, the following average results were: pace – 31±1,24 beats, total points – 251±8,96, accuracy of one strike – 8,09±0,157 points; maximum performance: pace – 36 beats, total points – 278, accuracy – 7,72 points; minimum indicators: tempo – 23 hits, total points – 175, accuracy – 7,61 points.

In the second period, the following averages were determined: pace – 33,25±1,382 hits, total points – 253,75±9,77, accuracy – 7,63±0,250 points; maximum: pace – 39 beats, total points – 295, accuracy – 7,56 points; minimum: the pace – 24,5 beats, the sum of points – 192,5, accuracy – 7,85 points.

In the third period, the average indicators: pace – 34±1,53 beats, total points – 258±10,39, accuracy – 7,59±0,163 points; maximum indicators: tempo – 41 beats, total points – 310, accuracy – 7,56 points, minimum: tempo – 25 beats, total points – 201, accuracy – 8,04 points.

The total values for the three periods of the test of measuring the effect of the training action were as follows: averages – a pace of 33±0,428 beats, the accuracy of all movements or the

Table 2

Survey results (rowing, boys 13–14 years old)

		Indicators	M±m	M_{max}	M_{min}	σ	A
Effect of a training action	First period	Pace (number of beats)	31±1,24	36	23	4,11	13,23
		Total points	251±8,96	278	175	29,65	11,81
		Accuracy (points)	8,09±0,157	7,72	7,61	0,52	6,51
	Second period	Pace (number of beats)	133±5,53 (33,25±1,382)	156 (39)	98 (24,5)	18,30	13,76
		Total points	1015±39,08 (253,75±9,771)	1180 (295)	770 (192,5)	129,34	12,74
		Accuracy (points)	7,63±0,250	7,56	7,85	0,84	11,17
	Third period	Pace (number of beats)	34±1,53	41	25	5,05	14,85
		Total points	258±10,39	310	201	34,38	13,33
		Accuracy (points)	7,59±0,163	7,56	8,04	0,54	7,07
	Total	Pace (number of beats)	198±2,57 (33±0,428)	233 (38,8)	146 (24,3)	8,52	4,30
		Total points	1524±51,08 (254±8,513)	1768 (294,6)	1146 (191)	169,09	11,13
		Accuracy (points)	7,69±0,14	7,58	7,84	0,46	5,99
Tests	EMR (s)	Sound	0,182±0,0078	0,249	0,167	0,0258	14,2
		Light	0,216±0,015	0,269	0,158	0,035	16,2
	PT ($l \cdot s^{-1}$)	Inhale	5,66±0,199	6,5	4,4	0,66	11,7
		Exhale	5,26±0,15	6,1	4,5	0,51	9,51
	DM_{rev} (kg)		1,03±0,162	2,0	0,3	0,536	52,0

Remark. *The data in brackets are given to a single time indicator of 15 s, in particular, 133±5,33 (33,25±1,382).*

sum of points – 254±8,513, the accuracy of one movement – 7,69±0,14 points; maximum: pace – 38,8 beats, total points – 294,6, accuracy – 7,58 points; minimum: pace – 24,3 points, total points – 191, accuracy – 7,84 points.

Athletes maintained a high rate of movement, which in the second period was more than the first by 2,25 beats (7,26%), the amount of points increased by 2,75 (1,09%), the accuracy decreased by 0,46 points (6,03%). In the third period, as compared with the first, the rate increased by 3 beats (9,68%), the accuracy of all movements increased by 7 points (2,79%), the accuracy of one strike decreased by 0,5 points (6,59%); compared to the second increased: the pace – by 0,75 beats (2,26%), the amount of points – by 4,25 (1,67%), the accuracy was almost unchanged, decreased by 0,04 points (0,53%).

The accuracy of movements in the first period in the maximum and minimum values was less than the average, respectively, by 0,37 points (4,79%) and 0,48 points (6,31%); in the second period, with the maximum rates and the sum of points, the accuracy was less than the average by 0.07 points (0,93%), that is, it did not change, with the minimum – the accuracy was noted more than the average values by 0,22 points (2,88%); in the third period, according to the maximum results, the accuracy of one strike was virtually the same with the average value, the difference was 0,03 points (0,39%), and the minimum - more than the average by 0,45 points (5,93%).

By the sum of the results of the three periods when comparing, the maximum indicator was more than the average for the pace – by 5,8 beats (17,56%), the sum of points – by 40,6 (15,98%), and the accuracy was less by 0,11 points (1,45%); minimum indicator: less than the average pace by 8,7 beats (35,81%), total points – by 63 (32,98%), accuracy – more by 0,15 points (1,95%).

Athletes aged 13–14 years showed a high starting speed, the ability to maintain distance speed, good speed endurance.

Sensomotor reactions were determined for a sound stimulus and were on average 0,182±0,0078 s, the best result was 0,167 s, less than the average by 0,015 s (8,98%), the worst – 0,249 s, more than the average – by 0,067 s (36,81%); the average value for a light stimulus is 0,216±0,015 s, the best result is 0,158 s, which is less than the average by 0,058 s (36,71%), the worst is 0,269 s, more than the average by 0,053 s (24,54%).

The results of pneumotachometry were noted on average on the inhale 5,66±0,199 $l \cdot s^{-1}$, the maximum – 6,5 $l \cdot s^{-1}$, more than the average by 0,84 $l \cdot s^{-1}$ (14,84%), the minimum – 4,4 $l \cdot s^{-1}$, less than the average by 1.26 $l \cdot s^{-1}$ (28.64%); on expiration – 5,26±0,15 $l \cdot s^{-1}$, maximum – 6,1 $l \cdot s^{-1}$, 0.84 $l \cdot s^{-1}$ more than the average (15.97%), minimum – 4,5 $l \cdot s^{-1}$, less than average at 0,76 $l \cdot s^{-1}$ (16,89%).

The indicator of reversible dynamometry noted an error in the execution of a given muscular effort of 15 kg, which was on average 1,03±0,162 kg, maximum – 2 kg (10%), minimum – 0,3 kg (1,5%).

Athletes aged 15–16 years were examined according to the method of measuring the effect of the training action (Table 3).

In the first period of the test, the average indicators were observed as follows: pace – 32±2,05 beats, total points – 245±14,69, accuracy – 7,65±0,44 points; maximum: pace – 39 beats, the number of points for all movements – 280, accuracy – 7,18 points; minimum: tempo – 23 beats, total points – 162, accuracy – 7,04 points.

The maximum indicator was more than the average rate of 7 hits (21,88%), the sum of points – by 35 (14,29%), the accuracy decreased by 0.5 points (6,55%); minimal: less than the average pace by 9 beats (39,13%), total points – by 83 (51,23%), accuracy – by 0,61 points (8,66%).

Table 3

Survey results (rowing, boys 15–16 years old)

		Indicators	M±m	M_{max}	M_{min}	σ	A
Effect of a training action	First period	Pace (number of beats)	32±2,05	39	23	6,49	20,29
		Total points	245±14,69	280	162	46,43	18,95
		Accuracy (points)	7,65±0,44	7,18	7,04	1,40	18,01
	Second period	Pace (number of beats)	142±6,22 (35,5±1,555)	164 (41)	105 (26,25)	30,84	21,72
		Total points	1050±52,50 (262,5±13,125)	1182 (295,5)	824 (206)	165,91	15,80
		Accuracy (points)	7,39±0,32	7,21	7,84	1,01	13,43
	Third period	Pace (number of beats)	37±3,08	42	27	9,74	26,33
		Total points	262±6,16	314	212	19,48	7,44
		Accuracy (points)	7,30±0,39	7,48	5,35	1,23	16,86
	Total	Pace (number of beats)	211±13,25 (35,17±2,208)	245 (40,83)	156 (25,83)	41,88	19,85
		Total points	1556±54,35 (259,5±9,058)	1776 (296)	1199 (199,67)	266,56	17,13
		Accuracy (points)	7,42±0,34	7,25	7,69	1,09	14,48
Tests	EMR (s)	Sound	0,170±0,01	0,250	0,150	0,032	19,10
		Light	0,194±0,006	0,225	0,170	0,019	0,595
	PT ($l \cdot s^{-1}$)	Inhale	6,4±0,266	7,6	5,0	0,84	13,19
		Exhale	5,9±0,29	7,3	4,5	0,91	15,41
	DM_{rev} (kg)		1,77±0,560	2,0	0,5	1,29	73,4

Remark. *The data in brackets are given to a single time indicator of 15 s, in particular, 142±6,22 (35,5±1,555).*

In the second test period, the average values: tempo – 35,5±1,555 beats, total points – 262,5±13,125, accuracy – 7,39±0,32 points; maximum: pace – 41 beats, the sum of points – 295,5, which is more than the average, by 5,5 beats (15,49%) and 33 points (12,57%), the accuracy is less than the average by 0,18 points (2,49%); minimum: the pace is 26,25 beats, the sum of points is 206, which is less than the average, respectively, by 9,25 beats (35,24%) and 56,5 points (27,43%), the accuracy is higher than the average by 0,45 points (6,09%).

In the third test period on average: the pace – 37±3,08 beats, the sum of points – 262±6,16, the accuracy – 7,30±0,39 points; maximum: pace – 42 beats, total points – 314, accuracy – 7,48 points; minimum: pace – 27 hits, total points – 212, accuracy – 5,35 points. The best result was observed more than the average pace by 5 hits (13,51%), the sum of points – by 52 (19,85%), accuracy – by 0,18 points (2,47%), the worst – less than the average pace by 10 beats (37,04%), total points – by 50 (23,58%), accuracy – by 1,95 points (36,45%).

The sum of the three periods was observed on average: the pace – 35,17±2,208 hits, the sum of points – 259,5±9,068, the accuracy – 7,42±0,34 points; maximum: pace – 40,83 beats, total points – 296, accuracy – 7,25 points; minimum: tempo – 25,83 beats, total points – 199,67, accuracy – 7,69 points. The best indicator was more than the average pace by 5,66 beats (16,09%), the sum of points – by 36,5 (14,07%) and less in accuracy of movements by 0,17 points (2,34%), the worst – less than average in pace by 9,34 points (36,16%), total points – by 59,83 (29,94%) and more in accuracy of movements by 0,27 points (3,64%).

In the first period of the test, a rather high level was noted, when compared with our other observations, the pace of movements, the number of points scored for all motor actions, the accuracy of one movement.

In the second period of the test of measuring the effect of the training action, compared with the first period, the average pace increased by 3,5 beats (10,94%), the amount – by 17,5 points (7,14%), the accuracy decreased by 0,25 points (3,52%); at the maximum – the pace increased by 2 beats (5,13%), the amount – by 15,5 points (5,54%), accuracy – by 0,03 points (0,42%); at the minimum – the pace increased by 3,25 beats (14,13%), the amount – by 44 points (27,16%), accuracy – by 0,8 points (11,36%).

In the third period of the test, compared with the first and second periods, respectively, increased the mean value – pace of 5 beats (15,63%) and 1,5 beats (4,23%), the amount – at 17 points (6,94%) and did not change, the accuracy decreased by 0,35 points (4,79%) and 0,09 points (1,23%); maximum – the pace increased by 3 beats (7,69%) and 1 beats (2,44%), the amount – by 34 points (12,14%) and by 18,5 points (6,96%), accuracy – by 0,3 points (4,18%) and 0,27 points (3,74%); minimum – the pace decreased by 4 beats (17,39%) and 0,75 beats (2,86%), the amount – by 50 points (30,86%) and 6 points (2,91%).

Athletes aged 15–16 years old who are practicing rowing, on average, maintained a good level of pace during testing, which gradually increased by more than 15%, the total points gained increased by 7%, but the accuracy decreased by 5%; according to the best indicators, the pace increased slightly less – 8%, the amount of points – by 12%, accuracy – by 4%; at worst – the pace increased by 17%, the amount of points – by 30%, accuracy – by 3%.

Sensomotor reactions to the sound signal ranged from 0,170±0,01 s with a minimum time of 0,150 s, a difference of 0,020 s (13,33%), a maximum of 0,250 s, a difference of 0,080 s (47,06%); the light signal is 0,194±0,006 s with a minimum time of 0,170 s, the difference is 0,024 s (14,12%), the maximum is 0,225 s, the difference is 0,031 s (15,98%).

The result of pneumatic tachometer inhalation was on average 6,4±0,266 l·s^{-1}, maximum – 7,6 l·s^{-1} , which is 1,2 l·s^{-1} (18,75%), minimum – 5,0 l·s^{-1} , less by 1.4 l·s $^{-1}$ (28.00%); on expiration, the average result is 5,9±0,29 l·s^{-1}, maximum – 7,3 l·s^{-1} , more by 1,4 l·s^{-1} (23,73%), minimum 4,5 l·s^{-1}, less by 1,4 l·s^{-1} (31,11%).

The reverse dynamometry test showed an average error when performing an exercise of 1,77±0,560 kg (8,85%), the maximum error was 1,0 kg (5%), the minimum error was 0,5 kg (2,5%).

The results of a survey trains in rowing young men aged 17–18 years, are presented in table 4.

In the first period of the test of measuring the effect of the training action, the average pace was 31,7±0,68 beats, the number of points scored for all movements at a certain time was 247±5,42 points, and the accuracy was 7,79±0,18 points. The maximum result: the pace – 40 beats, the sum – 285 points, the accuracy – 7,12 points, which is more than the average – by the pace of 8,3 beats (26,18%) and the sum – by 38 points (15,38%) , and the accuracy of motor actions is less by 0,67 points (9,41%); minimum: pace – 22 beats, total – 175 points, accuracy – 7,95 points, which is less than the average – in terms of 9,7 beats (44,09%), total – by 72 points (41,14%), and accuracy is above average value by 0,16 points (2,05%).

In the second period, the average indicators were: pace – 34±1,448 beats, total – 250,25±7,055 points, accuracy – 7,36±0,29 points; the maximum indicator is 8,5 times more than the average pace (25,00%), the sum is 54 points (21,58%), the accuracy is less than 0,2 points (2,79%); the minimum is less than the average pace by 11 beats (47,83%), the amount is 68.75 points (1,38%), the accuracy is 0,53 points higher (7,21%).

In the third period, the average values: pace – 36,5±1,34 beats, the sum – 253±10,99 points, accuracy – 6,93±0,44 points; maximum: pace – 44 beats, the sum – 308 points, accuracy – 7,01 points, which is more than the average – by the rate of 7,5 points (20,55%), the amount – by 55 points (21,74%) of accuracy – 0,08 point (1,15%); minimum: pace – 26 beats, sum – 160 points, accuracy – 6,15 points, which is less than the average – by pace by 10,5 beats (40,38%), sum – by 93 points (58,31%), accuracy – 0,78 point (12,68%).

Over the three periods, the total average results: pace – 34,03±1,288 beats, total – 251,8±5,183 points, accuracy – 7,36±0,33 points; maximum result: the pace is 42,33 beats and the sum is 301 points, which is 8,3 hits (24,39%) and more than the average, and 49,2 points (19,54%), however, the accuracy is less than 0,25 points (3,52%); the minimum result: the pace – 23,33 beats and the amount – 176,8 points, which is less than the average, respectively, by 10,7 beats (45,86%) and 75 points (42,42%), and the accuracy – 7,58 points higher than average by 0,22 points (2,99%).

The level of functional preparedness in athletes of this age group, sports specialization and qualification is characterized by indicators of pace, total points, accuracy of motor actions, as well as dynamic changes during all testing periods according to the method of measuring the effect of a training action. In the second period compared to the first in average, the pace increased by 2,3 beats (7,26%), the amount – by 3,25 points (1,32%), the accuracy decreased by 0,43 points (5,84%); at the maximum – the rate increased by 2,5 beats (6,25%), the amount – by 19,25 points (6,75%), the accuracy – by 0,04 points (0,56%); at the minimum – the pace increased by 1 hit (4,55%), the amount – by 6,5 points (3,71%), and the accuracy decreased by 0,06 points (0,76%); in the third period, compared with the first and second, respectively, average values – the pace increased by 4.8 beats (15,14%) and 2,5 beats (7,35%), the amount – by 6 points (2,43%) and 2,75 points

Table 4

Survey results (rowing, boys 17–18 years old)

		Indicators	M±m	M_{max}	M_{min}	σ	A
Effect of a training action	First period	Pace (number of beats)	31,7±0,68	40	22	2,31	7,27
		Total points	247±5,42	285	175	21,03	8,52
		Accuracy (points)	7,79±0,18	7,12	7,95	0,71	8,93
	Second period	Pace (number of beats)	136±5,79 (34±1,448)	170 (42,5)	92 (23)	22,48	16,52
		Total points	1001±28,22 (250,25±7,055)	1217 (304,25)	726 (181,5)	109,50	10,94
		Accuracy (points)	7,36±0,29	7,16	7,89	1,14	15,12
	Third period	Pace (number of beats)	36,50±1,34	44	26	5,19	14,21
		Total points	253±10,99	308	160	42,65	16,85
		Accuracy (points)	6,93±0,44	7,01	6,15	1,71	23,53
	Total	Pace (number of beats)	204,2±7,73 (34,03±1,288)	254 (42,33)	140 (23,33)	30,00	14,69
		Total points	1511±31,10 (251,8±5,183)	1810 (301)	1061 (176,8)	120,70	7,99
		Accuracy (points)	7,36±0,33	7,11	7,58	1,27	16,80
Tests	EMR (s)	Sound	0,166±0,009	0,211	0,132	0,028	16,69
		Light	0,201±0,006	0,241	0,178	0,020	10,18
	PT (l·s^{-1})	Inhale	6,17±0,257	7,10	4,60	0,81	13,15
		Exhale	5,73±0,363	7,00	5,46	1,15	20,05
	DM_{rev} (kg)		1,59±0,20	2,16	0,66	0,73	46,11

Remark. *The data in brackets are given to a single time indicator of 15 s, in particular, 136±5,79 (34±1,448).*

(1,09%), however, the accuracy decreased by 0,86 points (12,41%) and 0,43 points (6,21%); maximum – the pace increased by 4 beats (10,00%) and by 1,5 beats (3,53%), the amount – by 23 points (8,07%) and by 3,75 points (1,23%), accuracy decreased by 0,11 point (1,57%) and 0,15 point (2,14%); the minimum ones – the pace increased by 4 beats (18,8%) and 3 beats (13,04%), the amount decreased by 15 points (9,38%) and 21,5 points (13,44%), as well as accuracy by 1,8 points (29,27%) and 1,74 points (28,29%).

Athletes of 17–18 years old, specializing in rowing, in the test of measuring the effect of a training action showed, by average values, a gradual increase in the rate of movement from the first to the third period by 15%, the total points by 3%, but a decrease in accuracy to 10–12 was observed %; at maximum – an increase in pace by 10%, the sum of points – by 8%, accuracy – by 2%; at minimum – an increase in pace by 18%, a decrease in the amount of points by 13% and accuracy – up to 29%.

Sensomotor reactions were noted at the level: on average, a sound stimulus – 0,166±0,009 s, the best indicator – 0,132 s, less than the average by 0,034 s (25,76%), the worst – 0,211 s, more than the average by 0,045 s (27,11%); on average, the light stimulus is 001±0,006 s, the best result is 0,178 s, less than the average by 0.023 s (12,92%), the worst – 0,241 s, more than the average by 0.04 s (19,90%).

Indicators of pneumotachometry on inspiration were observed within 6,17±0,257 $l \cdot s^{-1}$, maximum – 7,10 $l \cdot s^{-1}$, which is more than the average by 0,93 $l \cdot s^{-1}$ (15,07%), minimum – 4,60 $l \cdot s^{-1}$, less than the average by 1.57 $l \cdot s^{-1}$ (34,13%); on the exhale – 5,73±0,363 $l \cdot s^{-1}$, maximum – 7,00 $l \cdot s^{-1}$, 1,27 $l \cdot s^{-1}$ more than the average (22,16%), minimum – 5,46 $l \cdot s^{-1}$, less than average at 0,27 $l \cdot s^{-1}$ (4,95%).

In the reverse dynamometry test, the average reproduction error of a given force of 20 kg was 1,59±0,20 kg (7,95%), the maximum – 2,16 kg (10,80%), the minimum – 0,66 kg (3,30%).

When comparing the results of the survey of young men specializing in rowing, the following results were obtained in the test of measuring the effect of the training action.

In the first period of the test, which reflects the body's ability to quickly start work, from the youngest to the older group, the average rate increased by 12,28%, the sum of points – by 16,04%, the accuracy – by 6,59%; at the maximum value they increased: the rate – by 29.03%, the sum of points – by 17,28%, the accuracy – by 10,81%; on the minimum value increased: the pace – by 4,55%, the amount of points – by 10,49%, the accuracy – by 12,93%.

In the second period of the test, which determines the functional state of the body if possible to perform long-term work, the pace increased by 6,77%, the amount of points increased by 7,16%, and the accuracy increased by 7,46%; at the maximum value, the rate increased by 11.84%, but the sum of points decreased by 12,21% and the accuracy by 20,81%; at the minimum – the rate decreased by 17,39%, the amount of points – by 17,36%, the accuracy practically did not change, the difference was 0,51%.

In the third test period, which characterizes the body's ability to continue working after prolonged physical exertion, the pace increased by an average of 8,82%, the sum of points increased by 9,81%, the accuracy rose by 9,52%, and the maximum value increased by 12,82%, the sum of points practically did not change, the difference was 2,61%, the accuracy of movements from the younger to the older group decreased by 11,98%; at the minimum – to the older group, the rate decreased by 12,00%, the amount of points increased by 25,62%, the accuracy changed from 8,22% to 38,86%.

In terms of the total test score, which characterizes athletic ability, on average, the highest values of the pace of movement were observed in 15–16-year-old athletes (third group), the lowest – among 13–14-year-old athletes (second group), the difference was 6,58%; 11–12-year-old athletes had the lowest score (the first group), a little more – by 8,23% among the fourth group of athletes (17–18 years old), even more – by 9,18% among the rowers in the second group and the big one – among the athletes of the third group, the difference was 26,85 points (11,54%); the accuracy of movements is the smallest – in athletes of the first group, in the second – the biggest, the difference is 7,41%, slightly less accurate in the third group – 3,63% and even less in the fourth group – 2,79%. In terms of maximum values, the lowest rate among the first group of rowers is gradually increasing and the biggest among the fourth group athletes, the difference is 14,41%, the sum of points is the highest in the first group, the others are smaller, the difference is 5,91%, the accuracy of movements is the same trend, the difference was 18,57%; on the minimum – low rate in the fourth group and high in the first, the difference was 13,59%, the sum of the points was the smallest in the fourth group, in the others about the same level, the difference was 12,94 (4,95%).

When analyzing sensorimotor reactions, there was a clear tendency for a decrease in average response time to a sound stimulus from the younger group to the elder one, the second to the first – 13,74%, the third to the second – 7,06%, the fourth to the third – 2,41%, the total the difference is 24,69%; according to the best results, the difference was 19,62%, for the worst – 18,48%. The same directionality of the reaction to the light stimulus – the average reaction time gradually decreases, the difference was 19,59%, at the best fluctuations – 19,62%, at the worst – 20,89%.

The index of pneumotachometer on inspiration gradually increased from the second group to the first by 6,79%, from the third to the second – by 13,07% and slightly decreased from the fourth to the third by 3,73%; on the exhale, the air flow rate also increases, respectively, by 1,94%, 12,17% and decreases slightly by 2,97%. The difference in all age groups for maximum and minimum values does not have a clear focus and is not reliable.

The average error of muscular effort in the test of reverse dynamometry was the lowest among athletes of the second group, less than the first – by 0,47 kg (2,34%), the third – 0,74 kg (3,70%), and the fourth – 0,56 kg (2,80%), by the minimal error the best result in the first and in the second groups, slightly worse in the third – by 0,2 kg (1,00%) and the fourth – 0,36 kg (2,80%), the maximum error was actually the same in all groups – 2–2,3 kg (10–11,5%).
Features of the reaction of the body of athletes are a manifestation of effective individual adaptation to intense and complex stimuli of training and competitive activity.

In determining the functional state of athletes, a comprehensive analysis of the level of development of various physical qualities, coordination abilities, properties of the nervous system is necessary, which allow you to specifically choose sports specialization, since for each particular sport is characterized by the optimal combination of the above factors. Insufficient development of some of these may be offset by other factors, but the fundamental importance are some indicators that determine suitability for employment by the sport that cannot be compensated at all.

Conclusions / Discussion

The results of our research on the method of measuring the effect of the training action developed by us and the proposed parameters for determining the reaction rate to sound and light stimuli, measuring the air flow rate during inhalation and exhalation, accuracy of muscular effort in terms of various levels – average, maximum, minimum – made it possible to study the functional state athletes to determine the prospects of training in their favorite sport.

The optimal structure of sports activities contributes to the improvement of all its components, which in the early stages and due to the age characteristics of athletes, as well as the patterns of development of motor skills do not significantly affect the level of results, however, have a great impact on the appearance of the corresponding functional basis, especially in the early age periods maximize the realization of individual capabilities.

The proposed tests for measuring the effect of the training action, electromyoreflexometry, pneumotachometry and reverse dynamometry are sufficiently informative in sports practice and allow us to determine and evaluate the individual prerequisites for sporting achievements.

The obtained parameters of the functional state allow you to identify the individual characteristics of the athlete's body, the possibility of their correction and management of the training process.

Conducted comprehensive surveys of the psycho-physiological and functional characteristics of the body of athletes rowers allow you to create methods for assessing the prospects of athletes in their chosen sport.

Prospects for further research. On the basis of new information about the developmental characteristics of the ontogenesis of the corresponding psycho-physiological and motor mechanisms, develop a methodology for their improvement with the help of special training loads

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Staffing as a topical issue of the modern fitness industry

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The article substantiates the problem of staffing the fitness industry of Ukraine.

Purpose: *to study the current state of the problem of staffing in the system of health fitness in Ukraine.*

Material & Methods: *theoretical analysis and synthesis of scientific literature, sources and information of the world Internet, comparison and comparison method, system analysis, organizational analysis, expert evaluation.*

Results: *in recent years have increased the attention of scientists to personnel issues in the field of physical culture and sports, in particular – fitness. The strengthening of the social significance of the professional activities of fitness industry professionals is due to new socio-economic changes, the development of our state in accordance with the new market conditions. The processes of transformation, globalization and integration that are currently taking place in the system of health fitness in Ukraine require the improvement of its staffing. The necessity of providing the labor market with competitive specialists has been proved, since in the professional environment there is a shortage of qualified fitness personnel and a mismatch of competencies in a large part of the existing personnel with modern challenges.*

Conclusions: *the need for scientific substantiation of the concept of staffing in the system of health fitness in Ukraine has been actualized in order to overcome the revealed contradictions between existing practice and the requirements of modernity.*

Keyword: *fitness, staffing, fitness industry, professional standards, competence.*

Introduction

The problem of formation and further effective use of personnel potential was considered and considered in the scientific works of both foreign and domestic scientists. Among them are the following: E. Mayo, M. Meskon, D. Sule, F. Taylor, A. Fayol, V. Dyatlov, A. Egorshin, P. Zhuravlev, A. Kibanova, E. Maslov, Yu. Odegov, V. Travin, S. Shekshnya, G. Shchekin and others. Since each sphere has its own characteristics of functioning, staffing the fitness industry requires study and research, because there are many debatable and unresolved problems in this direction.

The field of physical culture and sports provides physical fitness services to various segments of the population. The growing demand of the population for health promotion, physical improvement and active recreation contributed to the development of the fitness industry in Ukraine, which is a relatively new business area. Today it is one of the most dynamic segments of the sphere of physical culture and sports, which is developing [25]. Competition in the modern market, a wide range of fitness services puts quite high demands on staffing [7; 8]. The effectiveness of the work of fitness clubs, their success in achieving certain goals depends on the quality of staff. That is why in modern conditions the fitness industry needs specialists who have received appropriate training and ensure their further professional growth in order to properly compete in the labor market and meet the new needs of consumers of their services.

Purpose of the study: to study the current state of the problem of staffing in the system of health fitness in Ukraine.

Material and Methods of the research

Research methods: theoretical analysis and synthesis of scientific literature, sources and information of the world Internet, comparison and collation method.

Results of the research

Today, mainly, training and retraining of personnel in the field of physical culture and sports is provided by the state (the law of Ukraine "On physical culture and sports"). The dynamic development of the fitness industry necessitates the need for qualified personnel. That is why there is a need to implement measures to improve the system of staffing in the sphere of recreational fitness, which would satisfy the requirements of the fitness industry.

In the National Report "The Sustainable Development Goals of Ukraine", the Government presented 17 sustainable development goals adapted for Ukraine (2015–2030) [41]. Among the main ones are defined "good health and well-being" (goal 3), the achievement of which should be the main concern of society and "quality education" (goal 4). The government sees their achievements as possible due to the reform of both the health system and the education system in Ukraine [41]. All this leads to increased scientific interest in the study of the phenomenon of public-private partnership [22] in these areas, in particular – in physical culture and sports. Today, em-

ployers do not sufficiently trust the state of training and offer their own training programs (non-formal education) to form professional competencies [7]. The field of activity of specialists in recreational fitness provides professional readiness for teaching, research, advisory, cultural, educational, coaching, organizational, managerial and other activities in the system of special education and the fitness industry in accordance with established requirements. That is why, in our opinion, at the present stage, the main tasks of improving the system of personnel support for the functioning of the sphere are the development of requirements for the qualifications of employees, their competencies, educational qualification characteristics (professions: fitness trainer, aerobics instructor, etc.), which they serve as the basis for the professional standard (the formation of professional qualifications) and the industry standard for higher education in the relevant specialty. It is the professional standard that will allow to determine general and labor functions, qualification level, actions, performed by employees within their professional sphere, as well as the necessary knowledge and skills.

field of physical culture and sports: the Constitution of Ukraine and the laws of Ukraine "On Education", "On Higher Education", "On Physical Culture and Sport", Concept of the State Program "Health 2020: Ukrainian dimension" for 2012–2020 (2011), National strategy for improving motor activity in Ukraine for the period up to 2025 "Motor activity – a healthy lifestyle – a healthy nation" (2016), Action Plan for the implementation of the National Qualifications Framework of Ukraine for 2016–2020 and the like.

The system analysis of published materials suggests that in recent years, both domestic and foreign scientists have increased their attention to personnel issues in the field of physical culture and sports (Table 1).

Most of the conducted research concerns the training of future specialists:

- on physical education and sports (Sushchenko L.P.)
- with adaptive physical education (G. Karpyuk)
- on physical recreation (Andreeva A.V., Krutsevich T.Yu.)
- using an interdisciplinary approach (S. Balandin I.)
- managers in physical culture and sports (Sazonov I.Yu., Lomovtseva O.V., Kuzmin A.M.)
- in recreational and recreational activities (Danilevich M.V.)
- to the introduction of health fitness technologies in the school (A. Atamas);
- to improve their quality (Bondin V.I., Putilina T.A.)
- to conduct lessons (fitness classes) with different age groups (Saikina E.G., Batischeva M.G., Krendeleva V.V.)
- on the use of health fitness technologies (Zakharina E.A.)
- on competitiveness (Khazova S.A.), etc.

Investigating the issue of staffing the fitness industry, we also relied on the development of domestic and foreign scientists, who examined various aspects of it in their research (Table 2).

These scientific works cover a wide range of issues of staffing the fitness industry, in particular, the professional activity of a fitness trainer. Thus, experts [5; 7; 32] highlighted the current state of training of specialists who will work in the fitness industry, in institutions of higher education (universities). The absence of professional higher education in most fitness trainers was stated. The prices and the introduction of health

Table 1

Study of the problems of staffing in the field of physical culture and sports

No.	Meaning of the problem	Authors
1.	Theoretical foundations of professional training of specialists in the field of physical culture and sports	Karpyuk R.P., 2008; Hazova S.A., 2011; Matrosova O.Yu., 2011; Sushchenko L.P., 2003, 2015, 2017; Azhippo O.Yu., 2013; Zakharina Ye.A., 2013; Belikova N.O., 2012, 2017; Andreeva O.V., Blagoy O.L., 2015; Atamas O.A., 2015; Sushchenko V.P., 2016; Stepanchenko N.I., 2017; Kuznetsov N.I., 2017 Bondin V.I., Putilina T.A., 2017; Danilevich MV, 2018; Sazonov I.Yu., Lomovtseva O.V. and others, 2018
2.	Personnel support of physical culture and sports in Ukraine, training for: - social sphere; - sports of the highest achievements	 Gasiuk I.L., 2010; Kulish N.M., 2016; Dutchak M., Shkrebtiy Yu. et al., 2010
3.	Mechanisms of state management of the development of physical culture i sport in higher educational institutions of Ukraine	Vavrenyuk S.A., 2015
4.	Conceptual bases of professional training of specialists in physical education and sport	Kurilo V.S., 2006
5.	Functioning and development of physical culture and sports in the market	Michuda Yu.P, 2008
6.	Place and value of vocational guidance in the process of staffing the field of physical culture and sports	Zolotukhina I., 2007
7.	Problems of state personnel policy in the field of physical culture and sports	Oluiko V. M., 2006; Moiseyeva S., 2012; Zhurba M.A., 2017; Melnichenko O.A., 2016
8.	Internal resource development in the field of physical culture and sports	Leonov Ya.V., Prikhodko I.I. and others, 2013

fitness in schools of various types: pre-school institutions, secondary schools, universities, etc. [28; 32]. That is, there is a certain social demand for relevant specialists, to which the education system would respond promptly and adequately. In Ukraine, the formation of a system of training specialists for the sphere of health fitness continues.

Our analysis of the scientific literature suggests that the considerable attention of domestic scientists to the problems of training future fitness trainers in higher educational institutions. M. Vasilenko [8] thoroughly covers her in her works [8]. A. A. Berest examines the preparation of future fitness trainers in recreational and recreational activities [4], A. K. Kornosenko – the specifics and functions of the professional activity of a fitness trainer [18], A. V. Korh-Cherba – the main directions

Table 2

Study of the problems of staffing of the fitness industry

No.	Meaning of the problem	Authors
1.	Fitness trainer training system	Levitsky V., 2005; Korh-Cherba O.V., 2015 [19]; Pristupa E., Muzika F., Zhdanova O., Chekhovska L., 2017 [32]; Vasilenko M.M., 2018 [7]
	Formation of professional competences of a fitness trainer	Volkov K.D., 2009 [9]; Milov Yu.V., Volf T.V., 2016 [26]; Slobozhaninov P.A., 2017 [35]
	Improving the professional competence of a fitness trainer	Levchenkova T.V. 2018 [24]
2.	Staffing of fitness in foreign countries	Levitsky V., 2011 [23]; Czerwińswki J., 2001; Berezanskaya M., 2013 [3]; Vasilenko M.M., 2013 [6]; Zhdanova O., Chekhovskaya L., Shevtsev U, 2016 [16]
3.	Legal and regulatory aspects of the fitness trainer	Dutchak M., 2010 [13]; Dutchak M., Vasilenko M., 2013 [14]
4.	Staffing fitness clubs	Priimak M., 2016 [28]
5.	Advanced training of a fitness trainer, level of knowledge	Stacey D., Hopkins M., Adamo K.B., Shorr R., Prud'homme D., 2010 [52]; Priimak M., 2017 [29]
6.	Professional training: – trainer-teacher;	Svatyev A.V., 2013; Pavlyuk E.O. 2017
	– fitness trainer in Ukraine;	Miroshnikov A. B., Nesterov P.V., 2010 [27]; Berest O.O., 2015, 2016 [4; 5]; Pyatnitskaya D.V., 2016 [33]; Kornosenko O.K., 2015 [18]; Vasilenko M.M., 2018 [8];
	– fitness trainer in foreign countries	Vasilenko M.M., 2013 [6]; Saykyna E.G., 2015 [34]; Prima A., 2017 [30]; Tverdokhlib O., Kuzmenko N., Luscan O., 2010 [39];
	– athletic gymnastics instructor	Ponomarev V. O., 2010; SM Bulakh, 2015
7.	Technology management of physical education in organizations of fitness-oriented	Demekh S., Hayevy V., 2013 [12]
8.	Certification / licensing of a fitness trainer	Deana I. Melton, Jeffrey A. Katula, Karen M. Mustian, 2011 [52]; Halvorson R., 2009 [48]; Feito, Y., 2018 [47]; Shestakova E.V., 2017 [43]
9.	The role of fitness professionals and their impact on consumer health	Alexander T.C. De Lyon, Ross D. Neville, Kathleen M. Armour, 2016 [46]
10.	Features of the activities of fitness managers	Melton D.I., Dail T.K., Katula J.A., Mustian K.M., 2010 [50]; Stadnyk S., 2017 [37]
11.	Providing fitness trainers with fitness services, taking into account: - quality	Aronov G.E., 2008; Smirnov S.I., 2013 [36]; Dutchak M., Malkova D., 2017 [15]
	- emotional aspect (pleasure)	McGuire, A.M., Anderson, D.F., Trail, G., 2009 [49]
	- management aspect	Smirnov S.I., 2013 [36]; Kabanovskaya Ye.S., 2008; Krusevich T., las T., 2012 [20]
12.	The specifics and functions of the professional activity of a fitness trainer	Kornosenko O.K., 2017 [18]; Vasilenko M.M., 2018[8]
	Evaluation of a fitness trainer	Melton D., Dail T. K., Jeffrey A. Katula, Karen M. Mustian, 2011 [51]; Chiu W., Lee Y., Lin T., 2010 [45]
	The level of pedagogical skill fitness trainer	Bennie J.A., Wiesner G.H., van Uffelen J.G.Z., Harvey J.T., Biddle S.J.H., 2017 [44]; Aftimichuk O., 2012 [1];
	"Professional burnout"	Volosatov E.B., 2010 [10];
	Adaptation to physical stress	Kutuzov A.E., 2012 [21];
	staff motivation	Fedorenko, T.M., Avershina, Yu.S., 2016[40]
13.	Evaluation of the competitiveness of institutions of the fitness industry	Gaptar V.M., 2010 [11]; Stadnik SA, Sereda N.V., 2016 [38]; Prypatie E., Chekhovskaya L., 2018 [31]
14.	Management, marketing in the domestic market of sports and recreational services	Potapyuk I.P., 2013; Smirnova V., 2015; Cherdantseva I.G., Ibragimova L.S., Ibragimov E.Yu., 2018 [42]

for the implementation of the system approach in the professional activity of the future fitness trainer [19], D. V. Pyatnitskaya – analysis of the forms of organization of the educational process of future fitness trainers [33], A. Prima – implementation of the competence approach in the formation of professional competence of future fitness trainers to the professional ionalnoy activities Fitna with industry [30] and so on.

In particular, A. V. Korh-Cherba also notes that in the field of fitness and fitness, mainly those who have completed short-term instructor training courses work and do not meet modern requirements of the fitness industry due to their professional qualifications [19].

In his research, M. M. Vasilenko notes the need to provide the

labor market with competitive specialists, since the professional environment discusses the problem of the lack of qualified fitness trainers and the mismatch of the competencies of physical education personnel with the reality of practice. The author emphasizes the need and feasibility of specifying employers' requirements for future fitness trainers [7]. That is why, in our opinion, cooperation between teachers and business is necessary, which would be appropriate and would contribute to improving the system of training, the quality of fitness services and the competitiveness of fitness clubs in general.

We agree and support the view that the professionalism of a fitness trainer affects the consumer and his health [46]. That is why it is necessary to regularly evaluate its activities [50] and the level of skill [2; 50], because it is possible to "professional burnout" [10] of the above-mentioned specialists that can negatively affect the quality of fitness services.

Special attention should be paid to the work of foreign experts in evaluating the activities of a fitness trainer [50; 51] and its certification [47; 48; 50; 51]. These aspects are interrelated and are mandatory in the professional activity of a fitness trainer. Unfortunately, domestic scientists do not carry out similar studies, since these aspects are not sufficiently implemented in the practice of health fitness in Ukraine.

We agree with the opinion of J. Czerwiński (2001) that the effectiveness of a specialist's professional activity depends on the quality of his training, level of professional knowledge, abilities and skills of applying the knowledge gained in practice, the level of readiness to carry out professional activities in modern market conditions, as new directions of fitness

However, V. V. Kovalchuk notes that it is necessary not only to possess knowledge and skills that form the basis of the profession and determine qualifications, but also to be able to realize the acquired professional potential and creatively influence the development of the production situation [17]. We share this opinion and consider it important for our research.

It should be noted that in the fitness industry the time of production and consumption of the product coincide in time. In this regard, the service manufacturer is also its seller. Therefore, the success of fitness centers, image and reputation depend on the attitude of staff to consumers, their satisfaction [49], the ability to provide a fitness service, the quality of which should be evaluated [15]. It is obvious that its competitiveness will also depend on these aspects and the strengths of the internal environment of a fitness club [11; 31; 38]. In general, everything will help increase the number of consumers.

As a result of generalization of practical experience of staffing organizations of the fitness industry, as well as the ranking of factors influencing staffing, which create a balance between the need for personnel and their availability, it was found that according to the degree of influence of a group of factors are arranged in the following sequence: professional qualification – 82%; socio-economic – 74%; political and legal – 67%; scientific and technical – 63%; demographic – 59%; economic and geographical – 43%; natural biological – 39%; ideological and moral – 37%. The degree of consistency of experts is W – 0,82.

Organizational analysis of the personnel components of the fitness industry in Ukraine, analysis of the results of the fitness industry market research conducted by FitnessConnectUA (2016), allowed to establish that the level of service (3%) and professionalism of trainers (3%) in the structure of consumer preferences take only 6 and 7 places, and as of 2017 – the professionalism of coaches (5%), and the level of service (4%) – 7 and 8 respectively. This indicates a lack of awareness among consumers of fitness services about the correlation between staffing and quality of services. It should be noted that the market of the fitness industry in Ukraine is going through a period of development. So, in 2017, there were 1569 fitness facilities, which is 150 more than in 2016, with 56% are fitness clubs, 10% are fitness studios, 9% each are martial arts clubs and Pilates studios 7% are women's fitness clubs, 3% – yoga studios, 3% – dance studios, 2% – swimming pools.

It should be noted that all objects carry out staffing with the use of various methods, strategies, provision of working conditions, personnel selection, advanced training of workers, which, in our opinion, requires systematization, coordination of approaches and critical analysis of the state of staffing.

Paying tribute to the developments of domestic and foreign scientists, it should be noted that the complex and multidimensional problem of staffing in the system of health fitness in Ukraine has not yet become the subject of a separate scientific study. The relevance of this issue is explained by the presence of such contradictions between:

- growing pace of development of the domestic fitness industry and the insufficient level of feasibility of its staffing system;
- formation in Ukraine of the national qualifications system and the lack of organizational and managerial foundations of this process in the system of recreational fitness;
- increasing the demands of consumers of fitness services and employers to the competence of fitness personnel and the lack of relevant professional standards in Ukraine;
- existing practice of improving the competence of specialists in health-improving fitness throughout the entire period of their professional activities and the uncertainty of the organizational and managerial conditions for the implementation of a modern system of continuous professional development of fitness personnel in Ukraine.

Conclusions / Discussion

Analysis of literary sources and information resources of the Internet, domestic and foreign practical experience shows that the strengthening of the social significance of the professional activities of fitness industry professionals is due to new socio-economic changes, the development of our state in accordance with the new market conditions. The processes of transformation, globalization and integration that are currently taking place in the system of health fitness in Ukraine require the improvement of its staffing.

The system analysis of published materials suggests that in recent years, both domestic and foreign scientists have increased their attention to personnel issues in the field of physical culture and sports, in particular, in the fitness industry. The necessity of providing the labor market with competitive specialists has been proved, since the professional environment discusses the problem of the lack of qualified fitness person-

nel and the mismatch of the competences of these personnel with modern challenges.

The need of a scientific substantiation of the concept of staffing in the system of fitness and fitness in Ukraine was updated to overcome the revealed contradictions between the existing practice and the requirements of modernity.

Discussion remains questions of the appropriateness and prospects of borrowing some elements, forms and methods fessional standards for fitness staff.

of organizing staffing the fitness industry in other countries; taking into account a number of methodological provisions: informative and in-depth study of existing experience, the result of which may be the improvement of the concept of personnel management of the fitness industry.

Prospects for further research lie in the analysis of the legal regulation of the organization of proper staffing of the modern fitness industry, as well as the development of pro-

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Impact of physical activity on the level of development of the physical qualities of athletes 12–15 years old, involved in kettlebell lifting at the stage of initial training

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Purpose: *to investigate the development of the physical qualities of athletes 12–15 years old, involved in kettlebell lifting, under the influence of practicing kettlebell lifting during the one-year macrocycle.*

Material & Methods: *studies were conducted in Complex Youth Sports School No. 16 and Public Institution Complex Youth Sports School No. 8 of Kharkiv with athletes 12–15 years old engaged in kettlebell lifting during the one-year macrocycle in the amount of 30 people. The following research methods were used: analysis of literary sources and testing of the level of motor qualities in certain age categories.*

Results: *pedagogical testing is presented to determine the level of motor capabilities of young athletes 12–15 years old engaged in kettlebell lifting. Exercises were identified that are advisable to use at these stages of preparation: running at 60 meters; at 1500 m; number of jumps in 30 seconds, standing long jump; flexion and extension of the arms in the support lying on the floor; raising legs hanging on the wall bars.*

Conclusion: *as a result of the testing of motor skills using non-specific exercises for kettlebell lifting, it was found that the performance improves every year in all exercises ($p>0,05$), especially in 60 m running, which significantly increased in the age range from 13 to 14 years and in the race for 1500 m, from 14 to 15 years. The speed-strength abilities of young athletes aged 12–15 years who are involved in kettlebell lifting were more pronounced in the age range from 13 to 14 years.*

Keyword: *testing, physical qualities, kettlebell lifting, female athletes.*

Introduction

Kettlebell lifting is not an Olympic sport but it is in demand among modern youth (V. Platonov, 2004; L. S. Dvorkin, 2005; M. T. Lukyanov, 1969; V. G. Oleshko, 2011) [1; 3; 8; 18]. This circumstance attracts the attention of specialists to the development and scientific and methodological substantiation of the theory and methodology of training athletes of different ages and qualifications.

According to the research, the initial preparation stage is especially important, since during this period there is a rapid development of power abilities, the development of sportsmanship, an intensive process of adaptation to the specific conditions of doing weightlifting. The problem of training young athletes at the initial training stage in weightlifting is given some attention, there is a constant improvement in the training methods of young athletes. In particular, in recent years, research has been conducted on various aspects of this problem (Yu. V. Verkhoshansky, 2013; L. S. Dvorkin, 2005; V. G. Oleshko, 2011) [2; 3; 18–19], two methodological manuals were issued (L. S. Dvorkin, 2005; V. G. Oleshko, 2011) [3; 18]. A large number of scientific articles have been published, programs for youth sport school have been issued. All this testifies to the relevance of the studied direction.

Analyzing the available scientific and methodological literature on the training of athletes in kettlebell lifting, it should be noted that many issues are presented quite widely.

In particular, different views are considered on the age at which we begin doing kettlebell lifting (L. S. Dvorkin, 2005; V. G. Oleshko, 2011), the scope and content of the training work (Yu. V. Verkhoshansky, 2013, B. I. Sheyko, 2008), the use of various training tools (L. S. Dvorkin, 2005; N. A. Laputin, 1973; Yu. K. Gaverdovsky, 2007; A. V. Chernyak, 1970; V. Yu. Dzhym, 2013).

At the same time, the available information is often contradictory, it is fragmentary in nature, which does not allow us to develop a rational system for training athletes engaged in heavy sports (V. S. Farfel, 1963; V. P. Novikov, 1990) [10; 20].

Purpose of the study: to investigate the development of the physical qualities of athletes 12–15 years old, involved in kettlebell lifting, under the influence of practicing kettlebell lifting during the one-year macrocycle.

Material and Methods of the research

The research was carried out in the Complex Youth Sports School No. 16 and Public Institution Complex Youth Sports School No. 8 of Kharkiv, with female athletes 12–15 years engaged in weight lifting, for a one-year macrocycle of 30 people. The research methods used were: analysis of literary sources and testing of motor quality in selected age categories.

Our research was aimed at revealing the level of physical preparedness of young female athletes of 12–15 years engaged

in weight lifting, representing the process of development of motor qualities, as a result of which the level of athletic skill of athletes is manifested.

As a pedagogical testing to determine the level of motor capabilities of young female athletes 12–15 years old engaged in kettlebell lifting, we have chosen exercises that are appropriate to use at these stages of preparation.

Results of the research

Testing of motor skills in the training process took place with the use of in-preparatory exercises: 60 meters running; at 1500 m; number of jumps in 30 seconds; standing long jump seats; flexion and extension of the arms in the support lying on the floor; raising legs in vise on the wall bars (Table 1).

Table 1

Dynamics of indicators of general physical fitness of young female athletes 12–15 years old, involved in kettlebell lifting (n=30)

Indicators	12 years $\bar{X}_1 \pm m_1$	13 years $\bar{X}_2 \pm m_2$	14 years $\bar{X}_3 \pm m_3$	15 years $\bar{X}_4 \pm m_4$
Running at 60 m, s	10,4±0,10	10,1±0,11	9,6±0,13	9,2±0,09
Running at 1500 m, s	525,5±2,15	507,6±4,84	487,3±4,20	463,0±8,96
Jump-ups for 30 s, number of times	22,0±1,02	23,6±0,82	26,8±0,79	28,3±0,69
Standing long jump, cm	163,2±3,51	166,0±1,69	168,3±1,44	176,0±4,15
Flexion and extension of the arms in the support lying, num. of times	15,2±1,36	18,0±1,23	21,2±1,55	24,5±1,50
Raising legs hanging on the wall bars, the number of times	13,2±2,63	17,6±1,95	20,8±2,15	24,0±1,74

The indicator of speed qualities in the 60m race for girls 12–13 and 14–15 years old did not change (p>0,05), at the same time the changes were revealed in the age intervals of 12 and 14 years old, 12 and 15 years old, 13 and 14 years, 13 and 15 years (p<0,05–0,001) (Table 2).

Over the course of the study, for girls aged 12–15 years, stamina at a distance of 1500 m statistically significantly changed at all age intervals (p<0,05–0,001) (Table 2).

Testing the exercise, the amount of jump-ups for 30 seconds showed an increase in results at age intervals of 12 and 14 years, 12 and 15 years, 13 and 14 years, 13 and 15 years (p<0,05–0,001), while girls 12 and 13 years , as well as 14 and 15 years, the changes were not significant (p>0,05) (Table 3)

Indicators of a standing long jump among young female athletes aged 12–15 years involved in kettlebell lifting increased from 12 to 15 years, and from 13 to 15 years (p<0,05–0,001) (Table 3).

When testing the strength indices of the muscles of the upper extremities (flexion and extension of the arms in the rest lying on the floor), no difference was found in girls between 12–13 years, 13–14 years, and 14–15 years (p>0,05), however, statistically significantly increased results in girls from 12 to 14 years old, from 12 to 15 years old, and from 13 to 15 years old (p<0,05–0,001) (Table 4).

As can be seen from table 4, the results of raising legs hanging on the wall bars girls 12 and 14 years old, 12 and 15 years old, 13 and 15 years old have a statistically significant difference (p<0,05–0,001), while girls 12 and 13 years, 13 and 14 years, 14 and 15 years she is absent (p>0,05).

Conclusions / Discussion

Analysis of the scientific literature has confirmed that research in the field of weight-lifting has been mostly fragmented. In recent years, scientists conducted studies on the content and methods of the training process of young female gymnastics 12–15 years old with various methods of motor skills and

Table 2

Matrix of the significance of the difference in the performance of running 60 m and running 1500 m of young female athletes 12–15 years old engaged in kettlebell lifting (n=30)

Age	Test	13 years	14 years	15 years
12 years	Running at 60 m	t=2,02; p>0,05	t=4,88; p<0,001	t=8,92; p<0,001
	Running at 1500 m	t=3,38; p<0,01	t=8,10; p<0,001	t=6,78; p<0,001
13 years	Running at 60 m	–	t=2,94; p<0,01	t=6,33; p<0,001
	Running at 1500 m		t=3,17; p<0,01	t=4,38; p<0,001
14 years	Running at 60 m	–	–	t=2,53; p<0,05
	Running at 1500 m			t=2,46; p<0,05

Table 3

Matrix of the difference in jump-ups rates for 30 s and long jump from the place of young female athletes 12–15 years old engaged in kettlebell lifting (n=30)

Age	Test	13 years	14 years	15 years
12 years	Jump-ups for 30 s	t=1,22; p>0,05	t=3,72; p<0,001	t=5,12; p<0,001
	Standing long jump	t=0,72; p>0,05	t=1,34; p>0,05	t=2,35; p<0,05
13 years	Jump-ups for 30 s	–	t=2,81; p<0,01	t=4,39; p<0,001
	Standing long jump		t=1,04; p>0,05	t=2,23; p<0,05
14 years	Jump-ups for 30 s	–	–	t=1,43; p>0,05
	Standing long jump			t=1,75; p>0,05

Table 4

Matrix of the reliability of the difference in the indicators of flexion and extension of the arms in the support lying and raising legs hanging on the wall bars of young female athletes 12–15 years old engaged in kettlebell lifting (n=30)

Age	Test	13 years	14 years	15 years
12 years	flexion and extension of the arms in the support lying	t=1,53; p>0,05	t=2,91; p<0,01	t=4,59; p<0,001
	raising legs hanging on the wall bars	t=1,34; p>0,05	t=2,24; p>0,05	t=3,42; p<0,01
13 years	flexion and extension of the arms in the support lying	–	t=1,62; p>0,05	t=3,35; p<0,01
	raising legs hanging on the wall bars		t=1,10; p>0,05	t=2,45; p<0,05
14 years	flexion and extension of the arms in the support lying	–	–	t=1,53; p>0,05
	raising legs hanging on the wall bars			t=1,16; p>0,05

strength qualities (Yu. V. Verkhoshansky, L. S. Dvorkin [2; 3]), training planning process during the one-year macrocycle of female athletes 12–15 years old (V. M. Platonov [1]) and the influence of the training process of young female gymnasts 12–15 years old on manifestations of physical qualities (N. S. Ipolitov, B. S. Evdokimov; M. T. Lukyanov, V. P. Filin; A. V. Chernyak [4; 7–9; 11]. However, the influence of physical exertion on the performance of young female athletes 12–15 years old engaged in kettlebell lifting at the first stage of training for many years was not studied, which prompted us to do an analysis in this direction.

The study confirmed the results of other authors [2; 3] about the need to take into account the effect of training on the physical performance of athletes 12–15 years old at the initial training stage. Also, data of domestic ones were expanded [4; 7–9; 11] and foreign authors [21; 22; 23; 24] on raising the level of the most significant indicators of physical qualities on a young body of athletes involved in kettlebell lifting.

As a result of the testing of motor skills using non-specific exercises for kettlebell lifting, it was found that the indicators improve every year in all exercises (p>0,05), especially in 60 m running, which significantly increased in the age range from 13 to 14 years and in the race for 1500 m from 14 to 15 years (Table 2). The speed-strength abilities of young athletes aged 12–15 years who are involved in kettlebell lifting were more pronounced in the age range from 13 to 14 years.

Prospects for further research include the determination of the impact of kettlebell lifting training on the functional state and psychophysical indicators of young female athletes aged 12–15 years engaged in kettlebell lifting during the one-year macrocycle.

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Anthropometric and functional indicators of athletes with different types of body constitution

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Purpose: *to determine the main anthropometric indicators, the level of the functional state of the cardiovascular and respiratory systems of athletes, depending on the type of constitution of their body.*

Material & Methods: *in the course of the study, measurements were made of the type of body constitution, morphological indicators and indicators of the functional state of the cardiovascular and respiratory systems of athletes. Two experimental groups were formed from specialized sport school athletes.*

Results: *the analysis of anthropometric and functional indicators of the cardiovascular and respiratory systems of athletes specializing in freestyle wrestling and rowing from specialized sport school is carried out. The dependence of the state of morphological and functional parameters of athletes depending on the type of body constitution is shown.*

Conclusion: *the dependence is established between the type of body constitution with the morphological and functional indicators of athletes specializing in freestyle wrestling and canoeing.*

Keywords: *freestyle wrestling, rowing, anthropometric and functional indicators.*

Introduction

At the present stage of development and in the future for further research and development, the actual task of constitutional science is to study the processes of adaptation – identifying the advantages of certain constitutional types in certain cases of changing environment conditions. No less important theoretical and practical importance of research in sports morphology are the study of individual constitutions as genetic markers of the younger generation with a tendency to engage in various sports [3; 6; 7].

The effectiveness of competitive activity largely depends on the morphofunctional characteristics of the athlete's body, an integral indicator of which is the constitution of his body and its morphological manifestation - the somatotype. A number of papers [4–7] are devoted to evaluating the type analysis of the body of athletes, but different authors used different constitutional schemes to examine athletes in particular sports, and therefore their research results are often difficult to compare.

In modern literature there are scientific studies on the study of the morphological features of karatekas [4], wrestlers [10] representatives of team sports [5], swimming [1], all-around [9], rowing [2]. However, due attention is not devoted to the study of morphological characteristics and their relationship with functional indicators of athletes. At the same time, it is the constitutional features of athletes that influence the manifestations of many physical qualities, the performance of athletes and their adaptation to external influences, in particular, to physical loads.

Purpose of the study: to determine the main anthropometric indicators, the level of the functional state of the cardiovascular and respiratory systems of athletes, depending on the type of constitution of their body.

Material and Methods of the research

42 young men were studied on the basis of specialized sport school at the age of 15–18 years old, who were divided into 2 groups according to the types of sports: 20 people involved in rowing and 22 people involved in freestyle wrestling. Both groups of athletes were divided into three groups according to the type of body constitution (TBC) (method of M. V. Chornorutsky): Group I – persons of asthenic type, Group II – persons of hypersthenic type and Group III – persons of normostenic type. In the course of the study, measurements were made of morphological indicators and indicators of the functional state of the cardiovascular system (pulsometry, tonometry, Martine-Kushelevsky test) and respiratory system (vital capacity (VC), vital index (VI), Shange test, Skibinsky index).

Results of the research

Having determined the TBC by M. V. Chornorutsky in both groups of athletes who participated in the surveys, it turned out that the normostenic type of constitution prevails in them, namely 12 people each (60,0% are rowers and 54,5% are wrestlers). The asthenic type included 8 people, which accounted for 40,0% of the number of surveyed who are engaged in rowing, and 6 (22,7%) – wrestlers. We detected the hypersthenic TBC in 4 people, which is 18,2% of the total number of wrestlers, and not a single person was found in the group of rowers with this type of body constitution.

The average morphological data of the physical development of athletes of various types of body constitution are presented in Table 1. When analyzing the obtained morphological data of athletes-rowers of various TBC using Student's criterion, we found significant differences only between the torso length indicators of normostenic and astenic ($t=3,22$, $p<0,01$). During the statistical comparison of other indicators of the rowers' anthropometry of the normostenic and asthenic TBC,

we found no significant significant differences (t=0,38–1,36, p>0,05). According to the morphological surveys of the wrestler group, it can be noted that the average wrestlers turned out to be relatively low data of rowers, both with normostenic and asthenic TBC.

Comparative characteristics of the values of morphological parameters of the surveyed both groups showed that in relation to higher growth was observed in asthenic TBC persons who were characterized by high indicators of the length of the body, arms and legs. It should be noted that the width of the shoulders and pelvis were significantly higher in the examined normostenic type. In the group of wrestlers with hypersthenic TBC, as expected, we observed high rates of body weight, chest circumference (CC) and shoulder width. In a statistical analysis of the obtained anthropometric data of athletes involved in the wrestling of various TBC, we found significant differences only between the normal body mass indexes for hypersthenic values (t=2,23, p<0,05), the astenic values for hypersthene indicators (t=3,24, p<0,01). Other indicators of anthropometry of wrestlers of normostenic, asthenic and hypersthenic TBC did not differ significantly between themselves (t=0,12–1,08, p>0,05).

As you know, the functional state of the cardiovascular system is widely used in practice to determine the level of adaptation of the circulatory system to the conditions of muscle activity, therefore one of the directions of our study was to study its performance in the examined athletes of different body constitution. The average indicators are presented in Table 2.

The results of the study showed that in the group of rowers of the normostenic type of body constitution, the heart rate ranged from 64 beats·min^{-1} to 80 beats·min^{-1} with an average value of 72,8±1,5 beats·min^{-1}, corresponds to the age standard value. In the group of asthenic rowers, this indicators was 75,0±1,9 beats·min^{-1}. For comparison, it should be noted that the heart rate indicators of the wrestlers of various TBC averaged: in the normostenic – 76,4±1,7 beats·min^{-1}, asthenics – 78,2±2,8 beats·min^{-1} and hypersthenics – 75,5±2,6 beats·min^{-1}.

All the obtained HR indices in both groups of sportsmen of various TBC did not differ significantly among themselves (t=0,29–1,21, p>0,05) (Table 2).

Indicators BPsyst. in the rowers of normostenic TBC were in the range of 110–140 mmHg (On average – 122,5±1,5), BPdiast – from 60–80 mmHg (with an average value of 71,5±1,2) (Table 2). Whereas in the rowers of asthenic TBC, the average values are BPsyst made – 120,5±2,5 mmHg (t=0,69, p>0,05), and BPdiast – 73,9±1,6 mmHg (t=1,20, p>0,05).

It should be noted that only 10% of the surveyed registered high blood pressure; in other cases, its normative values are noted.

Analysis of the results of the heart rate in the group of wrestlers of various TBC suggests that there are no significant differences between the averages of the three groups (t=0,29–1,21, p>0,05). The average group indicators of HR were higher in the group of asthenic type and amounted to 78,2±2,8 beats·min^{-1}, and the lowest in the group of hypersthenics – 75,5±2,6 beats·min^{-1}.

n the group of examined wrestlers normostenic TBC indicators BPsyst and BPdiast on average, respectively: 120,5±1,4 mm Hg and 72,5±1,3 mmHg. In the group of asthenic wrestlers average scores were 118,7±1,8 mmHg, BPdiast – 75,3±1,8 mmHg. In the group of wrestlers hypersthenic TBC BPsyst was on average 123,8±2,2 mmHg, and BPdiast – 76,7±1,4 mmHg (Table 2). Statistical analysis did not allow us to identify significant differences between the indicators of the BPsyst. wrestlers of asthenic type with corresponding indicators of wrestlers of hyperstenic type (t=2,1, p<0,05) between indicators of BPdiast wrestlers of normostenic type with corresponding indicators of wrestlers of asthenic type (t=2,21–2,25, p<0,05) (Table 2).

We determined the analysis of the state of the respiratory system using the parameters of the VC, breath holding while inhaling (Stange test) and VI (Table 2). At the same time, we identified significant differences between the indices of the VC of rowers of the asthenic type with the corresponding indicators of rowers of the normostenic type (t=3,26, p<0,01); between indicators of rowers of normostenic type of rowers with corresponding indicators of asthenic rowers (t=2,03, p<0,05). We also found significant differences between indicators of the normostenic type wrestlers with corresponding indicators of wrestlers of asthenic type (t=2,83, p<0,05) between indicators of asthenic and hypersthenic types (t=2,36, p<0,05). Significant differences were found between the performance of the test Stange wrestlers normosthenic hypersthenic and TBC of the wrestlers of normostenic and hypersthenic TBC (t=2,47, p<0,05) (Table 2).

Breathing, like blood circulation, is extremely important to

Table 1

Main morphological parameters of the surveyed with different TBC

Groups	Body mass, (kg)	Body length, (cm)	Chest circumference, (cm)	Torso length (cm)	Arm length (cm)	Leg length (cm)	Shoulder width (cm)
Rowers							
Normostenic	71,1±2,6	174,2±3,8	83,6±1,7	56,4±0,9	75,6±3, 2	91,1±4,2	43,4±3,1
Asthenic	74,8±1,5	183,8±5,01	85,5±1,8	61,5±1,3	78,3±2,8	93,8±2,5	34,8±2,4
t_{1-2}	1,23	1,76	0,48	3,22	0,44	0,38	1,48
Wrestlers							
Normostenic	69,3±2,2	173,6±3,4	85,1±1,3	55,7±1,1	75,2±2,3	88,4±3,2	41,7±2,3
Asthenic	66,0±0,8	176,8±3,4	83,3±3,7	58,4±3,2	74,1±3,8	89,4±3,1	33,4±1,6
Hypersthenic	78,7±3,8	171,2±4,5	88,6±3,3	52,6±3,7	75,0±3,7	87,1±4,7	45,7±5,3
t_{1-2}	0,76	0,51	0,87	0,38	0,47	0,32	2,85
t_{1-3}	2,23	0,28	0,43	0,50	0,12	0,28	0,56
t_{2-3}	3.24	0,56	1,08	1,25	0,28	0,41	2,23

Table 2

Main functional indicators of the cardiorespiratory system of the surveyed with a different type of body constitution

Groups	HR (beats·min⁻¹)	BP syst. (mmHg)	BP diast. (mmHg)	VC (ml)	VI (ml·kg⁻¹)	Stange test (s)
Rowers						
Normostenic	72,8±1,5	122,5±1,5	71,5±1,2	4450±24	62,6±1,7	51,5±1,2
Asthenic	75,0±1,9	120,5±2,5	73,9±1,6	4250±40	56,8±2,3	53,6±2,2
t_{1-2}	0,91	0,69	1,20	3,26	2,03	0,84
Wrestlers						
Normostenic	76,4±1,7	120,5±1,4	72,5±1,3	4150±30	59,8±1,4	52,1±1,3
Asthenic	78,2±2,8	118,7±1,8	75,3±1,8	3950±64	59,2±2,5	48,3±1,8
Hypersthenic	75,5±2,6	123,8±2,2	76,7±1,4	4200±85	53,4±3,2	47,4±1,4
t_{1-2}	0,56	0,92	1,45	2,83	0,29	1,80
t_{1-3}	0,29	0,78	2,21	0,92	1,84	2,47
t_{2-3}	1,21	2,10	0,54	2,36	1,65	0,12

ensure the homeostasis of the body. Violation of respiration leads not only to changes in the gas composition of the internal environment of the body, but also to profound changes in all metabolic reactions, in all processes of life activity. Breathing is a complex of physiological processes that occur in the body and ensure oxygen consumption and removal of carbon dioxide. It is provided by the interaction of the respiratory system, blood circulation, blood and regulatory mechanisms.

As one of the methods of studying the functional state of the cardiovascular system, we used the Martine-Krushelevsky test, based on the indicators of heart rate and blood pressure during the recovery period. In norosthenic, which are engaged in rowing, heart rate indicators in 1 min of recovery averaged 124,1±2,0 beats·min^{-1} and during the next recovery period almost completely returned to the rest state indicator. The reaction of astenic was more reactive, was accompanied by a significant rise in heart rate, but after the entire recovery period it also almost returned to the resting state indicator.

In normostenic, who are engaged in wrestling, as well as in rowing athletes, a rise in the heart rate index was observed even after the first minute of work, and averaged 125,2±1,6 mmHg, and during the recovery period almost returned to the previous indicator rest state. The reaction of asthenics was more reactive, was accompanied by a significant rise in heart rate, and after three minutes of recovery has not fully returned to the previous indicator. And in hypersthenics, a significant increase in heart rate and a slow drop were observed, and the final heart rate exceeded the rest indicator.

BPsyst among the normosthenics, the group of rowers increased significantly, but the final indicator returned to the initial values. The reaction of aasthenics was more, their performance significantly exceeded the norm, the final BPsyst was significantly higher than the previous figure. BPdiast. in nomosthenics increased slightly and returned to the previous indicator. In asthenics there was a higher rise in BPdiast., Which also returned to the previous indicator. The hypersthenic type reacted with a relatively high growth rate of BPdiast. and incomplete recovery after three minutes of rest.

BPsyst for the wrestlers' normosthenics, it increased slightly, and, accordingly, the final indicator returned to the previous one within 1–2 minutes. Reaction of asthenics was more, their performance significantly exceeded the norm, the final BPsyst was significantly higher than the previous figure. The hypertensive reaction of the cardiovascular system was very reactive, which was accompanied by a very high rise in the BPsyst.

Bdiast in normosthenics increased slightly and returned to the previous indicator after 1-2 minutes of recovery. In asthenics, a higher elevation of BPdiast was observed. It also almost returned to the previous indicator. The organism of representatives of the hypersthenic type reacted with a strong increase

Table 3

Indicators of Martine-Kushelevsky test among athletes'

Groups	I minute		II minute		III minute	
	HR	BPs/BPd	HR	BPs/BPd	HR	BPs/BPd
Rowers						
Normostenic	124,1 ±2,0	131,3±3,2 /77,3±1,8	86,2 ±1,7	126,2±2,0 /72,6±1,3	73,7 ±1,4	115,5±1,7 /72,4±1,7
Asthenic	134,2 ±2,3	141,3±2,8 /70,5±1,0	90,3 ±2,0	137,3±1,8 /81,1±1,0	76,2 ±1,5	125,0±1,6 /74,5±2,3
Wrestlers						
Normostenic	125,2 ±1,6	128,2±2,0 /79,0±2,1	89,1 ±1,7	124,2±1,7 /76,3±1,1	76,1 ±13	124,1±1,5 /71,6±1,3
Asthenic	128,3 ±2,6	140,0± 2,5 /84,2±3,2	94,4 ±2,2	135,2±2,3 /81,2±2,1	79,4 ±2,2	121,2±1,8 /75±2,3
Hypersthenic	138,2 ±2,2	145,1±3,0 /86,0±1,9	96,2 ±2,1	139,0±2,6 /82,2±1,8	78,3 ±2,1	128,2±2,5 /81,3±1,9

in BPdiast, which, after recovery, was significantly higher than the rest state indicator.

Conclusions / Discussion

In this study, we studied the morphological and functional indicators, the reaction of the cardiovascular system to the dosed load of athletes, characterized by various types of body constitution (according to M. V. Chornorutsky).

As a result of the study, it was established that there is a relationship between the type of body constitution and the morphological and functional indicators of athletes who specialize in freestyle wrestling and rowing and canoeing.

This study complements the theoretical basis for studying the types of body constitution and the physical development of athletes of various kinds [1; 2; 4; 5; 9; 10]. At the same time, for the first time, we have carried out a comparative description of morphological and functional indicators of the physical development of freestyle wrestlers and rowers. The data obtained morphological and functional indicators of athletes of various types of body constitution fully confirm our vision of solving the problem of improving the various aspects of sports training of fighters and rowers, taking into account their individual characteristics of physical development. The results obtained can be applied in the practice of coaches in freestyle wrestling and rowing on canoes and canoes during the implementation of the training process and sports selection.

Prospects for further research in this direction are to study the characteristics of the type of constitution of the body of athletes and their relationship with the level of technical and physical preparedness.

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Technical and tactical readiness of the team "Helios" (Kharkiv) in the 26th Ukrainian soccer championship in the first league

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Purpose: *to determine the model characteristics of the technical and tactical readiness of the team that participated in the Ukrainian championship of the first league in order to further improve and correct the training process.*

Material & Methods: *the data were obtained using the method of expert evaluation, the calculation was carried out using the methods of mathematical statistics.*

Results: *analyzed the average values of the registered values for 19 games. Analyzed various technical and tactical actions and their differences in the first and second halves, as well as individual indicators of the game players and the team "Helios" (Kharkiv).*

Conclusion: *quantitative and qualitative (rejection rate) indicators were obtained both for team technical and tactical actions, and separately for each technical and tactical method for each game period.*

Keywords: *technical and tactical actions, total number of actions, reject rate, indicators for the first and second half, attacking and defensive actions of the team.*

Introduction

A great contribution to the construction of model characteristics of competitive activity in football was made by domestic experts [7; 9; 12]. Football experts analyze technical and tactical readiness from young football players [2; 6; 8] to football veterans [11]. Some experts are exploring certain indicators that, in their opinion, lead to a positive result of the game. Among them are: one-touch ball transfers in various zones of the football field [13], ball delivery in the opponent's penalty area [10], etc. There are some studies of the competitive activities of highly skilled football players (Ukrainian Football Premier League), which were conducted with the same the same team for a long time [15]. However, there are practically no longitudinal studies of technical and tactical preparedness of the teams of the First League of Ukrainian football. [3–5].

In our time, when developing quantitative indicators characteristic of a given level of sportsmanship, various approaches can be distinguished [14]. We used the approach associated with the study of a significant set of athletes of different qualifications, establishing the relationship between the level of sportsmanship and the dynamics of changes in a particular indicator.

Purpose of the study: to determine the model characteristics of the technical and tactical readiness of the team that participated in the Ukrainian championship of the first league in order to further improve and correct the training process.

Material and Methods of the research

Studies were conducted using the method of expert evaluation. As experts were involved 5 football professionals. Among them: one master of sports in football, one – candidate master of sports, the rest were players of professional football teams. All the experts in the past worked with professional and amateur football teams as coaches. From among experts: two professors, one candidate of pedagogical sciences, associate professor; two candidates of sciences in physical education, associate professors of the Department of Football and Hockey of the Kharkov State Academy of Physical Culture. If during the registration of the competitive activity of the Helios team in Kharkov there were debatable questions, they were decided by a majority vote. During the pedagogical observations, the methodology itself assumed mutual control over the indicators of competitive activity, which made it possible to obtain more objective data. So, one of the specialists counted the total number of transfer, and the other, at the same time, slandered the dictaphone which specific players (player number) and which was transfer in the direction and distance.

During the development of model characteristics, the mean – $\bar{X}$, was calculated, the sample mean error (the error of representativeness) was ± m. The significance of differences was determined using Student's t-criterion according to the generally accepted method [1].

Scientifically-methodical group at the team "Helios", Kharkov, 19 games were registered in their field. In the matches of 26 championships of Ukraine in the first league 18 teams participated. Players "Helios" had 34 games, got 16 wins, 10 – draws, 8 – defeats, the goal ratio was 31–22,58 points scored.

Results of the research

This study presents averages that were obtained for 19 home games in the 26 championship of Ukraine in football among the teams of the first league. Thus, the total number of technical and tactical actions was 644,98±27,91, while the reject rate when performing these actions was 35,86±2,01%. During the first half, the players of the Helios team performed

338,15±17,45 technical-tactical actions with a rejection rate of 37,48±2,99%. In the second period, the players did 301,4±14,64 technical and tactical actions, with a rejection rate of 40,47±3,03%. Significant differences in these indicators we have not identified (Table 1). Significantly less (t=3,2; p<0,01) of interceptions in the second period were performed by players of the Helios team in Kharkiv.

We also calculated the greatest number of technical and tactical actions of all players of the "Helios" team per match (the activity coefficient was also calculated). Thus, the greatest number of technical and tactical actions of the players was 82,0±3,26, while the reject rate in these players was 33,48±2,04%.

The average total number of pass that were performed by the players of "Helios" for 19 games amounted to 348,0±14,16 (Table 2). At the same time, the overall reject rate for pass was 37,5±1,85%. During the first half, 184,52±9,12 pass were carried out, with a rejection rate of 36,13±1,72%. In the second period, the players performed an average of 162,57±7,38 pass, with a rejection rate of 43,95±3,07%. The reject rate when making transfers for the first half is significantly better than the second half (t=2,23; p<0,05).

The reject rate when performing: short and medium forward passes – 42,4±2,02%, long forward passes – 64,14±1,73%. The number of forward passes is 236,05 ± 7,81, with a reject rate – 47,47±2,0%.

Table 1

Indicators of technical and tactical readiness of the players of the team "Helios" in the 26 First League Championship, n=19

No.	Technical and tactical actions	1st time	2nd time	t	p	1+2
		$\bar{X}$±m				
1.	Ball reception	59,18±11,97	47,36±9,95	0,75	p>0,05	106,54±21,61
	Reject rate,%	–	–	–	–	22,05±2,51
2.	Pass the ball forward (short)	88,0±7,62	86,63±5,49	0,14	p>0,05	174,63±12,06
	Reject rate,%	–	–	–	–	41,58±2,69
3.	Pass the ball foot back and across (short)	55,45±6,9	44,45±5,24	1,27	p>0,05	105,25±8,97
	Reject rate,%	–	–	–	–	16,92±1,66
4.	Pass the ball forward (long)	26,9±1,59	26,54±2,52	0,12	p>0,05	53,27±3,38
	Reject rate,%	–	–			64,31±2,09
5.	Pass the ball foot back and across (long)	3,3±0,68	3,11±0,45	0,23	p>0,05	6,1±0,9
	Reject rate,%	–	–	–	–	55,9±6,77
6.	Head-playing (overhead scramble)	25,63±2,43	24,18±3,02	0,37	p>0,05	49,81±4,46
	Reject rate,%	–	–	–	–	37,22±1,89
7.	Dribbling opposition	11,45±1,97	13,81±1,68	0,91	p>0,05	25,27±3,35
	Reject rate,%	–	–	–	–	51,4±3,34
8.	Turnover	15,72±1,13	9,72±1,5	**3,2**	**p<0,01**	25,63±1,53
	Reject rate,%	–	–	–	–	27,72±4,02
9.	Tackling	24,27±2,76	26,72±2,27	0,68	p>0,05	51,0±3,95
	Reject rate,%	–	–	–	–	58,86±2,76
10.	Shots on goal by foot	2,9±0,48	4,3±0,59	1,84	p>0,05	6,54±0,94
	Reject rate,%	–	–	–	–	41,48±9,18
11.	Shots on goal by head	1,71±0,35	1,5±0,34	0,43	p>0,05	2,62±0,65
	Reject rate,%	–	–	–	–	43,75±12,27
12.	11th penalty kicks	–	1	–	–	1
	Reject rate,%	–	0	–	–	0
13.	Penalties in the attack zone	2,4±0,47	2,0±0,37	0,67	p>0,05	3,81±0,67
	Reject rate,%	–	–	–	–	65,24±8,51
14.	Corner kick	2,45±0,52	2,27±0,4	0,27	p>0,05	4,72±0,72
	Reject rate,%	–	–	–	–	65,59±5,83
15.	Throwing the ball in from the sideline	16,0±1,22	15,0±0,76	0,69	p>0,05	31,3±1,88
	Reject rate,%	–	–	–	–	15,77±2,56
16.	The total number of TTA for the time (game)	338,15±17,45	301,4±14,64	1,61	p>0,05	644,98±27,91
17.	Coefficient of efficiency, %	59,39±4,41	57,2±4,32	0,35	p>0,05	64,07±2,48
18.	Reject rate,%	37,48±2,99	40,47±3,03	0,7	p>0,05	35,86±2,01

Remark. *Significant differences are highlighted in bold.*

Players of the team "Helios" on average performed per game back and across passes – 111,42±7,08, with a rejection rate of 18,18±1,41%.

The percentage of the number of passes in the total number of technical and tactical actions was 53,22±1,06%.

Table 2

Indicators of the total number of passes for the first and second halves of the players of the team "Helios", Kharkov, n=19

Indicators	1st time	2nd time	t	p	1+2
			$\bar{X}$±m		
Total passes	184,52± 9,12	162,57± 7,38	1,87	p>0,05	348,0± 14,16
Reject rate,%	36,13± 1,72	43,95± 3,07	**2,23**	**p<0,05**	37,5± 1,85

Remark. *Significant differences are highlighted in bold.*

We also registered the attacking and defensive actions of the "Helios" team and the opposing teams that the Kharkiv team met with (Table 3). Not only quantitative indicators were calculated, but also qualitative ones (efficiency indicators,%). Attacking actions are divided into successful, foiled and all. Were also registered (among all attacks) the number and effectiveness of penetrating attacks.

There were no significant differences in the indicators of attacking and defensive actions between the first and second periods.

On average per game, the "Helios" team in Kharkov in the 26th championship carried out 156,92±3,6 attacking actions (Table 4). Of these 129,35±4,56 fast attacks (82,36±1,71%) with an efficiency of 9,53±1,65%; 26,92±2,5 positional attacks (17,22±1,72%) with efficiency 19,43±3,79%.

In different zones of the football field, the players of the "Helios" team could not complete the attacks (Table 4). Thus, in the defense zone of the interrupted attacks there were 8,74±1,28%, on average – 45,98±5,76%, in the attack zone – 33,18±2,87%.

On average, per game the "Helios" team conducted 156,92±3,6 attacking actions (Table 5). Players hit the goal 8,09±1,14 times, the number of goals scored – 1,09±0,34. The indicator of the ratio of the number of goals scored to the number of attacking actions is of interest (0,69±0,22%).

Conclusions / Discussion

The development of modeling characteristics of competitive activity in football is devoted to many studies of specialists. At the same time, they cover a wide subset of subjects. Thus, in the works of A. V. Dulybsky, S. S. Kuznets and S. Lebedev in co-authorship, indicators of technical and tactical readiness of young footballers of different ages and qualifications are given. V. M. Kostyukevich, G. A. Lysenchuk, V. A. Marchenko reflect similar indices of qualified athletes and V. I. Perevoznyk investigated the technical and tactical readiness of veterans of football. In the

Table 3

Attacking and defensive actions of the players of "Helios" team in matches with different teams for 26 superiority, n=19

No.	Indicators		1st time	2nd time	p	Total
		Successful	7,9±1,26	8,73±1,35	>0,05	16,64±2,2
1.	Number of attacks of own team	Plucked	70,4±2,86	69,83±3,55	>0,05	140,27±3,99
		Total	78,34±2,86	78,57±3,32	>0,05	156,92±3,6
2.	Effectiveness of attacking action, %		10,1±1,6	11,24±1,69	>0,05	10,63±1,41
3.	Effectiveness of defensive action, %		91,57±1,21	89,8±1,3	>0,05	90,77±1,04
		Successful	6,39±0,91	7,81±1,14	>0,05	14,21±1,63
4.	Number of attacks from the opposing team	Plucked	70,73±3,09	70,59±3,81	>0,05	141,19±5,14
		Total	77,13±3,0	78,41±3,85	>0,05	155,41±5,42
5.	Effectiveness of attacking action, %		8,37±1,22	10,28±1,63	>0,05	8,34±0,75
6.	Effectiveness of defensive action, %		89,83±1,59	88,7±1,69	>0,05	89,33±1,4
		Successful	7,63±1,29	8,54±1,38	>0,05	16,18±2,25
7.	Number of penetrating attacks of own team	Plucked	29,37±1,9	26,93±1,53	>0,05	56,31±2,65
		Total	37,0±2,34	35,49±2,27	>0,05	72,5±3,69
8.	Effectiveness of attacking action, %		20,17±3,15	23,35±3,11	>0,05	21,86±2,55
9.	Effectiveness of defensive action, %		81,76±2,68	79,51±2,69	>0,05	80,74±1,84
		Successful	6,34±0,91	7,45±1,12	>0,05	13,93±1,57
10.	Number of penetrating attacks from the opposing team	Plucked	28,44±2,01	29,81±2,51	>0,05	58,26±3,3
		Total	34,79±2,18	37,4±2,81	>0,05	72,2±3,74
11.	Effectiveness of attacking action, %		18,2±2,68	20,41±2,69	>0,05	19,19±1,85
12.	Effectiveness of defensive action, %		79,79±3,16	76,57±3,11	>0,05	78,08±2,54

Remark. *No significant differences in the first and second periods were found.*

Table 4

Indicators of fast and positional attacks team "Helios" and their effectiveness, n=19

Total amount	Fast attacks,			Positional attacks,		
	Amount	%	Efficiency, %	Amount	%	Efficiency, %
156,92±3,6	129,35±4,56	82,36±1,71	9,53±1,65	26,92±2,5	17,22±1,72	19,43±3,79

Table 5

Indicators of the interrupted attacks of the "Helios" team in various areas of the football field, %, n=19

Football field zone	Defense	Central	Attacks
Percentage breakdown of attacks, %	8,74±1,28	45,98±5,76	33,18±2,87

chose a contingent of subjects different, that is, the players of the first league of Ukrainian football.

The results of our study show that the dynamics of changes in the technical and tactical preparedness of the team players influenced a positive result in a particular game and ultimately a place in the standings.

Table 5

Average effectiveness of attacking actions of the football team "Helios", ($\bar{X}$±m)

Number of attacking actions (n=19)	Number of strikes on goal (n=19)	Ratio of the number of strikes on goal to the number of attacking actions, % (n=19)	Number of scored goals (n=19)	Ratio of the number of goals scored to the number of attacking actions, % (n=19)
156,92±3,6	8,09±1,14	5,15±0,83	1,09±0,34	0,69±0,22

works of specialists, there is a desire to find in indicators of technical and tactical readiness those indicators that significantly affect the positive outcome of the match. Among them are the works of A. A. Pertsukhov on the game with one touch in different zones of the football field, V. V. Mulyk and co-authors of the delivery of the ball to the opponent's penalty area. However, they do not consider the dynamics of changes in technical-tactical readiness indices in long-term studies of the same contingent. V. M. Shamardin is close to our research, which he conducted with the team of the highest league "Dnepr" in Dnepropetrovsk, however, we

The studies were conducted with the aim of correcting the training process of the "Helios" team in Kharkov, selecting methods and means during training and achieving a high level of technical and tactical preparedness of the team players.

Further research will be aimed at obtaining model characteristics of the technical and tactical readiness of the "Helios" team in Kharkov and their comparison with the teams of the first league of Ukrainian football and those teams that participate in the games of the Ukrainian Premier League on football.

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Features of psycho-physiological indicators in various types of wrestling

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Purpose: *establish the characteristics of the manifestation of psycho-physiological reactions in various types of wrestling.*

Material & Methods: *analysis of scientific and methodological information, generalization of advanced practical experience, psycho-physiological research methods, methods of mathematical statistics. The study involved 30 qualified athletes involved in various types of wrestling, aged 19 to 22 years. Participants were divided into 2 groups of 15 people: 1 – Greco-Roman and freestyle wrestling; 2 – judo and sambo. Athletes were qualified as master of sports and candidate of master of sports.*

Results: *simple, complex motor reactions and specific perceptions of wrestlers were evaluated. In the course of the study, it was determined that the best indicators of simple reactions are observed in representatives of judo and sambo (from 1% to 4%), while in Greco-Roman and freestyle wrestlers, results in complex reactions (from 1% to 13%) and specific perceptions (from 5% to 14%).*

Conclusions: *it was established that different types of wrestling form the ability to quickly analyze, evaluate and predict situations and make the right decisions in a timely manner during the fight, which explains the unreliable differences ($p>0,05$) in the psycho-physiological indicators of the athletes studied.*

Keywords: *judo and sambo, Greco-Roman and freestyle wrestling, sensorimotor reactions, specific perceptions.*

Introduction

Diagnostics of the functional states of the athlete's body is one of the current trends in modern sports science. High sports achievements are closely connected with the psycho-physiological functions of a person. It is known that full commitment to training activities and competitive results achieved by an athlete are largely due to the level of development of psychosensory abilities [2; 10; 15; 21].

A number of authors [6; 9; 16; 19] consider that the psychophysiological functions of a person constitute the biological foundation of individually-typological features of the higher nervous system, they characterize the process of formation and improvement of special motor skills in the conditions of training and competitive activity. The functional state of psycho-physiological functions can be an indicator of both the level of fitness of an athlete and the development of fatigue and overstrain processes in him.

The basic properties of the nervous system determine the functional and psychological preparedness of athletes responsible for athletic performance, especially in situational sports (various types of wrestling) [11; 14; 20; 22].

Ability to conduct a large number of complex technical and tactical actions, taking into account possible actions of an opponent in a duel, making bold and instant decisions in extreme situations against the background of impacting factors – all this is a necessary condition for achieving success in competitive activities of martial artists and reflects their level of psychological preparedness [4; 7; 15; 18].

Training and competitive activity in the wrestling contributes to the formation of the whole complex of athletes specific reactions and perceptions. They are based on the threshold of perception of stimuli entering various sensory systems. The main role is played by the levels of musculoskeletal, visual, vestibular and auditory sensations. The higher the level of sportsmanship of an athlete, the higher the level of importance of psycho-physiological functions for achieving competitive results [3; 5; 12; 17].

Purpose of the study: establish the characteristics of the manifestation of psycho-physiological reactions in various types of wrestling.

Objectives of the study:

– based on the analysis of the methodological literature and generalization of the best practical experience to identify the psycho-physiological characteristics of the wrestlers;

– determine the indicators of psycho-physiological reactions in wrestlers of various types;

– to conduct a comparative analysis of the indices of psycho-physiological reactions in wrestlers of various types.

Material and Methods of the research

To solve the research problems, the following methods were used: analysis of scientific and methodological information, generalization of advanced practical experience, psychophysiological research methods, methods of mathematical statistics.

The study involved 30 athletes involved in various types of wrestling. Participants were divided into two groups: 1 – 15 representatives of Greco-Roman and free-style wrestling, av-

erage age (20,53±1,71) years; 2 – 15 people involved in judo and sambo, the average age (20,85±1,35) years, no significant differences in age (p>0,05). Athletes were qualified as Master of Sports and Candidate Master of Sports.

Based on the analysis of methodological literature and generalization of advanced practical experience, it was found that the specifics of the competitive activities of wrestlers affect the level of development of psycho-physiological reactions that provide high athletic performance [8; 13; 16; 22].

Evaluation of psychophysiological reactions was carried out using a set of tests developed for tablet personal computers [1]. The tests were divided into three groups: evaluation of simple sensorimotor reactions; evaluation of complex sensorimotor reactions; evaluation of specific perceptions.

To determine the homogeneity of sample observations, the coefficient of variation was used.

Results of the research

The obtained data testify to the homogeneity of indicators of simple and complex reactions of the athletes under study, both in the first (coefficient of variation ranges from 3,89% to 10,61%) and in the second group (from 4,41% to 11,02%), except for the indicator of a complex reaction to a moving object, which has a high coefficient of variation in the first (26,04%) and in the second group (24,53%).

The indicators in tests that reflect the specific perceptions of wrestlers also have a high coefficient of variation in the first (from 11,42% to 34,74%) and in the second group (from 11,79% to 43,09%), this is explained by the qualifications of the athletes , which individually displays a prediction of the situation (anticipation) (Table 1).

Table 2 presents the test results for specific sensorimotor responses and the perceptions of wrestlers of various types.

Comparing the indicators of sensorimotor reactions and specific perceptions of the subjects, it was found that the results of simple reactions are higher among the representatives of the second group (judo and sambo) in the tests: simple motility at 4%, resistance to confounding factors at 2%, simple visual-motor reaction at 1%, simple auditory-motor reaction at 1%; and complex reactions and specific perceptions are better for athletes of the first group (Greco-Roman and free-style wrestling): selection reaction from static objects by 1%, response to a moving object by 13%, discrimination response by 4%, selection reaction from dynamic objects by 1%, assessment of the sense of tempo by 14%, reproduction assessment of the accuracy of a given line by 5%, playback speed of a given line by 9%, assessment of the perception of a change in the object size by 7%.

The results of the study are explained by the specificity of competitive and training activities, Greco-Roman and free-style wrestlers carry out attacking actions, mainly from long and medium distance, and representatives of judo and sambo - from near, and they often struggle to disrupt the opponent's capture.

Conclusions / Discussion

Based on the analysis of methodological literature and generalization of advanced practical experience, it was found that the specifics of the competitive activities of wrestlers affect the level of development of psycho-physiological reactions, providing a high sports result.

During the study, the following indicators were obtained: the level of simple sensorimotor reactions (tests: "Simple motility and resistance to confounding factors", "Simple visual-motor reaction", "Simple auditory-motor reaction"), the level of complex sensorimotor reactions (tests: "Reaction of choice from static objects", "Reaction of discrimination", "Reaction to a moving object", "Reaction of selection from dynamic objects"), the level of specific perceptions (tests: "Evaluation of a sense of tempo", "Evaluation accuracy and speed when playing a given line", "Evaluation of the perception of a change in the size of an object").

In the course of the study, it was determined that the best indicators of simple reactions are observed in representatives of judo and sambo (from 1% to 4%), while in Greco-Roman and

Table 1

Coefficient of variation of indicators of psycho-physiological reactions of wrestlers (n=30)

No.	Indicators	1 group (n=15)	2 group (n=15)
	Simple reactions		
1.	Simple motility (the number of clicks for 10 s)	5,37	5,28
2.	Resistance to confounding factors (%)	3,89	4,41
3.	Simple visual-motor reaction (ms)	6,58	6,01
4.	Simple auditory-motor reaction (ms)	7,42	4,65
	Complex reactions		
5.	Reaction of selection from static objects (ms)	10,21	11,02
6.	Reaction to a moving object (ms)	26,04	24,53
7.	Reaction distinction (ms)	5,32	7,79
8.	Reaction selection of dynamic objects (ms)	10,61	7,09
	Specific perceptions		
9.	Estimate of tempo feeling (80 beats·min^{-1}) (ms)	34,74	43,09
10.	Evaluation of the reproduction of the accuracy of a given line (mm)	17,07	18,61
11.	Playback speed of a given line (mm·s^{-1})	11,42	37,59
12.	Evaluation of the perception of a change in the size of the object (s)	11,77	11,79

Remark. *1 group – freestyle and Greco-Roman wrestling; 2 group – judo and sambo.*

Table 2

Indicators of psycho-physiological reactions of the wrestlers of the first (freestyle and Greco-Roman wrestling) and second (judo and sambo) groups (n=30)

No.	Indicators	1 group (n=15)	2 group (n=15)	Confidence level t	Confidence level p
	Simple reactions				
1.	Simple motility (the number of clicks for 10 s)	25,31±0,36	26,33±0,37	–1,96	p>0,05
2.	Resistance to confounding factors (%)	77,85±0,81	78,93±0,93	–0,88	p>0,05
3.	Simple visual-motor reaction (ms)	231,50±4,04	229,67±3,69	0,33	p>0,05
4.	Simple auditory-motor reaction (ms)	212,70±4,22	210,25±2,61	0,49	p>0,05
	Complex reactions				
5.	Reaction of selection from static objects (ms)	646,58±17,64	648,49±22,56	–0,07	p>0,05
6.	Reaction to a moving object (ms)	19,05±1,33	21,57±1,14	–1,30	p>0,05
7.	Reaction distinction (ms)	284,05±4,04	294,97±6,14	–1,49	p>0,05
8.	Reaction selection of dynamic objects (ms)	366,82±12,36	369,37±6,99	–0,18	p>0,05
	Specific perceptions				
9.	Evaluation of tempo feeling (80 beats · min^{-1}) (ms)	37,10±3,44	42,14±4,85	–0,85	p>0,05
10.	Evaluation of the reproduction of the accuracy of a given line (mm)	0,41±0,02	0,43±0,02	–0,54	p>0,05
11.	Playback speed of a given line (mm · s^{-1})	70,50±2,15	64,30±6,46	0,91	p>0,05
12.	Evaluation of the perception of a change in the size of the object (s)	0,85±0,03	0,91±0,02	–1,97	p>0,05

Remark. *Confidence t=2,05; p<0,05.*

freestyle wrestlers, results in complex reactions (from 1% to 13%) and specific perceptions (from 5% to 14%).

It has been established that various types of wrestling form the ability to quickly analyze, evaluate and predict situations and make the right decisions in a timely manner during the fight, which explains the unreliable differences (p>0,05) in the psycho-physiological indicators of the athletes under study.

The findings suggest the importance of the psycho-physiological state of athletes as a factor determining success in various types of wrestling. This is also confirmed by the results of research presented in scientific works (V. V. Shatskikh, 2012; G. Korobeynikov and et. al., 2013; S. Latyshev, and et. al., 2014).

The use of modern statistical methods in the analysis of psycho-physiological indicators allows us to build models. They allow you to more clearly represent the changes occurring in the body of athletes. A. S. Rovnyi, V. V. Romanenko (2016) investigated the model characteristics of sensorimotor reactions and specific perceptions of taekwondo of highly qualified athletes, as a result of which the rating scales were developed.

H. Zi-Hong, (2013) determined the physiological profile of elite Chinese women wrestlers. The author recommends that the data be compared with other wrestlers to help identify individual weaknesses or strengths and develop training programs that will allow you to succeed in the fight.

S. Iermakov et. al. (2016) on the basis of model characteristics identified psycho-physiological qualities that are most significant for predicting success in martial arts.

The previously obtained data (R. V. Pervachuk, et al., 2017; Yu. N. Tropin, N. V. Boychenko, 2018; V. Miarka, 2016) on the issues of psycho-physiological control in martial arts were supplemented.

Further studies will be aimed at determining the relationship between psycho-physiological indicators and special physical preparedness of wrestlers.

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Increasing the level of preparedness of 400 m hurdles runners by means of hypoxic exposure as the basis for achieving a sporting result

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Purpose: *establish the dependence of the result of 400 m hurdles on the morphofunctional, physical and hypoxic preparedness of athletes.*

Material & Methods: *the study involved 18 athletes aged 16–18 years who had the level of preparedness of the first sports category and the candidate master of sports in the 400 m hurdles. To establish the role of hypoxic training in increasing anaerobic performance, multiple regression analysis was used, which determines the role of each factor in the adaptation mechanism, as well as in the performance of test tasks.*

Results: *determined the importance of training physical qualities, morphofunctional abilities, hypoxic stability for the successful manifestation of technical skill in competitive conditions.*

Conclusions: *the inclusion in the training process of interval hypoxic training contributed to a more significant increase in the anaerobic performance of 400 m hurdles runners.*

Keyword: *adaptation; hypoxic performance; 400 m hurdles; anaerobic power.*

Introduction

The level of sports preparedness is increased due to the development of functional capabilities, which is carried out through physical, technical-tactical, psychological and hypoxic training activities. The conditional division of the preparation process into relatively independent directions makes it possible to streamline the consciousness of its structural state, as well as systematize the methods and means, and thus develop a system for monitoring and controlling the training process [1–3, 8; 9; 11; 23; 24].

In real conditions of the training process, none of these aspects of training does not manifest itself in isolation, but is in a constant relationship [4; 12; 13; 18; 19].

It is proved that the achievement of sports results is possible only with a harmonious combination of all aspects of preparedness [10; 14; 15].

This scientific principle is particularly important in the preparation of 400 m hurdles runners. Running the 400 meters, and especially with the barriers, is one of the most difficult sports, which the researchers call "running killer" [21].

Some studies show that the most important factors that determine the severity of physical activity during a 400 m run with barriers is the level and duration of exposure to hypoxia [20; 22; 25], as well as sensitivity to it [5–7; 16; 17]. The lack of objective research materials on the technology of hypoxic training of 400 m hurdles runners and determined the direction of our research.

Purpose of the study: establish the dependence of the result of 400 m hurdles on the morphofunctional, physical and hypoxic preparedness of athletes.

Material and Methods of the research

The study involved 18 athletes aged 16–18 years old who had the level of preparedness of the first sports category and candidates for the master of sports in the 400 m hurdles.

The basis for building training sessions and sessions of anaerobic effects was a 10-day microcycle. After each training session, the load of the hypoxic exposure was applied alternately: 10 sessions of interval hypoxic influence during the return breathing into the closed space.

To solve the set tasks, the following research methods were used: analysis of scientific and methodological literature; pedagogical observation; pedagogical experiment; telepodometry; methods for determining the functional state of barrierists; method of interval hypoxic training; methods of mathematical statistics.

To establish the role of hypoxic training in increasing anaerobic performance, multiple regression analysis was used, which determines the role of each factor in the adaptation mechanism, as well as in the performance of test tasks.

Results of the research

For successful management of the training process, it is necessary to determine the importance of training physical qualities, morphofunctional abilities, hypoxic stability – for the successful manifestation of technical skills in competitive conditions.

The equations of mathematical models depend on a sporting result, on morphofunctional parameters, physical and technical readiness, hypoxic stability at the beginning and at the end of the preliminary basic training phase. The calculated ra-

tio explains 99.9% of the variation of the parameters studied. Such a mathematical model is defined by the following equation (formula 1):

$$W_{400\ w/h}=7,64xSBV+6,72xMBV+5,41xF_{expiration}+3,06x VI-4,06xIHST-2,75xI_{Ru}-2,06xh_f-1,75xL_f+1,63Xi_{Ro}-1,36xF_{inhalation}-1,26xHR-1,02xL_b+0,97xBP_{syst.}+0,87xBP_{diast}-0,53xL_f-0,36xVC-0,09xW_b, \quad (1)$$

where $W_{400\ w/h}$ – 400m hurdling result; SBV – systolic blood volume; MBV – minute blood volume; $F_{expiration}$ – forced expiration; VI – vital index; IHST– index of Harvard step test; I_{Ru} – Ruffier index; h_f – height of the arch of the foot; I_{Ro} – Robinson index; $F_{inhalation}$ – forced inhalation; HR – heart rate; L_b – body length; BP_{syst} – systolic blood pressure; BP_{diast} – diastolic blood pressure; L_f– foot length; VC – vital capacity; W_b – body weight.

Thus, the analysis of the presented model of the sports outcome dependence on morphofunctional indices shows that the most important determinants are systolic blood volume – 18,2%, minute volume of blood and forced exhalation – 12,8%.

Applying the method of reverse stepwise regression, the function of multiple regression can be simplified, where only the most important factors that explain 99.2% variation of the investigated factors remain in the final model (formula 2):

$$W_{400\ w/h}=4,64xSBV+4,58xMBV+3,72xIHST+2,65xh_f+2,36xF_{expiration}, \quad (2)$$

where $W_{400\ w/h}$ – 400m hurdling result; SBV – systolic blood volume; MBV – minute blood volume; IHST – index of Harvard step test; h_f – height of the arch of the foot; $F_{expiration}$ – forced expiration.

At the end of the preliminary preparation stage, the influence of each factor of the morphofunctional system changes somewhat (formula 3):

$$W_{400\ w/h}=7,64xSBV+8,02xMBV+4,51xF_{expiration}+2,36x xVI-2,76xIHST-1,75xIR_u-1,62xh_f+1,23xIR_o-1,06xF_{inhalation}--3,26xHR-1,55xR_b+0,95xBP_{syst.}+0,83xBP_{diast.}-0,72xL_h--1,27xVC-0,07xW_b, \quad (3)$$

where $W_{400\ w/h}$ – 400m hurdling result; SBV – systolic blood volume; MBV – minute blood volume; $F_{expiration}$ – forced expiration; VI – vital index; IHST– index of Harvard step test; IR_u – Ruffier index; h_f – height of the arch of the foot; IR_o – Robinson index; $F_{inhalation}$ – forced inhalation; HR – heart rate; L_b – body length; BP_{syst} – systolic blood pressure; BP_{diast} – diastolic blood pressure; L_f– foot length; VC – vital capacity; W_b – body weight.

The analysis of the final model actually confirms the level of significance of the factors established at the beginning of the experiment: SBV – 11M5%, MBV – 19,6%, and VI – 11,1%. The equation of the inverse step-by-step regression leaving only 4 factors, the value of which significantly influences the result of 400 m hurdles (formula 4):

$$W_{400\ w/h}=4,87xSBV+7,96xMBV+4,31xF_{expiration}+3,15xHR, \quad (4)$$

where $W_{400\ w/h}$ – 400m hurdling result; SBV – systolic blood volume; MBV – minute blood volume; $F_{expiration}$ – forced expiration; HR – heart rate.

Indicators of physical preparedness of an athlete contribute to the manifestation of his technical abilities directly during the overcoming of the barrier distance. Each physical quality has its own peculiarity in achieving a sporting result. So, there are defining qualities, and there are satellite or complementary. At the beginning of the preliminary basic preparation stage of the equation of a mathematical model of the dependence of a sporting result on the level of development of physical qualities is as follows (formula 5):

$$W_{400\ w/h}=3,52xR_{400}+4,06xR_{100b}+0,11xR_{100}-1,09xR_{20b}+0,17xR_{60}+0,81xR_{30}+0,08xJ_u-0,1xJ_5-0,09xJ_s, \quad (5)$$

where $W_{400\ w/h}$ – 400m hurdling result; R_{400} – result of a flat race on 400 m from a crouch start; R_{100b} – result of 100 m bounded run; R_{100} – result of 100 m running from a crouch start; R_{20b} – bounded run 20 m on one leg; R_{60} – result of 60 m running from a crouch start; R_{30} – result of 30 m running from a crouch start; J_u – result of jumping up according to Abalakov; J_5 – result of a five-fold jump from the spot; J_s – standing long jump.

The conducted analysis of multiple regression, which shows the role of each indicator in the result of a 400 m hurdles, established influential factors for the result in a 400 m hurdles: a 100 m bounded run; 400 m running from a crouch start and bounded run 20 m on one leg.

The equation of stepwise inverse regression leaves only two significant factors for the result in the 400 m hurdles (formula 6):

$$W_{400\ w/h}=3,059xR_{400}+4,387xR_{100b}, \quad (6)$$

where $W_{400\ w/h}$ – 400 m hurdling result; R_{400} – result of a flat race on 400 m from a crouch start; R_{100b} – result of 100 m bounded run.

At the end of the preliminary basic preparation stage, the mathematical model of the result dependence on 400 m hurdles has the following form (formula 7):

$$W_{400\ w/h}=3,782xR_{400}+8,02xR_{100b}+2,09xR_{200}--0,46xR_{100}-0,27xR_{20b}+0,93xR_{60}+3,05xR_{30}++0,07xJ_u-0,17xJ_5-0,14xJ_s, \quad (7)$$

where $W_{400\ w/h}$ – 400m hurdling result; R_{400} – result of a flat race on 400 m from a crouch start; R_{100b} – result of 100 m bounded run; R_{200} – result of a flat race on 200 m from a crouch start; R_{100} – result of 100 m running from a crouch start; R_{20b} – bounded run 20 m on one leg; R_{60} – result of 60 m running from a crouch start; R_{30} – result of 30 m running from a crouch start; J_u – result of jumping up according to Abalakov; J_5 – result of a five-fold jump from the spot; J_s – standing long jump.

The analysis of the results shows that the most important factors in achieving the result of 400 m hurdles is:

1. result of 100 m bounded run – 42,3%;
2. result of a flat race on 400 m from a crouch start – 19,9%
3. result of 30 m running from a crouch start – 16,1%.

The results of the inverse stepwise regression equation deter-

mine the three most influential factors (formula 8):

$$W_{400\ w/h}=10,45xR_{400}+8,52xR_{100b}+4,77xR_{30}, \quad (8)$$

where $W_{400\ w/h}$ – 400 m hurdling result; R_{400} – result of a flat race on 400 m from a crouch start; R_{100b} – result of 100 m bounded run; R_{30} – result of 30 m running from a crouch start.

The level of technical readiness is the basis for achieving a sporting result. All elements of the technique of barrier running have a significant role in achieving a sporting result. However, some elements of technology play a leading role, while others complement. In our studies, the task was to determine the leading factors of the barrier running technique and the dynamics of their changes under the influence of the training stage of preliminary basic training. According to the results of the correlation analysis, 14 elements of the barrier running technique were selected.

The equation of multiple regression determined the level of significance of each element of the technique in achieving a sporting result in the 400 m hurdles (formula 9):

$$W_{400\ w/h}=4,79xW_{202}+3,1xW_{201}+2,21xTC-1,75xV_{br}-$$
$$-1,68xV_{st}+0,043xW_{rt}+0,14xW_{st}-0,47xT_{rb}-$$
$$-0,12xT_{ls}+0,019xCCG+0,08xL_{at}+0,07xL_{i}+0,036xL_{ln}, \quad (9)$$

where $W_{400\ w/h}$ – 400 m hurdling result; W_{202} – run time of the second 200 m hurdles; W_{201} – run time of the first 200 m hurdles; TC – technical coefficient; V_{br} – barrier step speed; V_{st} – start run speed; W_{rt} – repulsion time when barrier is attacked; W_{st} – support time when landing behind the barrier; T_{rb} – distance to the repulsive barrier; T_{ls} – distance from the barrier to the landing site behind the barrier; CCG – common center of gravity over the barrier; L_{at} – angle of attack of the barrier; L_{i} – angle of inclination above the barrier; L_{ln} – torso angle when landing behind the barrier.

The analysis of the whole mathematical model of the dependence of the sporting result on various technical elements determined the contribution level of each factor, among which the most important factors are indicators: running time of the second 200 m distance – 32,3%, running time of the first 200 m distance – 20,3%, skill ratio – 14,9%.

The equation of stepwise inverse regression determines in the final model five significant factors (formula 10):

$$W_{400\ w/h}=3,79xW_{202}+3,18xW_{201}-2,75xTC+$$
$$+1,25xV_{br}-1,61xV_{rs}, \quad (10)$$

where $W_{400\ w/h}$ – 400m hurdling result; W_{202} – run time of the second 200 m hurdles; W_{201} – run time of the first 200 m hurdles; TC – technical coefficient; V_{br} – barrier step speed; V_{rs} – running step speed.

At the end of the preliminary basic training phase of applying the multiple step-by-step regression equation, the result of the 400 m hurdles depends on the level of technical readiness in this form (formula 11):

$$W_{400\ w/h}=4,295xW_{202}+7,065xW_{201}+1,753xTC-1,623xV_{br}-$$
$$-1,81xV_{rs}+0,958xV_{st}+0,721xW_{rt}-0,651xW_{st}+0,743xT_{rb}+0,093x$$
$$xT_{ls}+0,872xCCG+0,177xL_{at}+0,131xL_{i}+0,113xL_{ln}, \quad (11)$$

where $W_{400\ w/h}$ – 400m hurdling result; W_{202} – run time of the second 200 m hurdles; W_{201} – run time of the first 200 m hurdles; TC – technical coefficient; V_{br} – barrier step speed; V_{rs} – running step speed; V_{st} – start run speed; W_{rt} – repulsion time when barrier is attacked; W_{st} – support time when landing behind the barrier; T_{rb} – distance to the repulsive barrier; T_{ls} – distance from the barrier to the landing site behind the barrier; CCG – common center of gravity over the barrier; L_{at} – angle of attack of the barrier; L_{i} – angle of inclination above the barrier; L_{ln} – torso angle when landing behind the barrier.

The mathematical model at the end of the preliminary basic training stage significantly changed the significance of individual elements of the technique in achieving the result. The most factors: 1 – 30,8% and 2 – 29,8%. This confirms the equations stepwise inverse regression, in which there are only two of the most fundamental factors (formula 12):

$$W_{400\ w/h}=10,45xW_{202}+8,52xW_{201}, \quad (12)$$

where $W_{400\ w/h}$ – 400 m hurdling result; W_{202} – run time of the second 200 m hurdles; W_{201} – run time of the first 200 m hurdles.

The barrier step speed is one of the important elements of the barrier running technique. The speed of the barrier step is determined by the ratio of the length of the distance from the place of repulsion to the place of landing behind the barrier to the time from the support to the support. In our studies, the length of the barrier step is 3,47 m and the speed of overcoming the barrier is 5 $m \cdot s^{-1}$, that is, the speed of the barrier step is 6,54 $m \cdot s^{-1}$.

The use of the method of multiple regression allowed to establish the influence of each element of the technique on the speed of the barrier step (formula 13):

$$V_{br}=2,21xW_{rt}+4,79xW_{st}+1,75xT_{rb}-1,17xT_{ls}-$$
$$-0,96xL_{at}+0,75xCCG+0,36xL_{i}+0,08xL_{ln}, \quad (13)$$

where V_{br} – barrier step speed; W_{rt} – repulsion time when barrier is attacked; W_{st} – support time when landing behind the barrier; T_{rb} – distance to the repulsive barrier; T_{ls} – distance from the barrier to the landing site behind the barrier; CCG – common center of gravity over the barrier; L_{i} – angle of inclination above the barrier; L_{ln} – torso angle when landing behind the barrier.

Analysis of the mathematical equation shows that the most significant factors in overcoming the barrier are the support time when pushing the barrier (W_{rt}=39,7%) and the support time when landing behind the barrier (W_{st}=18,3%).

Inverse step-by-step regression determines three influential factors for increasing the speed of the barrier step (formula 14):

$$V_{br}=2,47xW_{rt}+4,74xW_{st}+1,82xT_{rb}, \quad (14)$$

where V_{br} – barrier step speed; W_{rt} – repulsion time when barrier is attacked; W_{st} – support time when landing behind the barrier; T_{rb} – distance to the repulsive barrier.

At the end of the pre-basic training phase, the influence of each factor on the level of the barrier rate has changed slight-

ly (formula 15):

$$V_{br}=2,79xW_{rt}+3,69xW_{st}-1,21xT_{rb}-0,97xT_{ls}-$$
$$-0,97xL_{at}+2,68xCCG+0,88xL_{i}+0,27xL_{ln}, \quad (15)$$

where V_{br} – barrier step speed; W_{rt} – repulsion time when barrier is attacked; W_{st} – support time when landing behind the barrier; T_{rb} – distance to the repulsive barrier; T_{ls} – distance from the barrier to the landing site behind the barrier; L_{at} – angle of attack of the barrier; CCG – common center of gravity over the barrier; L_{i} – angle of inclination above the barrier; L_{ln} – torso angle when landing behind the barrier.

The most significant factors in achieving a competitive result in 400 m hurdles running is the support time when landing behind the barrier – 39,7%, the repulsion time when the barrier is attacked – 18,3% and the distance of repulsion to the barrier. The model of inverse step-by-step regression determines three reliable factors (formula 16):

$$V_{br}=2,009xW_{rt}+2,739xW_{st}+1,98xCCG, \quad (16)$$

where V_{br} – barrier step speed; W_{rt} – repulsion time when barrier is attacked; W_{st} – support time when landing behind the barrier; CCG – common center of gravity over the barrier.

The obtained results contributed to the improvement of technical readiness indicators, which contributed to the improvement of the result of the 400 m hurdles run.

Thus, the results of the study show that the inclusion in the training process of interval hypoxic training contributed to a more significant increase in the anaerobic performance of 400 m hurdles runners.

Conclusions / Discussion

Studies have shown that the achievement of sports results is possible only with a harmonious relationship of all aspects of athletes' preparedness.

This scientific position is particularly important in the preparation of 400 m hurdles runners, since the 400 m run, and especially the hurdles, is one of the hardest sports that runs under conditions of prolonged exposure to hypoxia.

The materials of the study indicate the need for hypoxic training, since increasing adaptability to hypoxia is the main mechanism for improving athletic performance in the 400 m hurdles.

The research results deepen the scientific data on the features of adaptation mechanisms to this type of competitive activity.

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Age and anthropometric indicators of highly qualified football players

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Purpose: *to determine the age and overall dimensions of the body of football players – participants of the World Cup 2018.*

Material & Methods: *analysis, study and synthesis of domestic and foreign scientific and methodological literature allowed us to consider the model indicators of the sports capabilities of football players. Age and anthropometric indicators of highly qualified football players were considered. At the second stage, the studies were devoted to the study of indicators of the overall body dimensions of football players of the national teams of the participating teams of the 2018 World Cup. The study involved 736 football players aged 19 to 45 years. Such research methods as the analysis of scientific and methodical literature and methods of mathematical statistics were used.*

Results: *presents the age and anthropometric indicators of football players – participants of the 2018 World Cup. It has been established that football players participating in the 2018 World Cup have characteristic overall body dimensions and a number of their differences depending on the sporting role. Football players do not unite in one group, but are divided into classes according to the game specialization, which completely negates the thesis about the "universal" football player.*

Conclusions: *the data obtained suggest that the peak of sportsmanship in football is in the age range from 25 to 29 years. This age range included 342 people from 736 participants of the 2018 World Cup.*

Keyword: *age, body length, body weight, goalkeepers, defenders, midfielders, attackers.*

Introduction

Manning national teams, first of all, involves attracting the strongest players at the moment without regard to their age. Therefore, a particular distribution of players participating in the World Cup, for different age groups, reflects not the level of individual skill of the players, but most likely their ability to increase skill and achieve the highest level of skill at a certain time.

Currently, studies of the morphological indicators of young football players have been conducted [5–9; 12] and highly qualified football players [1–3; 10].

S. Golomazov and B. Chirva [4] identify five fairly distinct zones in the age distribution of players:

– prospect zone (up to 20 years);
– zone of growth of skill (up to 24 years);
– the flowering of skill (from 25 to 29 years);
– zone of extinction (from 30 to 34 years);
– zone of veterans (from 34 years).

But at the same time, experts note [4], one cannot ignore the fact that the development of football makes new demands on both technical skills and tactical thinking of players.

As part of the problem of age characteristics of physical condition, the average age of 20 teams participating in the 1994 World Cup in the USA was analyzed. The data obtained by the specialists allow us to say that the peak of sportsmanship in football is in the age range from 24 to 30 years. This age range included 272 people from 372 participants in the 1994 World Cup.

At the same time, the analysis of the preparedness of the football players of the national teams made it possible to conclude that by the age of 19, players would achieve physical fitness indicators typical of adult athletes. Achieved conditions are maintained for 10 years, and further begins the process of reducing the level of development, above all, distance speed and speed endurance [13].

As a result of another study, experts found that at the 2014 World Cup, the average age of the football teams participating was 26,9±0,1 years. The age of the players ranged from 18 (Cameroonian footballer Fabris Olinga) to 43 (Colombian footballer Farid Mondragon) years.

The oldest team in this World Cup was the national team of Argentina (28,7±0,6 years). The youngest team was formed by the national team of Ghana (25,0±0,6 years) [14].

At the 2014 World Cup, the average body length of the football teams participating was 181,7±0,3 cm. At the same time, the body length of the players was in the range from 163 cm (Italian national football player Lorenzo Insigne and Cameroon national team Edgar Sally) to 201 cm (national football player England Fraser Forster).

The average body mass of football players participating in the 2014 World Cup was 75,6±0,3 kg. Footballers' body weight varied from 58 kg (Algerian football player Abdelmumen Jabu, Ghana national team Harrison Affoul, France national team Mathieu Valbuuena) to 96 kg (Belgium national football player Daniel vann Beyten) [14].

Despite the fairly high weight-height performance, some players have successfully performed at competitions at vari-

ous levels. So, the main heavyweight of all the heavyweights is the 33-year-old Wimbledon English striker Adebayo Akinfenva (103 kg). With the growth of 180 centimeters Akinfenva weight passes for a hundred pounds.

In turn, Christopher Samba with a height of 193 centimeters during a career, the weight reached 101 kilograms. Before "Dynamo" and "Anji", this player played in England for Blackburn.

36-year-old Nikola Zigic with a height of 202 centimeters has a weight of 97 kilograms. N. Zigic played for the team, "Red Star", "Racing", "Valencia", "Birmingham". He scored 20 goals in 57 matches for the Serbian national team and was recognized as the player of the year.

The Belgian national team player Romelu Lukaku with a height of 190 centimeters weighs 94 kilograms. Now Lukaku shares first place in the sniper race in the English Premier League.

One of the indicators of the physical condition of football players can serve as the ratio of the components of body weight (muscle and fat). These components, being very labile, can both characterize the skill level of an athlete, and to some extent reflect the features of the training process [11].

Purpose of the study: to determine the age and overall dimensions of the body of football players – participants of the World Cup 2018.

Material and Methods of the research

According to the goal and objectives, the research program included methods of theoretical analysis and synthesis of scientific and methodological literature, methods of studying anthropometric characteristics, methods of mathematical processing of results.

Analysis, study and synthesis of domestic and foreign scientific and methodological literature allowed us to consider the model indicators of the sports capabilities of football players. Age and anthropometric indicators of highly qualified football players were considered.

At the second stage, the studies were devoted to the study of indicators of the overall body dimensions of football players of the national teams of the participating teams of the 2018 World Cup. The study involved 736 football players aged 19 to 45 years.

All research results were processed by generally accepted methods of mathematical processing of experimental data with the calculation of the arithmetic mean (x) and the standard error of the arithmetic mean (m). The methods of mathematical statistics are used in accordance with known recommendations using computer software "EXCEL" and "SPSS".

Results of the research

Table 1 presents the overall dimensions of the football players participating in the 2018 World Cup.

The results of the table indicate that the average age of football teams participating in the World Cup 2018 was 27,4±0,1 years. The age of football players ranged from 19 (7 football players) to 45 years (1 football player).

Table 1
Morphological indicators of football teams participating in the World Cup 2018

No.	Team	Age	Body length, cm	Body weight, kg
1.	Australia	27,6±0,9	181,1±1,5	76,4±1,7
2.	England	25,5±0,7	183,0±1,4	74,0±1,8
3.	Argentina	29,0±0,7	179,2±1,5	75,4±1,6
4.	Belgium	27,1±0,7	185,2±1,7	78,7±1,7
5.	Brazil	28,0±0,7	179,9±1,5	74,7±1,7
6.	Germany	26,6±0,6	185,6±1,0	79,6±1,3
7.	Denmark	26,5±0,7	185,5±1,6	79,5±1,6
8.	Egypt	28,4±1,1	182,1±1,4	76,7±1,3
9.	Iran	26,7±0,8	184,3±1,1	77,5±0,9
10.	Iceland	28,0±0,9	185,4±1,2	79,6±1,3
11.	Spain	28,0±0,8	179,8±1,4	74,3±1,4
12.	Colombia	27,8±0,8	180,4±1,3	74,9±1,2
13.	Costa Rica	29,2±0,7	180,9±1,2	75,5±1,6
14.	Morocco	26,7±1,0	183,0±1,3	75,3±1,4
15.	Mexico	28,7±1,0	179,3±1,4	72,3±1,3
16.	Nigeria	25,4±0,7	184,3±1,4	77,4±1,4
17.	Panama	28,4±1,1	183,2±1,1	77,8±1,3
18.	Peru	26,9±0,8	178,4±1,2	74,2±1,4
19.	Poland	27,8±0,8	183,3±1,4	76,7±1,1
20.	Portugal	27,9±1,1	179,4±1,4	72,9±1,6
21.	Russia	28,2±0,9	184,3±1,2	76,9±1,3
22.	Saudi Arabia	28,0±0,8	176,5±1,5	70,7±1,6
23.	Senegal	26,5±0,7	185,0±1,5	77,3±1,4
24.	Serbia	26,3±1,0	186,1±1,3	78,1±1,5
25.	Tunisia	26,0±0,7	183,6±1,2	75,4±1,1
26.	Uruguay	27,6±0,9	181,0±1,5	75,2±1,4
27.	France	25,6±0,8	183,2±1,6	76,6±1,8
28.	Croatia	27,4±0,7	185,1±1,3	79,0±1,4
29.	Switzerland	26,6±0,8	183,6±1,0	78,7±1,2
30.	Sweden	27,7±0,6	185,8±1,1	79,3±1,1
31.	South Korea	27,3±0,6	181,8±1,5	74,3±1,4
32.	Japan	28,1±0,7	178,7±1,2	71,9±1,1
Minimum value		19	164	58
Maximum value		45	201	99
Average value		27,4±0,1	182,4±0,3	76,1±0,3

The youngest were:

1. Trent Alexander-Arnold (England);
2. Ashraf Hakimi (Morocco);
3. Daniel Arzani (Australia);
4. José Luis Rodriguez (Panama);
5. Francis Uzoho (Nigeria);
6. Moussa Vahe (Senegal);
7. Kilian Mbappй (France).

The oldest player in this championship was Essam El-Hadhari (Egypt).

The oldest teams at the 2018 World Cup were the national teams of Costa Rica (29,2±0,7 years) and Argentina (29,0±0,7 years). The youngest team was formed by the national teams of France (25,6±0,8 years), England (25,5±0,7 years) and Nigeria (25,4±0,7 years).

In addition, at the present time, specialists from different sports pay much attention not only to the age of athletes, but also the date of their birth. So, according to some experts, more likely to become a high-class football player for those born at the beginning of the year.

The analysis of applications of teams and club teams of different levels indicates a noticeable superiority of players born in the first half of the year. This position is explained by the authors because UEFA considers the age of a player only by the year of birth, while the date and month have no meaning. Yes, and set in football schools around the world is made exclusively by the year of birth. With this method of selection, the biggest advantage is given to players born in January. After all, some of them are ahead in the development of their peers, born in December, by almost a year.

The results of our research confirm this position and indicate that the majority of football players participating in the 2018 World Cup were born in the first half of the year, mainly in January, February and March.

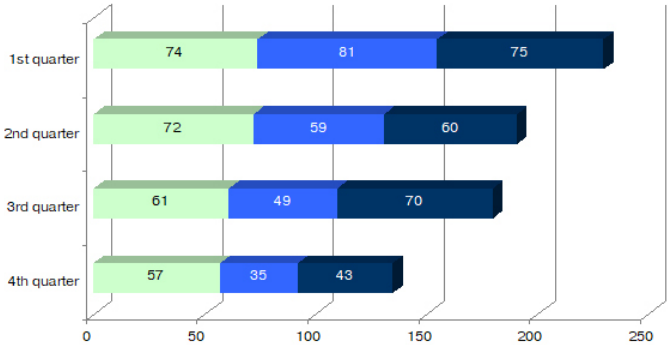

Figure 1. Number of football players participating in the 2018 World Cup, born in different months

From table 1 it can be seen that the average body length of the players was 182,4±0,3 cm. The body length of the players was in the range of 164 cm (Saudi Arabia's Yahya Al-Shehri) to 201 cm (Croatia's Lovre Kalinic).

The average body mass of the football players participating in the 2018 World Cup was 76,1±0,3 kg. The body weight of the players ranged from 58 kg (England football players Jesse Lingard and France national team Tom Lemar) to 99 kg (Panama football player Roman Torres).

Table 2 presents the morphological indicators of football players participating in the 2018 World Cup in various game positions.

Table 2
Morphological indicators of football players of different game teams participating in the 2018 World Cup

Position	Age	Body length, cm	Body weight, kg
Goalkeepers (n = 96)	29,1±0,4	188,8±0,5	82,2±0,6
Defenders (n = 242)	27,6±0,3	183,5±0,4	76,9±0,4
Midfielders (n = 288)	26,7±0,2	179,3±0,4	73,0±0,4
Forwards (n = 110)	27,0±0,4	182,8±0,6	77,3±0,6

If we look at the table according to the game positions of football players, then there is a tendency to decrease the age along the conditional line of the players 'position from their gates to the opponents' gates. Thus, the average age of goalkeepers is 29,1±0,4 years, defenders – 27,6±0,3 years, midfielders – 26,7±0,2 years, attackers – 27,0±0,4 years.

The goalkeepers were higher than the length of the body (188.8 ± 0.5 cm), relative to the defenders (183,5±0,4 cm), midfielders (179,3±0,4 cm) and attackers (182,8±0,6 cm).

A similar trend is observed in terms of body weight of football players participating in the 2018 World Cup. Thus, the average body weight of goalkeepers was 82,2±0,6 kg, defenders – 76,9±0,4 kg, midfielders – 73,0±0,4 kg and forwards – 77,3±0,6 kg.

Conclusions / Discussion

As a result of the study, data on model indicators of the sports opportunities of highly qualified football players of different playing positions were confirmed. The data on the age and anthropometric indices of highly qualified football players were supplemented and expanded.

The data obtained suggest that the peak of sportsmanship in football is in the age range from 25 to 29 years. This age range included 342 people from 736 participants of the 2018 World Cup

As a result of the study, it was established that the football players participating in the 2018 World Cup have characteristic body dimensions and a number of their differences depending on the sporting role. Football players do not unite in one group, but are divided into classes based on game specialization, which completely negates the thesis of the "universal" football player.

The results of our research are confirmed by previous studies [8–10].

Prospects for further research. Further research will be aimed at conducting a comparative analysis of the overall body dimensions of football players participating in the 2014 World Cup and the 2018 World Cup.

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