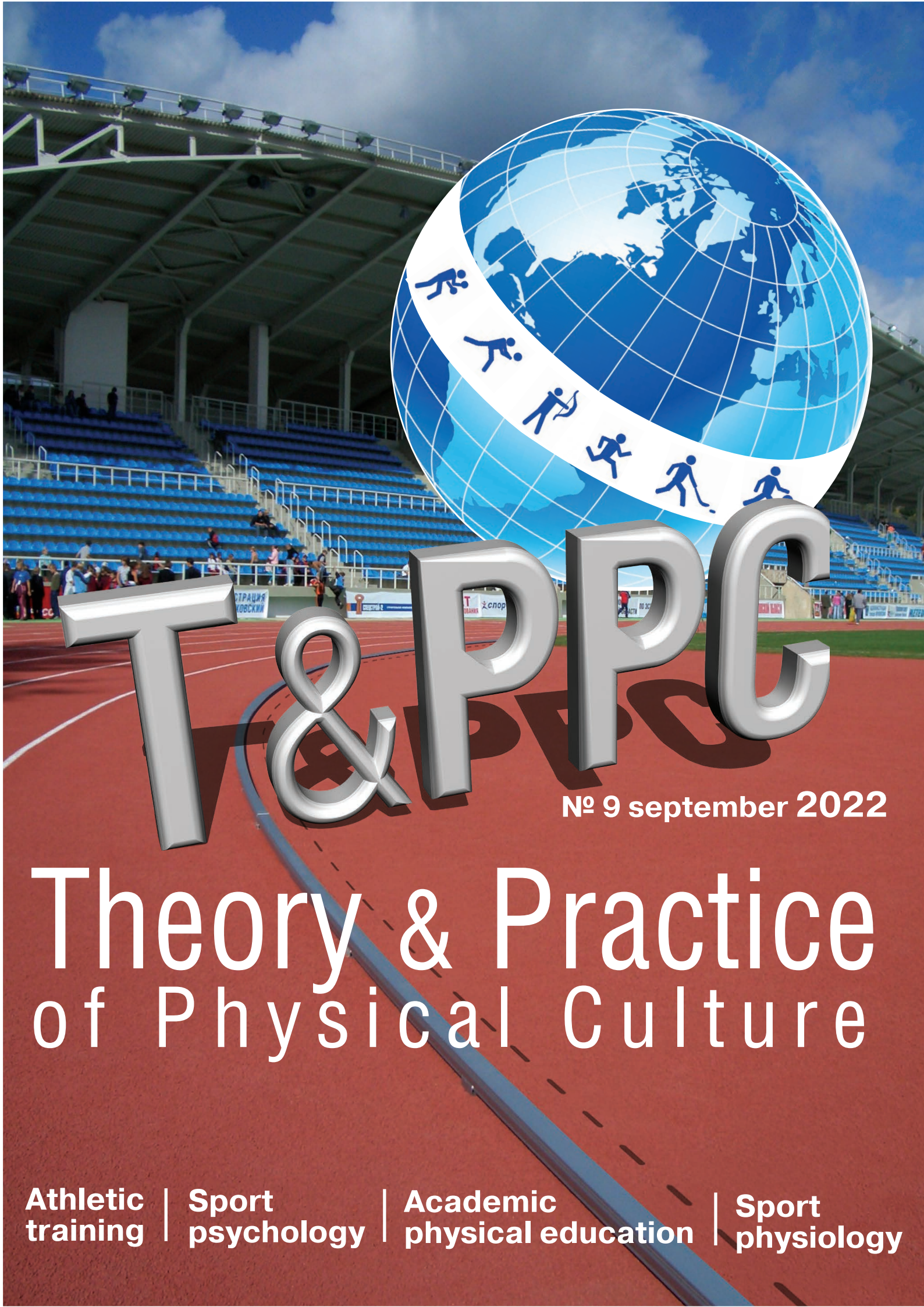

T&PPC

№ 9 september 2022

Theory & Practice of Physical Culture

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

Key issues of the modern sports science for discussion

The system of incentives and incentives in the conditions of polysubject management of the promotion of the TRP complex to Russian universities

The interest in improving the effectiveness of the implementation of the TRP complex in universities is caused by the aggravation of the political situation in which modern Russia finds itself.

It is known that the TRP complex is a component of physical education of the younger generation, students, as well as the normative basis of physical training of the population of the country. Being physically active and leading a healthy lifestyle (HLS) has become fashionable and relevant for many of us. A healthy student is a priority task of higher education. It is possible to solve it when forming motivation for physical exercises and sports. At the same time, it is necessary to understand the role of educational institutions in the implementation of this direction as organizations covering the most active and conscious part of Russian youth. During the formation of his moral values, it is important for a student to lay the foundations of a healthy lifestyle, an integral part of which is physical training. However, scientists and practitioners have noted a tendency to worsen the health and physical development of modern youth. According to sociological research, most of the students lead a passive lifestyle, do not adhere to the system of proper nutrition and optimal distribution of mental and physical activity (Peshkova, 2020). Of course, this situation affects the decline in health indicators, which, in turn, leads to a deterioration in the demographic indicators of our country's development.

Preparation for passing the TRP standards is an interesting and important social project that makes it possible to diversify the forms of physical training, increase the motivation of students for physical training, competitive activities. For example, an effective way to form motivation can be the introduction of new sports in physical education at the university, such as yoga, roller sports, workout, jumping, parkour, etc. These sports do not require expensive facilities, equipment and inventory, so they can be used in any educational institution.

Within the framework of the TRP project, it is possible to improve such vital qualities as endurance, strength, speed, efficiency of thinking, stability of the nervous system, ability to work in a team, organization, discipline, initiative. The TRP complex is a means of forming a student's personal responsibility for their own health, an active civic position.

The most important condition for increasing students' interest in passing the TRP standards is reflection, during which students can independently analyze their actions, discuss the results together with the teacher, and search for ways and ways to improve them. In this regard, the personality and professional competence of the teacher, his motivation and ability to improve skills, self-education become important. A teacher can and should create favorable conditions that motivate students to pass the standards.

Realizing the importance of the TRP complex, the university management needs to show a flexible policy of involving students in the preparation and delivery of standards, create a system of incentives and incentives. For students finishing their studies and entering the university, such a system has already been created in the form of an additional increase in USE scores. It is necessary to continue the formation and application of incentives throughout the entire period of students' studies at the university, such as: increasing the amount of scholarships, getting a place in a dormitory, switching from one level of education to another on a budget basis, priority allocation to industrial practices, etc.

It is important to remember that the modern TRP complex involves voluntary participation in the delivery of standards. Any form of coercion on the part of the management will lead to formalism and a negative reaction of students to participate in this project.

At the same time, the orientation of the university management to create a comfortable environment for sports at the university through the construction of stadiums, gyms, modern playgrounds, the arrangement of gyms, access to swimming pools on a free basis will expand the number of students willing to pass the standards of the TRP complex.

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

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

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Lubysheva L.I.

©ANO SPC «Theory and Practice of Physical Culture and Sport»

105122 Moscow,
Sirenevy blvd, 4.
e-mail: fizkult@teoriya.ru

http://www.tpfk.ru

Theory and Practice of Physical Culture

Contents

Modern social contradictions of mass sport

UDC 796.034.2

Dr. Hab., Professor **L.I. Lubysheva**[1]
PhD, Associate Professor **L.G. Pashchenko**[2]
[1]Russian State University of Physical Education, Sports, Youth and Tourism (SCOLIPE), Moscow
[2]Nizhnevartovsk State University, Nizhnevartovsk

Corresponding author: fizkult@teoriya.ru

Abstract

Objective of the study was to identify modern social contradictions of mass sports based on the analysis of youth involvement in physical culture and sports activities during leisure.

Methods and structure of the study. In a specific sociological study, 930 young people aged 18 to 39 took part. The survey showed that 64.9% of respondents use the means of physical culture and sports during their leisure time. Most believe that these activities can contribute to career success. Of those involved in physical culture and sports activities, 34.4% prefer individual lessons, 37.1% - group lessons, the motives for doing them do not differ significantly. In both groups there are young people who avoid participation in competitions. 38.9% of the total number of those involved in physical culture and sports activities independently use the means of physical culture and sports at their leisure.

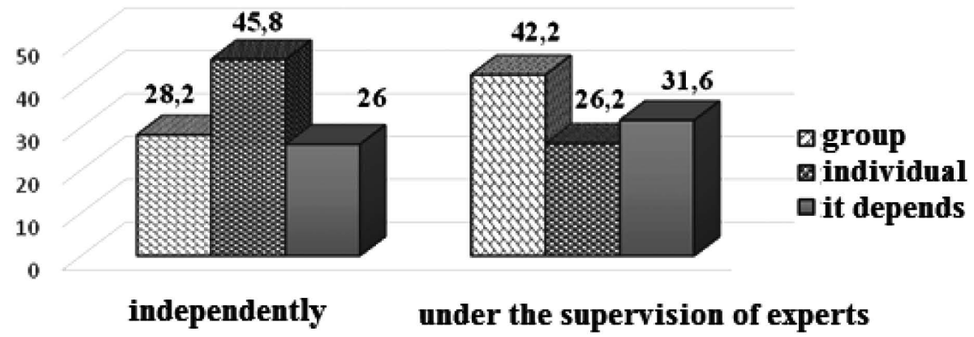
Results and conclusions. The survey showed the inconsistency of the directions of mass sports - the "Sport for All" movement, focused on uniting those involved through the system of mass physical culture and sports events, is opposed to persons who are isolated in the process of independent physical culture and sports activities and avoid interaction with other participants.

Keywords: *"Sport for all", "Sport for yourself", physical culture and sports activities, sports culture of the individual, involvement, youth, leisure, competitive relations.*

Introduction. The activation of mass sports is a priority direction of the Strategy for the development of physical culture and sports in the Russian Federation until 2030 [7]. At the same time, students of educational organizations involved in compulsory physical education classes, as well as those who are classified as participants in the "Sport for All" mass sports direction, are included in statistical reports to a greater extent. Domestic policy focused on restoring the traditions of the mass sports movement of the population does not take into account the emerging trend towards the isolation of the part of those involved in the process of independent physical education and sports activities. The increase in the number of young people using the means of physical culture and sports during their leisure time, the emergence of new physical culture and sports types requires a modern system analysis of mass sports as a sociocultural institution.

Objective of the study was to identify modern social contradictions of mass sports based on the analysis of youth involvement in physical culture and sports activities during leisure.

Methods and structure of the study. In the process of research work, a questionnaire was used, consisting of questions of closed and open forms, which allows assessing the involvement of an individual in physical culture and sports activities (link to the questionnaire https://docs.google.com/forms/d/1YjEoQEB63rfEq36TzhardHuMmoQhwNnQFgbHXrGw8zI/edit?usp=sharing). The survey was conducted in the spring of 2022. The study involved 930 young people aged 18 to 39 years (male - 363, female - 567).



The choice of the form of physical culture and sports activities during the leisure time of those involved independently and under the supervision of specialists

Results of the study and their discussion. The survey showed that 96% of respondents consider physical culture and sports to be beneficial for health. The number of people involved in various forms of physical culture and sports activity during leisure time was 604 people (64.9%) of the total sample of subjects (boys 71.3%, girls 60.8%). Of these, 34.4% of the respondents prefer individual lessons, 37.1% prefer group lessons, and for 28.3% the choice of the form of organization of interaction will depend on the circumstances. 79% of those who work in the company of friends and like-minded people and 72.6% of those who do it alone believe that these activities can contribute to success in their careers. The motives for engaging in physical culture and sports activities of young people who prefer group or individual activities during their leisure time do not differ significantly. An exception is the ability to communicate with friends among those who study in a group (26.3%) compared to those who prefer single classes (0%). Those who refuse to participate in competitions are more among those who study individually (37.5%), compared with those who prefer group classes (16.5%).

The survey revealed that among those involved in physical culture and sports activities, 38.9% of young people are engaged in their own free time, under the supervision of specialists in fitness clubs, sports complexes - 61.1%. A detailed differentiation of the preferred forms of employment is shown in the figure.

The data obtained as a result of the survey showed the inconsistency of the directions of mass sports. The “Sport for All” movement, which is widely promoted throughout the world and in our country, is opposed by a group of people engaged in physical culture and sports activities on their own - “for themselves”. This activity is not accounted for by any form of statistical control. Supporters of independent sports activities often avoid participation in mass physical culture and sports events, where open rivalry with other participants is envisaged.

From the standpoint of a systematic approach, the directions of mass sports can be presented as complex systemically organized objects and disclosed through the characteristics of the essence of the competitive relations shown by their participants, as well as the factors influencing the formation of these relations in the process of physical culture and sports activities, the mechanisms of internal and external functioning, evaluation of effectiveness at the personal and social levels.

The process of competitiveness as a source of individual and group activity is considered as a reliable universal indicator of the social and socio-psychological development of the subject of interaction, and manifests itself in the activity of the individual either to distinguish himself (separation) or to interact with others (integration) [2]. The observed trend towards a shift in competitive relations in modern Russian society from altruism and cooperation to individualism and competitiveness has not bypassed sports as a sociocultural institution. And if the predominance of the competitive orientation of competitiveness is characteristic mainly of elite sports, then altruism, along with the desire for cooperation, is more pronounced in “sport for all”, as a direction of mass sports. The individualistic orientation of competitiveness is considered as the realization by the subject of his goals without connection with the achievements of others and is reflected in independently carried out physical culture and sports activities, which can be represented as the “Sport for oneself” direction. At the same time, the isolation of the population during the pandemic also contributed to a shift in emphasis from mass physical culture and sports activities to individual ones.

"Sport for all" is considered a recognized direction of mass sports, since its content, methods and forms used contribute to the effective interaction of anthropocentric and sociocentric attitudes [3]. People involved in Sports for All events, realizing their individual needs in movement, interact with other individuals in the conditions of predetermined norms and rules, exchange existing knowledge with them, expand social ties, assimilate the values of physical culture and sports, focus on reference patterns of behavior [5].

"Sport for oneself" can be considered as a kind of physical culture and sports activity aimed at solving social and pedagogical problems focused on a person, on personal development: physical improvement, health improvement, recreation, formation and improvement of personal qualities and abilities [6]. For those who practice on their own, especially those who prefer individual forms of training, the motive of rivalry is not significant - once faced with an opponent and losing, they lose the desire to participate in activities that require maximum manifestation of physical and psycho-emotional qualities. At the same time, in self-organized activities, everyone shows competition with himself, which can be considered as a form of competition in which the individual achievements of "yesterday's self" are compared with "today's self".

The result of mass sports is the formation of a sports culture of the individual, the basis of which is a positive attitude towards sports as a type of motor activity and the values associated with it, manifested in the form of biological, psychological, pedagogical and social effects [1]. From the standpoint of the theoretical model of the sports culture of the individual, developed by V.A. Burtsev, persons involved in independent physical culture and sports activities and avoiding participation in sports competitions can only reach the reproductive level. An analysis of the manifestation of the structural components of sports culture showed the dominance of their health motives, physical self-improvement. The functional capabilities of the body are characterized by more intense mechanisms of functioning, in comparison with other participants in the mass sports movement [4]. The development of physical qualities can be both below the age and gender standards, and correspond to them. The knowledge of the theoretical organizational and methodological nature of this contingent, due to the lack of a long experience of playing sports in the past (63%), is superficial in nature - at the level of familiarity with this phenomenon. At the same time, the contingent, carrying out self-knowledge, position themselves as a subject of sports activities.

At the same time, the number of those engaged in physical culture and sports activities on their own includes young people who have had a long experience in sports, whose positive attitude towards the sports lifestyle does not change, their physical qualities exceed social standards, they show the ability to independently determine the goals, objectives and content of amateur activities. classes, taking into account their interests, which corresponds to a high level of sports culture of the individual. This fact requires clarification of the content of the structural components of the sports culture of persons involved in independent physical culture and sports activities during their leisure time.

The conducted research and theoretical analysis made it possible to identify the existing contradictions: firstly, when taking care of health, an individual, on the one hand, chooses independent physical culture and sports activities avoiding competition with other people, on the other hand, he considers the value of health as a factor in increasing his own competitiveness in conditions of modern market relations; secondly, the system of mass sports is focused on uniting those who go in for a system of mass physical culture and sports events, which are a stimulus for the participation of the population in the sports life of the country, in opposition to this are persons who are isolated in the process of independent physical culture and sports activities and avoid interaction with other participants.

Conclusion. Mass sport is a complex and multifaceted social phenomenon. His dualism is manifested in the opposition of "sport for all" to a little-studied direction - "sport for oneself". Additional research is required to determine and substantiate the socio-pedagogical and biological foundations of the population's involvement in independent physical culture and sports activities, which exclude participation in organized mass physical culture and sports events, but at the same time, involve competition with themselves for the purpose of recovery and self-improvement.

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Comparative evaluation of the main parameters of racing distances of the largest international and all-russian competitions in modern road cycling

UDC 796.093.554

PhD, Associate Professor **A.V. Kubeev**[1]
A.A. Oganesyan[1]
PhD **E.A. Savenkova**[1]
V.A. Matina[2]
[1]Federal Scientific Center of Physical Culture and Sport (VNIIFK), Moscow
[2]Sports complex «Megasport», Moscow

Corresponding author: kubeev.a.v@vniifk.ru

Abstract

Objective of the study was to conduct a comparative assessment of the difficulties of the racing distances of the largest international and Russian road cycling competitions.

Methods and structure of the study. The distance profiles of all stages of the Grand Tour series for the period 2018-2021 were collected and analyzed (220 stages in total), as well as the Russian championships in group races for men over the same period. Also, the methods used in cycling and other sports for assessing the difficulty of competitive distances were studied and their characteristic features were identified.

Results and conclusions. A publicly available method based on open data for assessing the difficulty of distances is proposed, recommendations are given for modernizing the structure and content of the calendar of Russian road cycling and sports training programs for young athletes. The obtained results of the study give specialists the necessary grounds for modernizing the structure and content of the calendar of all-Russian road cycling competitions, and also set clear guidelines in the development of the strategy and tactics of training programs for Russian cyclists in the context of the system of long-term sports training.

Keywords: *road cycling, competitive distance, distance difficulty.*

Introduction. The most spectacular and popular competitions in road cycling are group races - one-day and multi-day. The results demonstrated in recent years by Russian road cyclists at the main international competitions under the auspices of the UCI International Cycling Union allow us to talk about the dominance of them mainly by foreign athletes: in the UCI world ranking at the end of the 2021 sports season, among the 150 best athletes, only one represents the Russian Federation - A. Vlasov (35th place). At the end of the season, only six athletes - representatives of the Russian Federation were able to win UCI ranking points, which ultimately allows Russia to take only 19th place in this ranking.

According to leading coaches and experts in road cycling, one of the possible systemic reasons for such a lag of athletes representing the Russian national team in the international sports arena may be the lack of the necessary volume of medium-mountain and especially mountain tracks in the competitive practice of Russian athletes.

An analysis of information sources on the issue of assessing the difficulty of distances in road cycling showed the presence of various methods. So, for example, the organizers of multi-day races of the Grand Tour series set the categorization of racing distances at their discretion and, in fact, create their own local classifiers. It should be noted that the UCI does not have a unified classification of the difficulty of racing distances (UCDD). The current UCI road cycling regulations contain only guidelines for the length of distances in a certain type of race for athletes of different

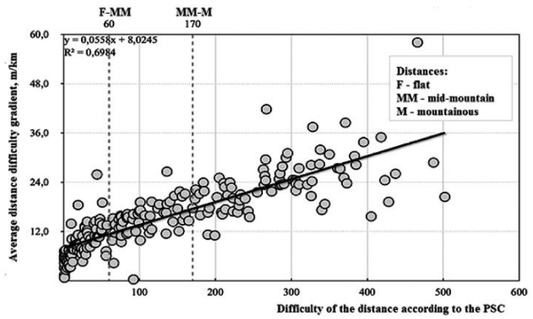
ages, genders and sports fitness; there are no uniform requirements for competitive distances in terms of their difficulty - the number of lifts on the track, their location along the length of the distance and their other parameters [1]. The absence of UCDD does not allow coaches and specialists to carry out high-quality planning of the training process and preparation for competitions and greatly complicates the possibility of predictive assessment of the level of sports results of Russian riders at all-Russian and international competitions.

Objective of the study was to conduct a comparative assessment of the difficulties of the racing distances of the largest international and Russian road cycling competitions.

Methods and structure of the study. The distance profiles of all stages of the Grand Tour races for the period 2018-2021 were collected and analyzed (a total of 220 stages), as well as the championships of Russia in group races for men over the same period. The methods used in cycling and other sports for assessing the difficulty of competitive distances were also studied and their characteristic features were identified.

The materials proposed in the article were prepared as part of the Federal Scientific Center of Physical Culture and Sport (VNIIFK), the research work "Study of the structure and content of the sports training system for highly qualified athletes in long-term cycling locomotion."

Results of the study and their discussion. The analysis of various sources of information in terms of determining the parameters of the profiles of racing distances of the main competitions confirmed the lack of a unified approach to determining the categorization of climbs and the nature of their difficulty. One of the most informative and reliable resources on the subject of road cycling is ProCyclingStat, which presents its method for assessing the difficulty of distances1 - the «PCS» method, in which the distance difficulty parameter (ProfileScore) is calculated based on three variables: 1) the position of each specific climb on the track in relation to the finish line, 2) its steepness and 3) its length.



The relationship between the parameters "difficulty of the distance according to the «PSC» method and the average gradient of distance difficulty according to the «GTCD» method at the stages of the Grand Tour 2018-2021 (n=220)

This, according to the developers, makes it possible to obtain a very accurate description of the difficulty of the route by determining the integral estimate of the difficulty of all climbs on the distance and their location on it.

Taking into account the opinions of experts and the availability of real opportunities to obtain from the websites of the organizers of cycling races necessary for the analysis of open data, in the course of the research work, a method was proposed, the application of which makes it possible to determine and compare the difficulties of the distances of various races in road cycling. The method is based on two main parameters of the racing distance: 1) the total amount of positive elevation changes over the distance - TC (Total Climb) and 2) the length of the distance - D (distance). Their ratio - TC/D - gives the parameter "average gradient of the total climb over the distance" - G. Hence the abbreviated working name of the method - "GTCD". The application of the GTCD method makes it possible to analyze an almost complete array of data on UCI races, as well as the main All-Russian competitions of the last few years.

Comparative analysis of data processing racing distances of the stages of all Grand Tour races for the period 2018-2021. (220 stages in total) by two methods - "PCS" and, more accessible in calculations - "GTCD", give fairly close results: there is a linear type dependence between them with an approximation coefficient of 0.6984 (see figure).

The figure also shows the vertical base lines (dotted line) at the level of 60 and 170 units of the parameter "difficulty of the distance according to the «PCS» method, which, according to the organizers of the GT "Tour de France", characterize the conditional division of distances into flat, mid-mountain and mountain. It is easy to establish that according to the GTCD method, the difficulty of the tracks equivalent to the PCS score can be taken as follows:

– flat distance: total distance gradient less than 11 meters per kilometer of distance, or G<11;

– mid-mountain distance: 11≤G<17;

– mountain distance: G≥17.

An analysis by the developed GTCD method of all stages of the races of the Grand Tour series held over the past four years revealed an approximately equal distribution of distances according to their difficulty: flat stages make up 34% of their total number, mid-mountain stages - 29% and mountain stages - 37%.

At the 2018-2021 Road Cycling World Championships. (WCH) the difficulty of distances for men ranged from 8.4 to 17.9 m/km. The analysis of the data showed that with an average length of distances in the world championship races equal to 260 km, the average distance values of the speed of the competition winners vw are relatively small and, according to the Unified All-Russian Sports Classification (URSC), are approximately at the level of "candidate for master of sports". The exception is the group race of the 2021 World Championship, the result of the winner in which corresponds approximately to the level of the "master of sports of Russia of international class" according to URSC. However, it should be noted that this was the most "flat" distance of all four WCHs: its average G was 8.4 m/km.

In the road group race for men at the 2020 Olympic Games in Tokyo (Japan), athletes competed over a distance of 234 km with a total climb of 4865 m, that is, an average G of the distance is 20.8 m/km, which is characterized as "mountainous". According to this indicator, the Olympic distance turned out to be much more difficult than the distances of the world championships of the last four years.

The average length of distances for men at the championships of Russia (CR) of the last four years is 181.6 km, which is 69.5% of the length of racing distances at the world championships. By this indicator alone, the races in the Czech Republic are one third less difficult than the races in the world championships. The level of difficulty of racing tracks in the Czech Republic is also lower than in the World Cup: the average G of the races of the Russian championships is on average 10.0 units against 13.7 at the World Cup. The average speed of vw winners in the Czech Republic is equivalent to the level of Candidate Master of Sports in URSC.

In the course of the study, it was also obtained that the average distance gradient G affects the average distance speed of the riders in inverse proportion: an increase in the difficulty of the racing distance in terms of its average G by 10–11 m/km is equivalent to a decrease in the average distance speed by one qualification level of URSC.

Conclusion. The method developed in the course of research work for determining the difficulty of competition tracks in road cycling based on measuring the average distance gradient made it possible to establish that the race distances of group races for men at the Russian championships of the last four years are on average 30% shorter and less difficult than similar distances at the World Championships and the Olympic Games.

In order to meet modern requirements for the level of preparedness of Russian athletes in road cycling and increase their competitiveness at international sports competitions, it is necessary to bring the parameters of the length and difficulty of the racing distances of the main All-Russian competitions among men and women closer to the similar parameters obtained in the research work of the races of the UCI World Tour, and also observe the principle of equal volumetric distribution of the difficulty of racing distances "1/3 - flat, 1/3 - mid-mountain and 1/3 - mountain distances" when forming the calendar plan of all-Russian competitions, using the "GTCD" method for this.

The work was carried out within the framework of the state task of the FGBU FNTs VNIIFK No. 777-00026-22-00 (subject code No. 001-22/2).

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Methodological bases of differentiated control and Evaluation of special physical and functional fitness of swimmers at different stages of long-term sports training

UDC 796.012

Dr. Biol., Professor **I.N. Solopov**[1, 2]
V.B. Avdienko[1, 3]
Dr. Hab., Associate Professor **T.G. Fomichenko**[1]
Dr. Hab., Associate Professor **I.V. Bgantseva**[1, 2]
[1]Federal Scientific Center of Physical Culture and Sport (VNIIFK), Moscow
[2]Volgograd State Physical Education Academy, Volgograd
[3]Russian Swimming Federation, Moscow

Corresponding author: Solopov58@mail.ru

Abstract

Objective of the study was to substantiate the main provisions of the method of differentiated control and evaluation of the special physical and functional fitness of swimmers at the stages of sports training.

Results and conclusions. It is noted that the diagnosis and assessment of swimmers' preparedness should be differentiated according to the following indicators: at the initial stages of training, the assessment of preparedness should be carried out mainly in terms of morphofunctional power indicators, at the stage of sports improvement - in terms of mobilization capabilities and at the stages of higher sportsmanship - in terms of the efficiency of the functioning of all body systems. Thus, the complex control of the special physical and functional fitness of swimmers should be based on a differentiated assessment of the main, dominant factors that determine the special physical performance and, ultimately, the actual sports result, at different stages of long-term sports training and reflecting biological and physiological patterns of development of adaptability to physical activity, taking into account the individual typological characteristics of athletes and their sports specialization. It is noted that the assessment of individual indicators of swimmers, associated with the calculation of intermediate and calculated indicators, ranking and their visualization, should be automated to the maximum extent based on digital technologies.

Keywords: *swimmers, special physical fitness, functional fitness, stages of long-term training, control, evaluation.*

Introduction. The effective implementation of the training of athletes is largely de-termined by the objectivity of monitoring the level of special preparedness, carried out on the basis of monitoring the most informative indicators that reflect the leading aspects of the activity [1,3,10]. In this regard, the development and methodological substantiation of the methodology for differentiated control and evaluation of the special physical and functional fitness of swimmers, depending on the degree of involvement of various factors in their provision at the stages of long-term sports training, is very relevant.

Objective of the study was to substantiate the main provisions of the method of differen-tiated control and evaluation of the special physical and functional fitness of swimmers at the stages of sports training.

Results of the study and their discussion. The special physical and functional readiness of swimmers is currently considered as a property of a trained organism, integrating a number of components that, to one degree or another, determine special performance and, in fact, the sports result itself.

Physical and functional readiness is formed due to the integrated functioning of various components, as a result of which specific manifestations of the activity of individual ele-ments of the general structure are always interdependent [1, 9, 11, 12]. It should be noted that the functional capabilities and mechanisms that determine them, to a large extent, also depend on such properties as power, mobilization, stability and economy [7], considered as qualitative characteristics of the functioning of the physiological systems of the body [1, 8, 9, 11].

At the same time, it is known that an increase in the level of special physical fitness in the process of long-term adaptation to physical loads occurs due to various factors that deter-mine it [4, 7, 11].

It is shown that at the beginning of the process of long-term adaptation of the organism to physical loads, special physical fitness is largely determined by the high level of “morphofunctional power” factors. In swimming, power factors are expressed in indicators of physical development (length and weight of the body, volume of muscle mass, etc.), indicators of the power of energy supply mechanisms (maximum oxygen consumption, glycolysis power, etc.), indicators of the power of the muscular system (maximum strength, strength thrust on land and in water), total external mechanical power (Pt0), etc. [1].

At the stages of sports improvement, along with the factors of "power", special physical performance to the greatest extent depends on the factors of "mobilization". At the same time, the importance of the factors of "economics" is also growing. In sports swimming, these factors include, for example, indicators of maximum swimming speed (Vmax), coefficient of use of power capabilities in water, etc. [1].

At the final stages of a long-term training, the factors of “economical” functioning of physiological systems have a dominant influence on sports performance while maintaining a high value of mobilization capabilities [1, 11]. Directly during swimming, the threshold values for aerobic and anaerobic metabolism, active resistance during swimming, the coefficient of coordination of movements in water, etc. are most often used as criteria for functional efficiency [1, 2].

Thus, the biological basis of the methodology for differentiated control and assessment of the preparedness of swimmers should be considered the idea of a stage-by-stage sequential development of certain physiological mechanisms and functional properties of the body that underlie the increase in the level of adaptation of the body to physical loads and the expansion of functional capabilities. organism [1, 4, 7, 11].

When determining indicators for assessing the functional and special physical fitness of swimmers and selecting tests to obtain them, we proceeded from several provisions.

The first provision determines the consideration of the significance of various factors and indicators that reflect them in determining the level of special physical and functional fitness and sports results as their main integrative indicator (at the initial stages of long-term training of swimmers - factors of morphofunctional power, at intermediate stages - factors of mobilization, and at the end - the factors of profitability).

The second provision is due to the fact that the selection of indicators for differentiated control is determined by the maximum correspondence of these parameters to the real conditions of the specific activity of the athlete and their greatest impact on the sports re-sult, which makes it extremely necessary to determine the degree of relationship between the actual sports result and the results of tests used for control. special preparedness [3].

The third component of accounting was the availability of the methods used for diagnosing the level of preparedness. Practice shows that even biochemical control is inaccessible for a wide range of athletes, especially in the early stages of many years of training. In this regard, it makes no sense to recommend, for example, biochemical indicators or gas analysis indicators to assess the preparedness of young swimmers.

The fourth condition that was taken into account is the number of indicators used for control. It is known that the control of 5-6 parameters provides an estimation error of 10-15%. With an increase in the volume of diagnosed indicators, the accuracy of the integra-tive assessment increases slightly [6]. Proceeding from this, it seems quite sufficient to use 5-6 most informative and reliable indicators that adequately reflect the dominant components of swimmers' preparedness at one or another stage of a long-term training.

The fifth condition reflects the reliance on the use of specific swimming tests to control the readiness of swimmers. The results of these tests, differentiated depending on age (orientation to biological age), swimming method, remote specialization, energy supply mechanisms (pulse zone), allow us to get an idea of the special physical and functional fitness of swimmers in a particular period of a large training session. th cycle. In addition, swimming tests are available for implementation with swimmers of any age and with any equipment of the training base.

The sixth provision, which was taken into account when forming a testing complex for assessing the preparedness of swimmers, is the conditional division of all swimmers into three main groups, depending on

the stage of many years of sports training and on the level of preparedness. At the same time, the criterion for attributing swimmers to a particular group is the level of sports performance. To be able to compare estimates of indicators of different dimensions, it is advisable to bring them to a single scale (normalization) according to the method of constructing evaluation scales of “selected points” [5,12].

Seventh position. It is advisable to automate the entire procedure for evaluating the indi-vidual indicators of swimmers, associated with certain calculations, ranking and visualization, through the use of digital technologies. On the basis of direct indicators according to a given algorithm, a number of intermediate parameters are calculated, all input indicators are ranked and evaluated in accordance with a given scale, and an assessment of two types is issued in digital and graphical form: an integrative assessment (issued as an average score of only the entered indicators) and a differentiated assessment of each indicator separately (allows you to obtain information about the "strong" and "weak" sides of the swimmer's preparedness and the ratio of their level).

Conclusions. Based on the foregoing, it seems to us that the assessment of the special physical and functional fitness of swimmers at different stages of a long-term training should be differentiated according to the following indicators: - in terms of mobilization capabilities and at the stages of higher sportsmanship - in terms of efficiency of functioning of all body systems.

Thus, the complex control of the special physical and functional fitness of swimmers should be based on a differentiated assessment of the main factors that determine the level of special sports performance at the stages of long-term training and reflect the biological and physiological patterns of development of adaptation to physical loads, taking into account individual typological features. athletes and their sports specialization. It is advisable to automate the assessment of individual indicators of swimmers, associated with calculations, ranking and visualization, to the maximum extent on the basis of digital technologies.

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Modernization of training of highly qualified croly swimmers on the basis of historiographical analysis of world records

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Dr. Hab., Professor **V.Yu. Karpov**[1]
PhD, Associate Professor **M.N. Komarov**[2]
PhD, Professor **I.A. Rodionova**[3]
PhD, Associate Professor **L.N. Porubaiko**[4]
[1, 2] Russian State Social University, Moscow
[3]Moscow State Technical University of Civil Aviation, Moscow
[4]Kuban State Medical University, Krasnodar

Corresponding author: vu2014@mail.ru

Abstract

Objective of the study was to identify the main directions of modernization of the training system for highly qualified freestyle swimmers based on a historiographic analysis of world records.

Methods and structure of the study. The dynamics of world records in freestyle swimming at distances from 100 to 1500 m for men and from 100 to 800 m for women was analyzed, and methodological “finds” were identified based on the analysis of scientific and methodological literature on swimming. The study was conducted in 2021.

Results and conclusions. In the period 1910-2020. there is an abrupt increase in record sports results in freestyle swimming. Basically, there is a conjugate change in these results in men and women at swimming distances of one energy supply zone, which indicates a methodological factor in changing sports results at this historical stage in the development of world swimming. The initial phase of rapid growth observed in the first decades of the 20th century is clearly marked, with a gradual slowdown in the growth of record results. In the second half of our century, a new acceleration in the growth of world records was revealed, which then gradually decreases.

The relationship between the dynamics of world records of swimmers and the evolution of the methodology for training highly qualified athletes is traced. This pattern is observed in both men and women. Methodical "finds" appear, as a rule, every 20 years. The main prospects for improving the system of training elite swimmers: advanced training of coaching staff; the problem of finding outstanding performers; further intensification of training; modern logistics; regular monitoring of the athlete's condition; search for rational options; social guarantees for athletes and coaches.

Keywords: *world records, swimmers, training methods, results gains, freestyle.*

Introduction. The constant growth of sports achievements in swimming, high competition in the international arena oblige specialists to look for new ways to improve the efficiency of the training process and competitive activity in this sport [1-4]. Comparing the growth of world records in freestyle swimming and methodological findings in this sport, it is possible to predict possible directions for improving the process of training highly qualified freestyle swimmers [5]. Unfortunately, such comparisons of results are not enough, therefore, additional research is needed in order to timely identify promising areas for modernizing the training system for highly qualified swimmers.

Objective of the study was to identify the main directions of modernization of the training system for highly qualified freestyle swimmers based on a historiographic analysis of world records.

Results of the study and their discussion. In the period 1910-1920. world records for men in swimming in the 100 m freestyle improved by 3.2%, in 1920-1930 - by 4.9%, in 1930-1960 the growth of world records decreased markedly and averaged only 1.1 per decade %. During the periods 1960-1970. (4.9%) and 1990-2000. (4.8%) showed an increase in the gains of world records, and then the growth of these results decreased.

During the analyzed period, the most intensive growth of world records at a distance of 200 m freestyle was noted in 1910-1920 - 6.0% and 1920-1930 – 7.1%. New waves of gains in world records appeared in the periods 1960-1970 (4.8%) and 2000-2010 (4.7%). At the present stage of 2010-2020 there was a significant decrease in the growth of record results at this distance.

In swimming in the 400 m freestyle, periods of intensive growth in record results: 1920-1930 - 7.7%, 1970-1980 - 5.1%. At a distance of 1500 m freestyle, there was also an abrupt change in record results: the periods of the largest gains in 1920-1930 - 8.6%, 1970-1980 - 8.8%.

For women at a distance of 100 m freestyle, the periods of the largest increases in world records were noted at the beginning of the historical development of swimming: 1910-1920 - 22.9%, 1920-1930 - 8.1%. In the future, the increase in record results has declined markedly, especially over the past decade. At a distance of 200 m freestyle, in general, a similar pattern can be traced: periods of intensive growth - 1920-1930 - 7.0%), 1930-1940 - 8.8%. At a distance of 400 m freestyle, periods of intensive growth in world records: 1920-1930 - 10.7%, 1930-1940 - 11.4% and 1970-1980 - 9.1%. In the future, there is a uniform, less significant increase in world records. At a distance of 800 m freestyle, the periods of the largest gains in world records: 1920-1930 - 8.8%, 1960-1970 - 9.4%, 1970-1980 - 8.6%.

Thus, in the period 1910-2020. there is an abrupt increase in record sports results in freestyle swimming. There is mainly a conjugated change in these results for men and women at swimming distances of the same energy supply zone, which indicates a methodological factor in changing sports results at this historical stage in the development of world swimming.

The undulating growth of world records in freestyle swimming for both men and women is clearly visible. The initial phase of rapid growth observed in the first decades of the 20th century is clearly marked, with a gradual slowdown in the growth of record results. In the second half of our century, a new acceleration in the growth of world records was revealed, which then gradually decreases.

Now let's trace the evolution of the methodology for training highly qualified swimmers. At the beginning of the 20th century, the determining method of training athletes was the method of long-term continuous work, during this period they worked out for eight months a year, two to three times a week. In the 30s, the methods of variable and repeated work were actively used, and in the 40s year-round training was introduced with elements of interval training, variable and repeated swimming.

The growth of world records in freestyle swimming in the 50s is associated primarily with the widespread introduction of the interval training method, and in the 70s swimming lessons were already complex in nature using various ergogenic means. At that time, year-round training in swimming was actively developed, divided into periods and stages, taking into account the age characteristics of those involved. Training loads increased sharply, primarily due to the volume of training equipment, and by the beginning of the 80s, their intensity began to increase significantly with a decrease in the total volume of swimming with strict rest intervals and an increase in the volume of swimming aimed at developing anaerobic capacity. Devices were actively used to transfer the development of strength abilities from land to rowing movements in water.

Conclusions. For more than a century of development of swimming in the world, various options for using training exercises, load parameters, repetitions, rest pauses have been tested, so most likely a new leap in “methodical thought” in speed swimming will be aimed at finding combinations of physical activity with ergogenic means.

The main directions for modernizing the process of training highly qualified swimmers based on a historiographic analysis of world records:

1. Improving the information support of the sports training system.
2. Modernization of technology for searching for especially gifted athletes.
3. Optimization of the training process by improving the anaerobic capabilities of swimmers based on a high level of aerobic endurance development in combination with the use of ergogenic means.
4. Modern logistics for training swimmers on land and in water.
5. Implementation of information and analytical monitoring of the swimmer's physical condition.
6. Search for a rational variant of individual swimming technique.
7. Improving social guarantees for athletes and coaches.

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Analysis of the age dynamics of competitive activity in athletics all-around in the aspect of sexual dimorphism

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Postgraduate student **E.S. Netsvetaeva**[1]
Associate Professor **V.A. Borovaya**[1]
Dr. Hab., Professor **E.P. Vrublevskiy**[1]
PhD, Associate Professor **S.V. Sevdalev**[1]
[1]Skorina Gomel State University, Gomel, Belarus

Corresponding author: vru-evg@yandex.ru

Abstract

Objective of the study was to identify the specific features of the age dynamics of competitive activity in track and field all-around events in terms of sexual dimorphism.

Methods and structure of the study. The competitive activity of the strongest all-around athletes of the world, women and men, was analyzed throughout the entire sports career of each of the athletes. 221 results in the heptathlon disciplines for women (n=25) and 276 results for men (n=30) in the decathlon were subjected to statistical processing, shown by them throughout their sports career at the age of 18 to 33 years.

Results and conclusions. Women three years earlier than men reach the zone of realization of individual abilities, maintaining a high level of sports performance up to 27 years, and in men at the age of 30, 57% of the respondents are included in the top list of 50 strongest decathletes in the world.

At the beginning of a sports career for men, the highest total points are scored by those athletes whose physical fitness prevails over technical. For women at this stage, the priority is training in disciplines that make the maximum contribution to the total score. At all stages of sportsmanship in women, the greatest contribution to the final result is made by achievements in high jumps, and in men - in long jumps. Common to the two types of all-around is the significant contribution of the result in hurdling to the total points and the indicators achieved in throwing are less significant.

Keywords: *all-around, competitive activity, decathlon, heptathlon, points, result, sexual dimorphism.*

Introduction. Complex all-around is an independent specific sport, and not the sum of performances in several different types [4, 6]. In this regard, in order to design an optimal plan for the multi-year training of athletes, it is necessary to fully understand what is required for the success of an individual athlete at each stage of multi-year improvement.

Currently, there is a growing interest in the structure of competitive activity of highly qualified athletes who specialize in various sports [3, 4, 7], as well as in the peculiarities of training athletes in terms of sexual dimorphism [1, 2]. A search is being made to optimize the process of managing the training of all-around athletes, based on identifying the strengths and weaknesses of their preparedness and timely correction of training effects. At the same time, following the strategic goals of training, it is recommended to take into account the individual characteristics of a particular all-rounder and rely more on his leading motor abilities [3, 4, 5, 10]. At the same time, the analysis of the literature showed the absence of works on the problem of studying the age dynamics of the competitive activity of elite all-around athletes and their gender differences.

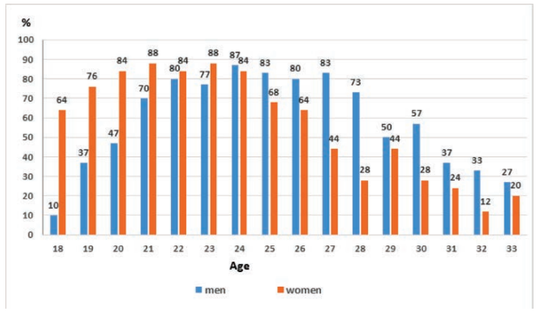
Objective of the study was to identify the specific features of the age dynamics of competitive activity in track and field all-around events in terms of sexual dimorphism.

Methods and structure of the study. The competitive activity of the strongest all-around athletes of the world, women and men, was analyzed throughout the entire sports career of each of the athletes. 221 results in the heptathlon disciplines for women (n=25) and 276 results for men (n=30) in the decathlon, shown by them during their sports career at the age of 18 to 33 years, were subjected to statistical processing.

Results of the study and their discussion. In elite sport, there is a whole range of various problems that do not allow an athlete to demonstrate world-class results every year, throughout his entire sports career. This is especially pronounced in women, due to a break in the training process associated with pregnancy and childbirth. So, of all the athletes we studied, seven female representatives (28%) and eight male representatives (27%) had no breaks in their sports career.

Analysis of the number of competing athletes at each age (figure) made it possible to identify trends in the age dynamics of the maximum realization of the individual capabilities of all-around athletes, depending on gender. So, we can say that women three years earlier than men reach the zone of realization of individual capabilities, and women lose the ability to maintain a high level of sports performance by the age of 27. At this age, only 44% of the athletes we studied show world-class results. While for men at the age of 30, another 57% of the studied athletes are included in the top list of the 50 strongest decathletes in the world.

To compare the age dynamics of sports performance of men and women specializing in track and field all-around events, the contribution of individual types to the total amount of the best competitive results shown by athletes aged 18, 23 and 27 years was carried out. These are the most significant, from our point of view, years in the career of all-around athletes. So, 18 years old is the age when international competitions with standard equipment begin. 23 years old is the age of reaching the zone of optimal opportunities, and at 27 years old comes the age where representatives of both sexes show maximum results in their careers (see figure).



The ratio of the number of studied all-around athletes who are in the annual top lists, depending on gender and age (%)

The table shows the structure of competitive results in the studied ages for men and women.

The data obtained indicate that at the beginning of a sports career in men, the greatest total amount of points is scored by athletes whose physical fitness prevails over technical ones. They manage to realize their functional capabilities to the fullest extent in such simple, technical exercises as running 1500 meters and long jump. For women at this stage, the priority direction of the training process is technical training in the disciplines that give the maximum contribution to the total score.

At the age of 23, for men, the total amount of points is generated randomly, in contrast to women, who at this age equalize the significance of the contribution of individual disciplines to the total amount of the heptathlon. By this age, athletes significantly raise their level of speed-strength fitness, acquire the necessary level of technical skill in throwing.

Based on this, we can conclude that by the age of 23, the leaders among women are those who have fully mastered the technique of performing all types of heptathlon, which allows them to "collect" the results in individual disciplines close to personal records, in the total amount of all-around. For men, the process of developing technical mastery has not yet been completed, there is no stability in performance in technically complex exercises.

The culmination age, when the average competitive result reaches its maximum in men and women, is 27 years. Since the result in jumps depends on the speed of the run, it can be argued that in the men's all-around at the peak of their career, as a rule, the one who has the best speed abilities wins. This is confirmed by the results of the correlation analysis - in women, as well as in men, a statistically significant relationship ($p \leq 0.05$) of the total score with sprint distances and jumping disciplines was revealed.

Conclusions. Thus, the study made it possible to reveal certain features of the age dynamics of competitive activity in track and field all-around events in terms of sexual dimorphism.

An analysis of the age dynamics of the competitive performance of men and women showed that athletes do not always achieve their best results in certain disciplines at the peak of their competitive activity. Thus, men in the high jump and 1500 m run show high results at a younger age. In women, this is observed only in javelin throwing.

The difference in the structure of the competitive activity of men and women specializing in track and field all-around events is also the contribution to the total amount of points in jumping events. At all stages of sportsmanship for women, the greatest contribution to the final result is made by achievements in high jumps, and for men - in long jumps. Common to the two types of all-around is a significant contribution of the result in hurdling to the total points and less significant indicators achieved in throwing.

Thus, dimorphic features in the structure and functions of the female body have an impact on the performance of competitive activity, which determines the necessity of constant clarification of the content of training influences, adequacy to the current state of the athlete's body during training sessions [8, 9].

The structure of competitive activity in the types of decathlon and heptathlon

Age	Men (decathlon)		Women (heptathlon)	
	Result	Contribution, %	Result	Contribution, %
	100 m, s		-	
18 years old	11,12±0,19	10,85±0,51	-	-
23 years old	10,83±0,21	10,74±0,50	-	-
27 years old	10,75±0,23	10,72±0,50	-	-
	Long jump, m		**Long jump, m**	
18 years old	7,24±0,16	11,32±0,42	6,00±0,20	14,83±0,90
23 years old	7,49±0,20	11,12±0,49	6,27±0,17	14,64±0,58
27 years old	7,56±0,23	11,10±0,54	6,42±0,23	15,02±0,79
	Shot put, m		**Shot put, m**	
18 years old	12,97±0,67	8,64±0,59	11,89±0,96	11,03±0,89
23 years old	14,66±0,71	9,17±0,52	13,62±1,14	12,03±0,93
27 years old	15,25 ±0,84	9,41±0,60	14,04±0,99	12,23±1,14
	High jump, m		**High jump, sm**	
18 years old	2,00±0,05	10,56±0,67	174,00±4,60	16,05±1,13
23 years old	2,05±0,05	10,10±0,56	182,00±5,45	15,72±0,85
27 years old	2,03±0,06	9,82±0,68	183,00±4,36	15,55±0,53
	400 m, s		**200 m run, s**	
18 years old	49,73±0,66	10,74±0,36	24,75±0,31	15,96±0,54
23 years old	48,49±0,84	10,57±0,29	24,24±0,51	15,02±0,70
27 years old	48,22±0,93	10,51±0,44	24,21±0,61	14,73±0,74
	110m hurdles, s		**100m hurdles, s**	
18 years old	14,66±0,28	11,57±0,40	14,16±0,29	17,00±0,63
23 years old	14,27±0,29	11,22±0,38	13,52±0,19	16,44±0,62
27 years old	14,09±0,27	11,26±0,32	13,36±0,31	16,41±0,49
	Discus throw, m		-	
18 years old	39,55±1,76	8,52±0,54	-	-
23 years old	45,31±2,50	9,23±0,59	-	-
27 years old	46,39±2,58	9,31±0,60	-	-
	Pole vault, m		-	
18 years old	4,47±0,26	9,76±1,02	-	-
23 years old	4,80±0,23	10,13±0,78	-	-
27 years old	4,97±0,21	10,54±0,72	-	-
	Javelin throw, m		**Javelin throw, m**	
18 years old	56,95±5,12	8,98±0,88	38,79±4,80	11,06±1,45
23 years old	61,98±3,52	9,22±0,63	45,63±4,62	12,12±1,16
27 years old	62,72±4,11	9,11±0,72	45,58±2,86	11,86±0,94
	1500 m, min, s		**800 m, min, s**	
18 years old	4.36,36±6,75	9,13±0,48	2.20,75±2,59	14,07±0,73
23 years old	4.34,45±8,03	8,56±0,62	2.14,40±2,90	14,03±0,63
27 years old	4.36,21±7,74	8,26±0,62	2.12,74±2,62	14,21±0,56

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Theoretical modeling of assessment of professional skills of athletes

UDC 159.99:076

PhD **A.I. Kharitonova**[1]
PhD, Associate Professor **E.M. Klimova**[2]
Central Sports Club of the Army, Moscow
[2]Moscow Region State University, Mytishchi, Moscow Region

Corresponding author: kharitosha85@mail.ru

Abstract

Objective of the study was to develop a theoretical model for assessing the level of professional skills of athletes.

Methods and structure of the study. On the basis of theoretical analysis, synthesis, expert evaluation and modeling, criteria, indicators, indicators for assessing the level of professional skill of athletes were identified, which made it possible to develop a theoretical model for assessing the level of professional skill of athletes, consisting of target, technological, procedural and resultant components.

Results and conclusions. In the course of the theoretical analysis, it was determined that the professional skill of an athlete is an integral indicator that includes the highest level of mastered professional skills in the field of sports, efficiency and reliability, responsibility, emotional stability, special abilities, self-realization of an athlete and includes the highest qualification. Given these indicators, the theoretical model for assessing the professional skills of athletes includes the following components: target, technological, procedural and resultative.

Keywords: *professional excellence, skill assessment, target component, technological component, procedural component, resultant component.*

Introduction. The main goal of elite sport is the demonstration by athletes of high sports results. Sports activities are associated with the evaluation of the results of sports achievements, the analysis of the development of an athlete and the level of his preparedness. Modern sport is at such a stage of development that the level of preparedness of the strongest athletes practically does not differ, which makes it difficult to assess their professional skills.

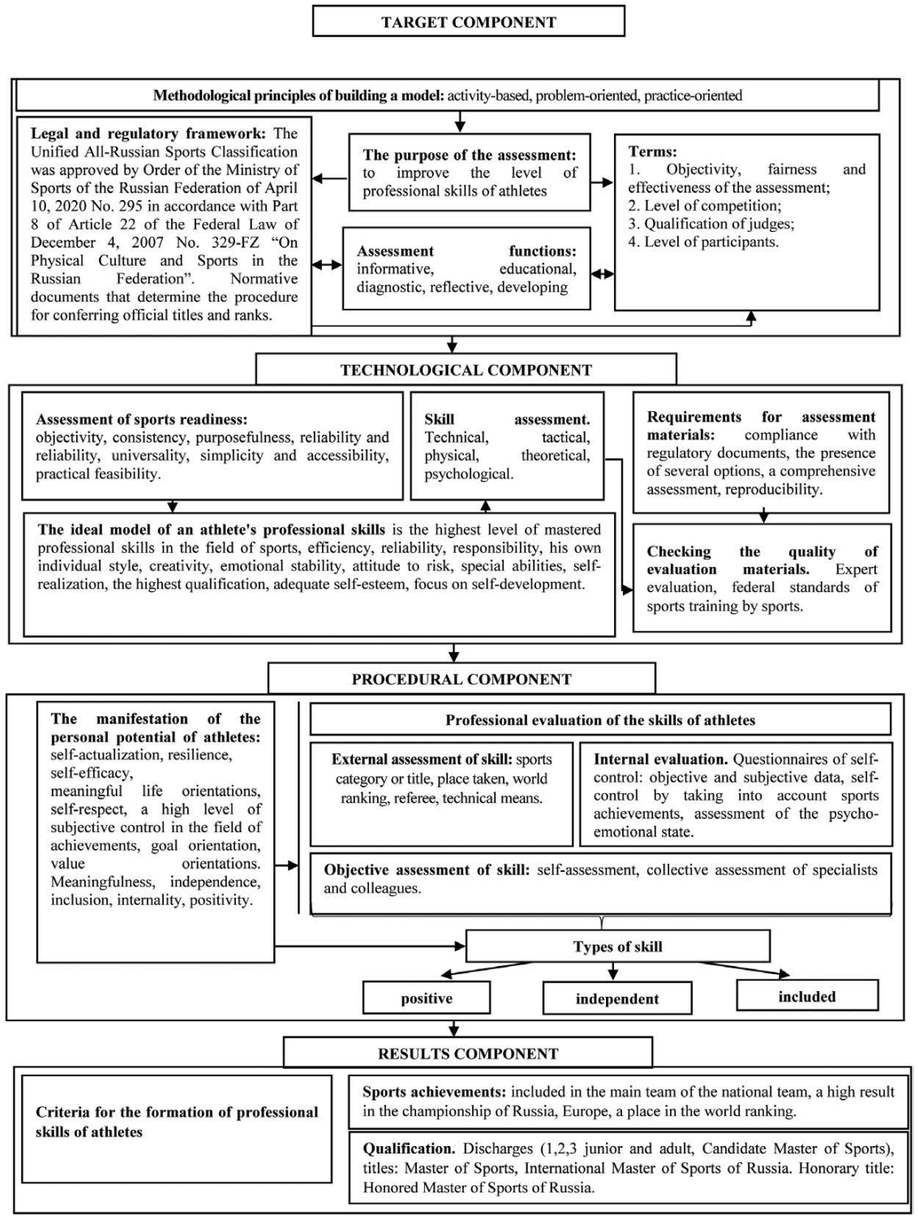
The professional skill of an athlete "cannot be assessed by one indicator, its full characterization requires a multilateral approach" [9], since obtaining information about the athlete and various indicators of professional skill is carried out using a comprehensive assessment or comprehensive control, which allows determining the level of the athlete's preparedness and contributes to management of the process of his sports improvement [1, 10].

Objective of the study was to develop a theoretical model for assessing the level of professional skills of athletes.

Methods and structure of the study. Currently, scientists identify various indicators for assessing the professional level of athletes, forming the so-called "ideal model of skill":

• V.E. Milman developed a questionnaire for assessing mental reliability, by which he understood the stability of the functioning of the main mental mechanisms in difficult competitive conditions, which consists of a set of indicators of the components: competitive emotional stability, self-regulation, motivational-energy component, stability and noise immunity [3];

• Yu.I. Smirnov, when evaluating the competitive reliability, took into account such indicators as the coefficient of motor performance and the coefficient of readiness, indicators of error-freeness, recoverability and timeliness [8];



Assessment of the level of professional skills of athletes

• V.G. Nikitushkin and F.P. Suslov evaluates the effectiveness of an athlete in martial arts by the coefficient of reliability of attacking and defensive actions, as well as by the activity of technical and tactical actions [5];

• S.V. Pavlov developed a methodology for assessing the technical and tactical readiness of taekwondo athletes in competitive fights. Determining the level of technical readiness is carried out through an assessment of the effectiveness of technical actions performed by an athlete during a fight. The level of tactical preparedness through the assessment of actions that contribute to the implementation and restructuring of the conduct of combat, as well as situational and preparatory tactical actions [7];

• A.M. Ovechkin, using the methodology for assessing the technical and tactical readiness of hockey players, calculated the average complexity of using technical and tactical actions per game or training session [6];

• E.V. Melnik and E.V. Silich revealed an expert assessment of the success of sports activities, which takes into account many indicators that reflect the subjective and objective aspects of sports activities, as well as a latent assessment, which is calculated taking into account judges' ratings, difficulty coefficient and grade coefficient [2];

• I.Yu. Mihuta, P. Sun and Y. Liu revealed an integral assessment of the degree of readiness and readiness of an athlete for competitive activity, represented by the following blocks: control of competitive activity; pedagogical control; psychological and psychophysiological control; morphofunctional control; biomechanical control [4].

Results of the study and their discussion. In the course of the theoretical analysis, it was determined that the professional skill of an athlete is an integral indicator that includes the highest level of mastered professional skills in the field of sports, efficiency and reliability, responsibility, emotional stability, special abilities, self-realization of an athlete and includes the highest qualification [eleven]. Considering these indicators, we have developed a theoretical model for assessing the professional skills of athletes (see figure).

We consider it important to note the need to highlight the target, technological, procedural and resultative components in the theoretical model for assessing the professional skills of athletes.

The target component is based on the methodological principles of building a model: activity, problem-oriented and practice-oriented and is based on the legal framework, includes the goal, functions and conditions for assessing the athlete's professional skills.

The technological component includes an assessment of sports readiness and focuses on the ideal model of an athlete, skill assessments, requirements for assessment materials and is implemented through checking the properties of assessment materials.

The procedural component takes into account the manifestations of the athlete's personal potential, professional assessment of the athlete's skill, includes both external, internal and objective assessment, which makes it possible for us to attribute the athlete to one of the selected types of professional skill.

The effective component reflects the criteria for the formation of professional skills of athletes and necessarily takes into account sports achievements and the level of sports qualifications.

Conclusions. The evaluation of an athlete's professional skills is a complex indicator that includes evaluation of the procedure and results of sports activities.

The introduction of an athlete's professional skill assessment sheet into sports activity, which reflects the procedural and performance components, can significantly expand diagnostic capabilities in assessing the preparedness of athletes and outline new approaches to improving their professional skills.

When evaluating the professional skills of athletes, it is important to take into account objective and reliable qualification characteristics, professional skills and abilities of athletes.

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Factors of successful sports activities in road-ring racing

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PhD, Associate Professor **I.G. Stanislavskaya**[1]
Dr. Philol., PhD **G.M. Biryukova**[1]
Dr. Psych., Professor **S.D. Gurieva**[2]
Master student **I.A. Kostyukov**[1]
[1]Lesgaft National State University of Physical Education, Sports and Health, St. Petersburg
[2]Saint Petersburg State University, St. Petersburg

Corresponding author: irina.stanislavskaya@mail.ru

Abstract

Objective of the study was to identify the psychological characteristics of athletes associated with the achievement of high sports achievements in road-ring racing (RRR).

Methods and structure of the study. In the process of collecting empirical information, the following psychodiagnostic tests and methods were used: an expert assessment questionnaire “Athlete through the eyes of a coach” to determine performance, emotional stability and motivation; determination of the type of character according to K.G. Jung; Bass-Darkey aggression level questionnaire. The study involved 30 athletes.

Results and conclusions. The effectiveness of pilots in the RRR is influenced not only by the training of skills, but also by a number of individual psychological qualities of pilots. Efficiency largely depends on the motivation indicators of pilots. The aggressiveness of pilots acts as an undesirable personality trait for RRR pilots (this statement applies only to this sport!), which hinders their performance and prevents them from making adequate decisions in the face of time pressure. There is a statistically significant difference between highly successful and less successful pilots in terms of emotional stability: highly successful athletes are more stable, which means they are less prone to panic and less likely to fall into a stupor.

Keywords: *success in sports activities, road racing, emotional stability.*

Introduction. The study of the success of pilots in road racing is still not covered by a large number of scientific works, since this is a relatively young type of sports, and the problems of this sport have not yet taken their due place in the field of view of researchers. It is known that the productivity of an athlete’s achievements largely depends on the individual psychological characteristics of the individual. This thesis is also valid in relation to the ring road motorsport.

Objective of the study was to identify the psychological characteristics of athletes associated with the achievement of high sports achievements in road-ring racing (RRR).

Methods and structure of the study. The methodological basis of the study is the concept of E.G. Singurindi that the training of the skills of race car drivers should be preceded by the psychological preparation of future athletes and the analysis of their individual characteristics and reactions.

In the process of collecting empirical information, the following psychodiagnostic tests and methods were used:

- Expert evaluation questionnaire “Athlete through the eyes of a coach” to determine performance, emotional stability and motivation;
- Determining the type of character according to K.G. Jung;
- The Bass-Darkey aggressiveness level questionnaire (only the integrated indicator “Agressiveness” was used (Aggressiveness = Physical aggression + Irritation + Verbal aggression). When deriving estimates, we were guided by the approach of Rogov E.I., according to whose studies, the norm of aggressiveness is the value of its index, equal to 21±4, and hostility - 6.5-7±3).

The study involved 30 athletes.

Results of the study and their discussion. Based on the results of testing athletes and questioning coaches, a data table was compiled (Table 1).

Table 1. *Indicators of testing and questioning*

№	Efficiency	Emotional stability	Motivation	Aggressiveness index	Vertization
1	9	9	9	12	45
2	9	7	8	21	55
3	8	9	9	18	50
4	8	8	7	20	55
5	8	6	7	19	79
6	7	7	6	22	85
7	7	7	8	11	70
8	7	6	7	25	75
9	6	5	6	24	29
10	5	6	8	32	75
11	4	5	4	31	70

Table 2. *Matrix of intercorrelations*

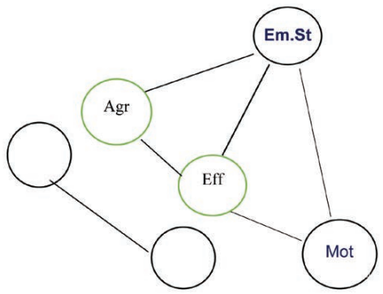
Correlation	Efficiency	Emotional stability	Motivation	Aggressiveness	Vertization
Efficiency	1				
Emotional stability	**0,758**	**1**			
Motivation	**0,610**	**0,726**	1		
Aggressiveness	**-0,696**	**-0,721**	-0,577	1	
Vertization	-0,292	-0,279	-0,337	0,302	1

Note. The table highlights the coefficients that reach the level of statistical significance.

Table 3. *Differences between highly successful and less successful athletes*

Correlation	Mann–Whitney U Test (group comparison) Highlighted values with significance level p <,05000			
	Rank sum in the 1st group	Rank sum in the 2nd group	U-criterion	p-level
Emotional stability	**41,00000**	**25,00000**	**4,000000**	**0,049235**
Motivation	39,00000	27,00000	6,000000	0,120692
Aggressiveness	20,00000	46,00000	5,000000	0,082838
Vertization	24,00000	42,00000	9,000000	0,315303

Further, a correlation analysis was carried out of the qualities and performance indicators of athletes indicated in the table at competitions (Table 2, Figure 1). As can be seen from the table and figure, performance positively correlates with indicators of emotional stability. This seems quite logical, since emotional instability produces the likelihood of erroneous actions. Athlete performance is also positively correlated with motivation for success. All these three indicators create a stable structure, where each of the indicators of personal quality depends on the previous ones. Aggression is negatively correlated with performance, as well as with emotional stability. We propose to comment on these regularities as follows. Apparently, in this kind of sport - road racing - aggressiveness (for example, in contrast to boxing or freestyle wrestling) interferes with making the right decision by narrowing the distribution of attention and worsening the ability to analyze the situation.



Correlation galaxy of test indicators.

Symbols: Eff - effectiveness; Agr - aggressiveness; Em.St. - emotional stability; Mot - motivation for success

To identify differences between the indicators of personal characteristics in athletes of different groups, all the examined athletes were divided into two groups: highly successful (these are those whose performance indicators are 8 points or more) and less successful (whose performance indicators are below 8 points). The comparison was made using the Mann-Whitney U-test.

A comparative analysis showed that the groups of highly successful and less successful athletes differ in terms of emotional stability (Table 3). This is consistent with the indicators of correlation processing (the correlation between the indicators of emotional stability and performance was the highest) and once again confirms the thesis we have already put forward: low indicators of emotional stability prevent making the right decision under time pressure and do not contribute to performance in this sport. Differences in other indicators do not reach the level of statistical significance.

It was found that successful motorsportsmen tend to be ambiversive, while less successful pilots are more extroverted - their average values are 56.8 (highly successful) and 67.3 (less successful), respectively.

The variability of vertization values for highly successful individuals is lower than for less successful ones (standard deviations are 13.1 and 19.6, respectively). The analysis of linear regression, carried out in the Statistica program, showed that the effectiveness depends on the indicators of vertization and it is expressed by the following formula: *Effectiveness* = 8.55 - 0.02 · *Vertization.*

Conclusions. The effectiveness of pilots in road races is affected not only by the training of skills, but also by a number of individual psychological qualities of pilots.

Efficiency largely depends on the motivation indicators of pilots.

The aggressiveness of pilots acts as an undesirable personality trait for pilots of road races (this statement applies only to this sport!), Interfering with their performance and preventing them from making adequate decisions in the face of time pressure. There is a statistically significant difference between highly successful and less successful pilots in terms of emotional stability: highly successful athletes are more stable, which means they are less prone to panic and less likely to fall into a stupor.

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Methodology for training judges in oriental martial art

UDC 796.814

I.V. Liman[1]
PhD **A.V. Zhalilov**[2]
PhD, Associate Professor **D.M. Pravdov**[2]
A.Yu. Zagorodnikova[2, 3]
[1]Interregional physical culture and sports public organization "Budo-club", Vidnoe, Moscow region
[2]Russian State Social University, Moscow
[3]Moscow Pedagogical State University, Moscow

Corresponding author: bonifacii1977@mail.ru

Abstract

Objective of the study was to develop a methodology for training judges in oriental martial arts (a group of sports disciplines Shotokan).

Methods and structure of the study. At the heart of the experimental methodology for the training of sports referees in Shotokan, verbal and visual methods were used in the form of lectures, tasks of varying degrees of complexity and focus, developing the basic skills and abilities of a sports referee. The pedagogical experiment was carried out during 2021 on the basis of the Federation of Oriental Martial Arts Shotokan in Moscow. The total number of participants in the study was 20 judges of various qualifications.

Results and conclusions. The educational course was held for five days. The first day was devoted to the development of theoretical knowledge in the sports discipline Shotokan. Further, for four days at the seminars, the students performed tasks in the form of dictations (dictations of the "protocolist", "judge", "referee") and assessment of various situations in the duel with face-to-face sparring of two athletes on the tatami, presented in the video materials.

It is noted that the practice of conducting lectures and seminars, including dictations and assessment of various situations in a duel, makes it possible to cover all aspects of refereeing and contributes to the effective organization and implementation of multilateral training of referees in Shotokan.

Keywords: *training of sports judges, martial arts (shotokan group of sports disciplines), seminars.*

Introduction. At present, the preparation of a sports referee in Shotokan is a long and at the same time rather complicated process, requiring candidates not only to master the “mechanics of refereeing”, but also to immerse themselves in the essence of the martial art itself. These are necessary conditions for candidates, which allow them to properly evaluate all the multifaceted nuances of techniques in kumite, as well as the technical complexity of the kata, which has a combat application in martial arts [1].

An analysis of the scientific and methodological literature on the topic of the study allows us to say that the only current methodological recommendations for the training of judges in Shotokan are presented in the edition of the rules of V.V. Markov [2]. In addition, the activities of sports referees in Shotokan are regulated by the regulation on sports referees and the qualification requirements for sports referees in the sport of “oriental martial arts” of the Ministry of Sports of the Russian Federation [3], on the one hand, and the regulation on refereeing in USKO (All-Russian physical culture and sports public organization “United Organization Shotokan karate-do Russia”) of Russia according to the rules of Shotokan, on the other. In this regard, a competent referee training plan must meet the requirements of both organizations and involves a gradual even promotion of a referee, both in the qualification categories of sports referees and in the USKO referee categories.

Objective of the study was to develop a methodology for training judges in oriental martial arts (a group of sports disciplines Shotokan).

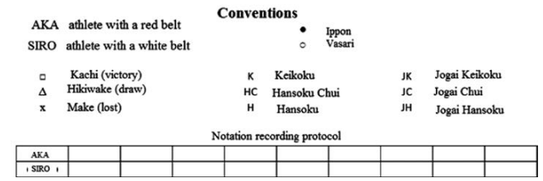
Methods and structure of the study. At the heart of the experimental methodology for the training of sports referees in Shotokan were used verbal and visual methods in the form of lectures, tasks of varying degrees of complexity and focus, developing the basic skills of a sports referee. The pedagogical experiment was carried out during 2021 on the basis of the Federation of Oriental Martial Arts Shotokan of the City of Moscow, the total number of participants in the study was 20 people from the composition of judges of various qualifications.

Results of the study and their discussion. The first day of the educational program was devoted to four lectures, which provided detailed information about judging in the martial art of Shotokan. After mastering the theoretical part, seminars were held with the students for four days, during which they performed methodological and practical tasks in the form of performing dictations, as well as assessing specific situations on the tatami presented in the video materials (see table). The training course was held in the experimental group three times a year (in January, June and September), the rest of the time the students actively practiced in refereeing sports competitions.

The exercises in the methodology were distributed as follows:

Exercise 1 - “Recorder’s dictation”. The main objective of this exercise was to teach the correct recording of scores, penalties, as well as the results of the fight in the competition protocols:

– “simple” level: The announcer calls marks, punishments or results in a prearranged order. Students write down everything in a specially prepared protocol (see figure) in the form of symbols. If the named material requires recording for both athletes, two corresponding columns are filled in. If the scores are called for only one athlete, only one corresponding column is filled in, the second one remains empty;



Simple protocol for notation

- level “difficult”: the announcer does not just name the terms, but completely copies the referee’s phrases from the competition. For example, the announcer says “Aka jodan-zuki Wazaari”, in which case the student must put a “○” sign in the appropriate box. The announcer may accompany the phrases with the appropriate gestures of the referee;

– “expert” level: at this level, the announcer, at his discretion, can pronounce phrases with his voice or use only gestures, or use both.

Exercise 2 - “Dictation of the judge.” The purpose of this exercise was to teach the correct demonstration of referee signals:

– “beginner” level: the announcer calls the terms and shows their designation with flags, if necessary, accompanies with a sound signal of a whistle. The subjects repeat only visual and, if necessary, sound signals, without using the terms themselves;

Shotokan Referee Training Exercises

Name of the exercise	Method	Difficulty levels	Demo
Recorder’s dictation	Verbal Illustrative	Simple Difficult Expert	
Judge’s dictation	Verbal Illustrative	Newbie Simple Difficult Expert	
Referee dictation	Verbal Illustrative	Newbie Simple Difficult Expert	
4 angles - 4 opinions	Illustrative		In person Video materials
Judging «by pieces»	Illustrative		Video materials
«Blind» referee	Illustrative		In person
Sabotage	Illustrative		In person

- level “simple”: the announcer calls the terms. Students demonstrate visual and, if necessary, audio signals that characterize these concepts;

- level “difficult”: the announcer verbally pronounces combat situations. Students must correctly show a visual and, if necessary, an audible signal corresponding to the situation in the duel;

- “expert” level: athletes are given tasks to demonstrate clearly certain situations in a duel on the tatami. The trainees must correctly show the visual and, if necessary, the audio signal that characterizes this episode.

Exercise 3 - Referee’s dictation. The task was to teach the correct demonstration of gestures, terms and commands of the referee:

- the level of “beginner”: the announcer calls the terms and shows them with gestures, if necessary, gives the appropriate commands, the students repeat the gestures and commands.

- level “simple”: the announcer calls the terms. Students demonstrate gestures and give the necessary commands;

- level “difficult”: the announcer verbally pronounces combat situations. The subjects need to give the correct command, accompanying it with the correct gesture;

- “expert” level: athletes are given tasks in advance to clearly demonstrate combat situations in a duel, students must give the correct command, accompanying it with the correct gesture.

Exercise 4 - “4 angles - 4 opinions.” The task is to teach the correct understanding of how accurately the referee saw the specific situation of the fight:

– in person: athletes demonstrate a mock fight, the referee stops it after a certain situation requiring evaluation. The students who are in the positions of the corner judges show their opinion by means of signals. There is a discussion of what they saw, as well as the correctness of the opinions of the judges with their foreshortening and viewing angle;

- by video: students are shown in turn the same simulated situations, filmed from four different angles. Students express their opinion and evaluate the technical action taken from each separate angle.

Exercise 5 - “Judgement” in pieces. The main task was to develop the criteria for judging kata by the judges.

Description: Students are invited to watch a video of the simultaneous performance of two athletes, in which they must choose the winner from the pair. Next, the subjects are offered to view the same performance, but divided into several video fragments, in this case the task was to choose the winner of the pair in each individual fragment, then sum the results by fragments and get the overall result. After watching all the fragments, compare the result with the one that was obtained after watching the whole video. Analyze the results obtained: whether the decision for the whole video coincided with the decision for the totality of fragments; if not, then for what reason; whether errors or inaccuracies were made; how they influenced the result (of a fragment or the entire performance).

Exercise 6 - “Blind” referee. The task was to develop the ability of the referee to model the situation based on the opinion of the side judges.

Description: A situation is simulated when the referee stopped the fight, but he himself saw the situation from an unfavorable angle or did not see it at all (“Mienai”). The judges of the Hantei team show completely different opinions on this situation with the help of flag signals. The task of the referee is to suggest what could happen in a real combat duel, about which the judges made just such an opinion. Voice and discuss your assumption, if such a situation really could be, then give the appropriate commands, accompanied by the necessary gestures.

Exercise 7 - “Sabotage”. The task was to check the correctness of the referee’s determination of the ability to see this or that situation by the corner judges, taking into account their angle.

Description: The number of corner judges includes an agent (maximum two), who has the initial setting to distort the situation: to show what he could not see; give a description that clearly does not adequately reflect a particular fight; while trying not to give yourself away. At this time, the referee is conducting a training duel between two athletes, he should try, if possible, to level the distortion of information by the agent, and ideally to calculate it. The moderator from among the senior judges may slightly prompt the referee, for example, by asking a leading question “Is it worth relying on the opinion of this judge? Could he see the situation?

Conclusions. As a result of the pedagogical experiment, all students during 2021 took a direct part in judging competitions of various levels and ranks from regional and regional (Championship of the Moscow Region, Championship of the Tver Region, Vladimir City Competitions) to All-Russian (Championship of Russia, Cup of Russia, Championship of the Central Federal Districts, Championship of the Northwestern Federal District).

From the composition of the trainees according to the experimental methodology, two participants received the qualification of “young sports referee”, three participants - “sports referee of the 3rd category”, one participant - “sports referee of the 2nd category” and one participant - “referee of the 1st category”, also in the section of referee categories USKO kumite six participants received the category “USKO category “D” kumite judge”, three participants - “USKO category “C” kumite judge”, one participant - “USKO category “B” kumite judge”, one - “referee USKO category “A” in kumite”, as well as USKO category in kata, respectively, D - 7 participants, C - 5 participants.

The above data allow us to say that the developed methodology is effective and its use for training judges in martial arts (Shotokan group of sports disciplines) is justified and expedient.

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Building a year cycle of training athletes radio direction finders at the stage of improving sports skills

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PhD **K.G. Zelensky**[1]
Dr. Hab., Professor **G.N. Ponomarev**[2]
Dr. Hab., Professor **V.F. Kostyuchenko**[3]
PhD, Associate Professor **E.G. Shubin**[4]
[1]Stavropol State Pedagogical Institute, Stavropol
[2]The Herzen State Pedagogical University of Russia, St. Petersburg
[3]Lesgaft National State University of Physical Education, Sports and Health, St. Petersburg
[4]Saint Petersburg State University of Aerospace Instrumentation, St. Petersburg

Corresponding author: ardf_zelenskii@mail.ru

Abstract

Objective of the study was to optimize the structure of the annual training cycle for qualified athletes aged 16-17 in sports direction finding.

Methods and structure of the study. As a result of a longitudinal study (in the period from 2001 to 2021 with the participation of 39 athletes at the stage of improving sportsmanship), it was found that in sports radio direction finding, the single-cycle option for building a one-year training is optimal, when the preparatory period lasts from September to March, the competitive period from April to July, transitional - in August.

Results and conclusions. It was revealed that with such periodization due to the purposeful use of various training tools and exercises that contribute to the improvement of the technique and tactics of operational radio direction finding, near radio search and orientation on the ground, the competitive period can be multi-peak, that is, athletes are able to repeatedly reach the peak of their sports form to the responsible and main (culminating) competitions.

Keywords: *sports radio direction finding, stage of sportsmanship improvement, training load dynamics, annual training cycle.*

Introduction. An important aspect of improving sports training in sports radio direction finding (SRDF) is the scientific substantiation of the organization of the training process of athletes at various stages of long-term training.

At the stage of improving sportsmanship, one of the key structural elements of the sports training system is a one-year training cycle, the optimization of which construction determines the success of the training process as a whole [1]. That is why the study of the construction of a one-year training cycle for the training of athletes aged 16-17 in sports radio direction finding is relevant.

Objective of the study was to optimize the structure of the annual training cycle for qualified athletes aged 16-17 in sports direction finding.

Methods and structure of the study. In order to establish periodization and the optimal structure of training during the year for qualified athletes aged 16-17 in sports radio direction finding, a longitudinal study was conducted in two stages in the period from 2001 to 2021, the first stage - from 2001 to 2007, the second - from 2008 to 2021

During the first stage of the study, the scientific literature devoted to the problem of periodization of sports training was studied, the features of building training at the stage of improving sportsmanship were revealed, and options for planning the annual training of qualified athletes 16-17 years old in sports radio direction finding were analyzed.

During the second stage of the study, we experimentally tested the effectiveness of building a one-year training for athletes aged 16-17 in the SRDF. A total of 39 athletes took part in the experiment. Subsequently, the analysis of the dynamics of the training loads of athletes who became winners and prize-winners of the championships of Russia and all-Russian competitions (n=24) was carried out. In the course of a long-term study, the data of training loads of various directions were recorded, shown by each athlete: the total volume of running load (TVRL), km; volume of running load performed in aerobic mode (VRLAM), km; the volume of the running load performed in the aerobic-anaerobic mode (VRLAAM), km; volume of running load performed in anaerobic mode (VRLANM), km; the volume of loads during the development and improvement of short-range radio search and operational radio direction finding (TSR), km; the volume of loads during the development of tactical actions and radio search techniques (VLTA), km, the volume of loads during the improvement of technical and tactical skills and radio search techniques - integral training (TT-IT), km; the volume of loads during the development of skills and techniques of equipment and tactics of orientation on the ground (OG), km.

Results of the study and their discussion. At the first stage of a long-term study, it was established that at the stage of improving sportsmanship in sports radio direction finding, the improvement of sports and technical skills continues, increasing their reliability in extreme conditions of competitive activity.

The analysis of competitive activity in sports radio direction finding showed that the periodization of sports training in the annual cycle of training, based on the characteristics of performing a competitive exercise in this sport, is influenced by the calendar of competitions, which is built taking into account seasonal and climatic factors. Thus, the first major competitions may already be held at the end of March in the southern regions of the country, and the last in October (also in the southern regions of Russia). At the same time, the first qualifying competitions are planned in early May, the main championship (championship) of Russia - at the end of July. It is the seasonality and duration of the competitive and, as a result, the preparatory and transitional periods that make the single-cycle variant of building year-round training in the SRDF the most preferable [2].

It has been established that during the competitive period, the acquisition of a sports uniform occurs several times, followed by its temporary loss. The process of getting into a sports form is of a phase nature, in which the phases of the development of a sports form alternate in a certain way, which depends on the individual characteristics of the athletes and the training technical and tactical means used, which are characteristic of sports radio direction finding.

Based on the data obtained, a structure of annual training cycles was developed, in which the process of sports form development for athletes ends by the end of the preparatory period, and then, during the competitive period, by changing the training means used and exercises of a technical and tactical orientation, over several periods, the number of which depends on the duration of the competitive season, there is a preservation of sports form.

During the second stage of a long-term study, the effectiveness of the developed structure for building an annual macrocycle for athletes aged 16-17 was tested. As a result, the indicators of 24 athletes were identified and processed, who became winners and prize-winners of the championships of Russia and all-Russian competitions. For selected athletes, the annual training cycle began in September and ended in August.

The analysis showed that the maximum amount of running training work performed in the aerobic energy supply mode (VRLAM) falls on November-January, where the maximum indicators fall on December (221±33 km). Running loads of aerobic-anaerobic orientation (VRLAAM) reach their maximum in February (34±6.5 km). During the competitive period, starting from April, the indicators of aerobic running work are significantly reduced and fluctuate within 22-39% of the maximum in a year, and aerobic-anaerobic - within 40-74%.

The anaerobic running load (VRLANM) reaches its maximum at the end of the preparatory (March - 9.8±2.0 km) - the beginning of the competitive (April - 9.5±1.9 km) periods. In the future, it gradually decreases and by the end of the competitive period does not exceed 30% of the maximum volume in the year.

It has been established that by changing the applied training means aimed at improving the technique and tactics of operational radio direction finding, both in nature and in volume, the acquisition of a sports uniform occurs [3]. In our case, the first peak is reached by the beginning of May, when the first qualifying competitions are planned, and the second by the end of July, which is the main start of the season. This happens, first of all, due to the purposeful and large-scale use of technical and tactical exercises: improving the technique of short-range radio search and operational radio direction finding (TSR), with a maximum volume in March (16.1 ± 5.0 km) - April (11 .0±3.5 km) and June (12.3±4.0 km); development of tactical actions and radio search techniques (VLTA), with a maximum volume in April (10.1 ± 3.0 km) and June (10.0 ± 3.8 km); development of skills and techniques of orienteering techniques and tactics (OG), with a maximum volume in April (15.0 ± 7.0 km); improvement of technical and tactical skills and radio search techniques

The structure of the annual macro cycle of the training cycle for qualified athletes aged 16-17 in the SRDF

Options training load	Preparation period						Competitive period					TP	Total for a year
	RS	I BS				II BS	I CS			II CS			
	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	
VRLAM, km	140	100	170	232	200	99	92	54	74	40	57	78	**1336**
VRLAAM, km	6	22	30	38	28	38	30	32	24	22	16		**286**
VRLANM, km		2	5	7	6	9	10	10	8	6	3		**66**
TT-IP, km		24	10	6	10	44	84	88	68	88	68		**490**
TSR, km	8	14	8	4	12	18	18	10	10	10	8		**120**
VLTA, km				5	5	5	6	10	4	10			**45**
OG, km	8	26	14	8	14	16	16	20	14	14	8	12	**170**
Total volume TTP, km	**16**	**64**	**32**	**23**	**41**	**83**	**124**	**128**	**96**	**122**	**84**	**12**	**825**
Total volume of running load, km	**162**	**188**	**237**	**300**	**275**	**229**	**256**	**224**	**202**	**190**	**160**	**90**	**2513**

Note: RS - retracting stage, I BS - 1st basic stage, II BS - 2nd basic stage, I CS - 1st competitive stage, II CS - 2nd competitive stage, TP - transitional period.

- integral training (TT-IT), with a maximum volume in March (70.0 ± 16.0 km) - April (75.0 ± 19.0 km) and June (75 ± 12 .9 km). In the second half of May, there is a decrease in the volume of use of training means of this direction, which in turn leads to a slight decrease in the level of sports form, which in turn reaches the next rise by mid-July.

Based on the data obtained as a result of a long-term study, we developed the structure of the annual training cycle and determined the dynamics of training loads of various directions for athletes 16-17 years old in sports radio direction finding (SRDF) at the stage of improving sportsmanship (see table).

The annual cycle of training for athletes aged 16-17 at the stage of improving sportsmanship should have the following structure:

The preparatory period lasts from September to March. It includes the following stages of preparation.

Retracting stage (September). Switching to a hard training regimen. Preparing the body for significant running and functional loads. Elements of operational radio direction finding, short-range radio search and orientation on the ground are being worked out.

1st basic stage (October - January). Access to large and maximum volumes of running loads. Development of aerobic and aerobic-anaerobic capabilities. From the second half of the stage, an increase in the volume of anaerobic loads. Development of elements and improvement of TSR and orientation on the ground (OG).

2nd basic stage (February - March). Significant volume and maximum intensity of running loads. The development of anaerobic capacity reaches maximum values. Special trainings in the improvement of TSR reach maximum volumes. In the second half of the stage, integrated training means (TT-IT) are used in large volume.

The competitive period starts in April and ends in late July - early August.

1st competitive stage (April - May). The total amount of running load gradually decreases and by the end of the stage reaches 70-80% of the maximum monthly volume in a year. At the same time, the intensity of training loads and exercises is maximal. The technique of near radio search (TSR), OG is being improved, and integrated training facilities (TT-IT) are used to the maximum extent. The athlete participates in a series of control (control-training) competitions and a qualifying competition.

2nd competitive stage (June - July). The main task of this stage is preparation and participation in the main competition of the season. The total amount of running load is low and amounts to 60-70% of the maximum monthly volume in a year. As well as at the 1st competitive stage, a large amount of means are used aimed at practicing tactical actions and methods of radio search (VLTA), TSR and integral training (TT-IT).

Transitional period (August) - recovery of strength after the sports season. Prevention and treatment of injuries. Leisure. Preparing for the new sports season.

Conclusions. The developed structure of building a yearly training for athletes aged 16-17 in the SRDF will make it possible to optimally plan sports training at the stage of improving sportsmanship, which in the future will allow showing high results in the age zone of optimal opportunities.

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Spatio-time psychomotor references of motor characteristics in volleyball

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Postgraduate student **A.A. Rzhanov**[1]
PhD, Professor **A.A. Akhmatgatin**[3]
Dr. Med., Professor **V.Yu. Lebedinsky**[1, 2]
PhD **A.G. Kharkovskaya**[3]
[1]Irkutsk National Research Technical University, Irkutsk
[2]Irkutsk State University, Irkutsk
[3]Kuban State Agrarian University named after I.T. Trubilin, Krasnodar

Corresponding author: volley-angarsk@ya.ru

Abstract

Objective of the study was to determination of the significance and interpretation of the influence of psychomotor spatio-temporal characteristics of volleyball players on the game process, search for ways and methods to effectively form and develop these abilities.

Methods and structure of the study. The novelty of the developed methodology for the development of psychomotor spatio-temporal characteristics of volleyball players lies in their effective assessment and selection of training tools that develop the motor capabilities of athletes. The experimental group (EG) trained using the developed methodological tools that form the psychomotor spatial and temporal orientations of volleyball players. The control group (CG) trained according to the program for sports schools. The experiment involved 72 pupils of the Angarsk secondary school, aged 9-13 years. The experiment lasted from September 2019 to September 2021.

Results and conclusions. In the course of the study, it was found that in the CG there were no significant changes in the distinctive sensitivity of movements (DSM), and in the EG it was significantly improved. The evaluation of the results of the psychomotor activity of athletes in tests with game techniques, carried out at the end of the experiment, showed significant differences between the groups, characterizing the improvement in the accuracy of performing the EG techniques relative to the CG.

Keywords: *volleyball, psychomotor, movement sensitivity.*

Introduction. It is assumed that the correct perception and effective regulation of the spatio-temporal parameters of movements is the most important indicator that determines the effectiveness of the game actions of volleyball players [11]. At the same time, experts note a close relationship between time intervals and the correction of their own motor sensations, stabilizing the accuracy of hitting them [9].

Spatio-temporal motor procedures are controlled by a set of perceptions of visual, auditory, tactile analyzers, through sensations and their analysis [10]. Players' individual capabilities are characterized by a general psychomotor ability [1, 7], which consists of more subtle components: simple and complex choice reactions, vestibular characteristics, and distinctive sensitivity of one's own movements.

Experts note that the sense of time and space determines the accuracy of performing difficult-coordinating technical elements [4, 5]. Situational processes that are not programmable and inaccessible for assessment during the game are corrected due to the described psychomotor characteristics.

Objective of the study was to determination of the significance and interpretation of the influence of psychomotor spatio-temporal characteristics of volleyball players on the game process, search for ways and methods to effectively form and develop these abilities.

Methods and structure of the study. The experiment was carried out for two years with pupils of sports schools in the city of Angarsk - from September 2019 to September 2021. The CG consisted of 37 boys aged 9-13, studying at the volleyball department of the sports school of the Olympic reserve "Ermak", and the EG - 35 boys of the sports school of the Olympic reserve "Angara" of the same age. Athletes were included in the EG and CG of their own free will and with the permission of their parents. The CG and EG were tested for homogeneity of psychomotor spatio-temporal perceptions at the beginning and at the end of the experiment.

Table 1. *Developmental exercises*

Orientation of the exercise	Description of the exercise
On the development of spatial-distinctive sensitivity	Pass from above from your throw from the front mark, as close to the net as possible, to the opposite side (possible with touching the top cable)
	Pass through the entire playing field to the corner of the marking line touching the marking line. Variations: Serve, offensive hit with space control
	The athlete stands facing the net, the coach behind him throws the ball to the right / left to the side marking area. The player's task is to play from below only those balls that do not go out of bounds. He can turn on the ball only at the signal of the coach. Variants of the exercise for outgoing balls: from the block, from the serve, etc.
On the development of distinctive sensitivity over time	At the command of the coach with the simultaneous activation of the stopwatch, the players begin to perform a set of game techniques with switching. Players must complete the complex as accurately as possible in a predetermined period of time (7, 10 or 12 seconds). The number of repetitions of playing techniques is determined by the player independently according to his own sense of time. Based on the results of the exercise, the coach makes adjustments: a little earlier, a little later

The CG trained in the usual mode, provided for by the training program of the sports school of the Olympic reserve, and the EG - using the developed methodology, including a set of special exercises (Table 1) and methods for assessing the distinctive sensitivity of movements (DSM).

According to the technology of sports training, in the 1st and 2nd years of training, the use of the developed methodology was 30 minutes in each training session. The total time of its application for two years was 192 hours. At each lesson with athletes, the theoretical aspects of psychomotor connections were discussed [9, 10], approaching exercises that developed one's own sensations were used, vestibular and hypoxic loads were applied between contacts with the ball [6, 8], exercises were performed aimed at developing a reaction to sound and light signals with a gradual transition to a reaction of choice.

The methodology included tests for DSM in time and space and for the assessment of playing techniques associated with developed psychomotor reactions.

Distinctive sensitivity of movements in spatial perception was tested:

1.1. With the help of the "curvimeter" device, with which the athlete had to draw a curved line 50, 90, 130 mm long.

1.2. An alternative method involving the performance of a task in which the best result of a long jump from a place was taken as 100%, after which the athlete on the task had to get into the space parameter without visual control of the scale, reducing this result to 80, 70, 60%.

1.3. DSM in time was tested using a stopwatch, while the athlete had to stop the stopwatch according to the task without visual control of the scale in 7, 12, 19 s after its start.

During the analysis of test results (1.1.; 1.2.; 1.3.), the degree of hit by the athlete in the given parameters was determined as a percentage and its arithmetic mean values were calculated.

The assessment of playing techniques was carried out using the following tests:

2.1. Testing the basic game technique of "serving" for accuracy. Each player was offered 6 attempts to serve to a given zone - two attempts each to zones 1, 6 and 5.

2.2. Testing the basic game technique of the "attacking strike" - for technique and accuracy. Each player was offered 6 attempts to perform an attacking shot from the pass to the 4th zone. Only passes that were successful for the attack were taken into account. Then the attacking blow was carried out from its throw - two attempts each in zones 1, 6 and 5.

2.3. Testing the basic game technique "passing from below and above" - for accuracy. Each player was given six attempts to complete passes after hitting the floor from below into the ball cart and from above into the basketball hoop.

In tests (2.1, 2.2, 2.3), the accuracy of the hit in the first attempt was estimated at 2 points, in the remaining attempts - at 1 point.

Table 2. *Results of introductory and final testing of* DSM *athletes*

Test 1.1	Measurement results, %		
	CG; Me (25; 75)	EG; Me (25; 75)	p
Start	88,584 (81,4; 93,6)	88,282 (80,8; 93,2)	p>0,05
End	90,077(83,5; 94,2)	94,094 (87,4; 96,6)	p<0,05
p	>0,05	<0,05)	
Test 1.2	Measurement results		
	CG; Me (25; 75)	EG; Me (25; 75)	p
Start	72,62 (68,6; 76,8)	74,248 (70,1; 78,3)	p>0,05
End	73,52 (69,4; 77,5)	94,285 (85,2; 97,6)	p<0,05
p	p>0,05	p<0,05	

Note: Test 1.1 - determination of DSM in time, Test 1.2 - determination of DSM in space

Results of the study and their discussion. The results of testing the distinctive sensitivity of movements (DSM) in athletes from the EG and CG at the beginning and at the end of the experiment are shown in Table. 2.

The results of the evaluation of the performance of game tests (2.1; 2.2; 2.3) by EG and KG athletes at the end of the experiment are shown in Table 3.

During the experiment, it was found that at its initial stage, there were no statistically significant differences in the values of the parameters characterizing the distinctive sensitivity of the movements of athletes from the EG and CG. At the end of the experiment, there were statistically significant differences between the values of these parameters in athletes from the EG and CG, as well as athletes from the CG compared with the initial data ($p<0.05$).

Analysis of the results of playing techniques fulfillment, carried out at the end of the experiment, showed a statistically significantly better fulfillment of them by athletes from the EG compared to the CG ($p<0.05$).

Distinctive sensitivity of movements and its components develop from congenital inclinations, representing a part of the general complex structure of the formation of motor psychomotor characteristics. The results of evaluating game techniques reflect the effectiveness and applicability of the methodology that develops it.

Conclusion. In the course of the study, a methodology was developed for improving the psychomotor spatio-temporal characteristics of young volleyball players using special methodological influences and developing exercises. The pedagogical experiment showed the effectiveness of this technique, expressed in a significant improvement in the characteristics of DSM in athletes and the quality of their performance of game techniques.

Table 3. *Results of playing techniques at the end of the experiment.*

Test	Measurement results		
2.1.	CG; Me (25; 75)	EG; Me (25; 75)	p
	3 (2; 4)	6 (4; 7)	<0,05
2.2.	CG; Me (25; 75)	EG; Me (25; 75)	p
	4 (2; 5)	5 (3; 6)	<0,05
2.3.	CG; Me (25; 75)	EG; Me (25; 75)	p
	4 (3; 5)	6 (5; 7)	<0,05

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Method of functional evaluation of adaptation of volleyball players in microcycles of sports training

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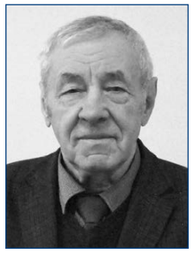

PhD, Associate Professor **V.F. Lutkov**[1]
PhD, Associate Professor **L.L. Miller**[1]
PhD, Associate Professor **G.I. Smirnov**[1]
PhD, Associate Professor **D.I. Shadrin**[1]
[1]Lesgaft National State University of Physical Education, Sports and Health, St. Petersburg

Corresponding author: v.lutkov@lesgaft.spb.ru

Abstract

Objective of the study was to substantiate the use of the method of variational pulsometry and electrocardiographic active orthotic test for individual assessment of the adaptation of highly qualified female volleyball players in training microcycles.

Methods and structure of the study. The object of the study was 32 volleyball players of qualification from the 1st category to the masters of sports. Variational pulsometry (VP) was recorded under conditions of relative rest in microcycles of the preparatory and competitive periods. After registration of 100 R-R cycles (an indicator of the duration of the cardiac cycle), an active ECG orthotest was performed.

Results and conclusions. In the course of studying the problem, it was revealed that heart rate indicators depend on the period of training and the nature of adaptation to training and competitive loads.

Keywords: *heart rate regulation, ECG orthotest, adaptation, maladaptation, stress cardiomyopathy, training microcycle.*

Introduction. In any sport, adaptation to the risk factors of sports training can be characterized by both physiological adaptation and its functional impairments or even pathological changes, overstrain syndrome [8]. This syndrome is caused by a discrepancy between physical activity and the functional adaptive reserve of the athlete's body. The clinical characteristic of the overstrain syndrome is manifested by changes in various organs and systems, but most often in the circulatory system by stress cardiomyopathy [6].

According to modern scientific research, psychoneuroimmunoendocrine imbalance is the basis of myocardial stress damage under the influence of inadequate training loads [5]. With stress cardiomyopathy, the process of repolarization of the heart ventricles, autonomic regulation of the heart rhythm is disrupted, an immune reaction occurs with an increase in the content of pro-inflammatory cytokines (interleukins, TNF-α,) in the blood. As a result, there is a decrease in the physical performance of the athlete and sports results. In this regard, it seems necessary to early diagnosis of stress cardiomyopathy by detecting impaired repolarization of the heart ventricles and autonomic regulation of the heart rhythm in training microcycles.

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Methods and structure of the study. The object of the study was 32 volleyball players of qualification from the 1st category to the masters of sports. Variational pulsometry (VP) was recorded under conditions of relative rest in microcycles of the preparatory and competitive periods. After recording 100 R-R cycles (an indicator of the duration of the cardiac cycle), an active ECG orthotest was performed [3]. When analyzing the variational pulsogram, the mode (Mo), variation range (ΔX), mode amplitude (AMo), ratio AMo/ΔX, voltage index of regulatory systems (VI) were calculated according to the method of R.M. Baevsky [1]. According to the ECG orthotest, the main attention was paid to the degree of tachycardia and the nature of the repolarization of the heart ventricles in the neuroreflex and humoral phases of the orthostatic reaction [2].

Table 1. *Heart rate indicators of volleyball players in training microcycles*

Training periods	Indicators (n=32) ($\bar{X}$, fluctuation limits)			
	ΔX (s.)	Mo (s.)	AMo (%)	VI (conventional units)
Preparatory	0,14 (0,02-0,26)	0,97 (0,88-1,18)	35,5 (18,0-60,0)	57,2 (13,0-102,0)
Competitive	0,19 (0,12-0,26)	1,03 (0,88-1,18)	43,1 (32,0-50,0)	118,7 (86,0-177,0)
P by criterion U	>0,05	>0,05	<0,05	<0,05

Results of the study and their discussion. The results of the study of the dynamics of the heart rhythm in volleyball players in the microcycles of the preparatory and competitive periods of the training process are presented in Table 1.

It was revealed that heart rate at rest in the preparatory period of sports training is characteristic of the normotonic type of regulation. The quantitative characteristics of the indicators correspond to a good functional state and a high functional reserve. At the same time, in the microcycles of the competitive period, quantitative and qualitative changes in the heart rhythm and indicators of its regulation are observed: the amplitude of the mode and the tension index of the regulatory systems increase significantly. The average duration of the cardiac cycle tends to increase ($p>0.05$), heart rate is 58.0 bpm.

The indicated direction of changes in the indicators of the rhythm of cardiac activity indicates the state of tension of the body's regulatory systems. This tension is characterized by an increase in the activity of the sympathetic-adrenal system and is expressed by the centralization of the control of the process of excitation of the sinus node, an increase in the amplitude of the mode and the tension index of the regulatory systems. The state of tension in the mechanisms of central regulation indicates a decrease in the functional reserves of the body and can only last for a short time [4], after which prepathological and pathological changes occur.

Consequently, the marked changes in cardiac activity in female volleyball players in the competitive period necessitate ongoing monitoring in order to prevent the development of prepathological conditions.

Individual analysis of the data revealed that the intensity of heart rate regulation in the competitive period is not observed in all female volleyball players (Table 2).

In the competitive period, female volleyball players experience various adaptive changes in the heart rate. The majority of athletes have a normotonic or vagotonic type of heart rhythm regulation in combination with a negative ECG orthotest. However, these types of heart rhythm regulation can be combined with a positive ECG orthotest, and with greater orthostatic tachycardia (athletes No. 7, 9, 11). The latter indicates the relative diagnostic value of quantitative criteria for heart rate indicators for assessing the nature of adaptation.

Table 2. *Individual indicators of heart rate in female volleyball players in microcycles of the competitive period*

№ Full name	Indicators ($\bar{X}$)					
	ΔX (s.)	MO (s.)	AMo (%)	VI (conventional units)	Δ Heart rate, bpm	T wave with an orthotest
1. S-va	0,22	1,08	32	67	19	+
2. A-ka	0,16	1,18	26	69	31	+
3. R-ich	0,14	0,91	42	164	12	+
4. L-va	0,20	1,08	26	87	20	isoline
5. Ch-va	0,28	1,18	52	79	11	+
6. M-va	0,18	1,18	42	99	19	+
7. V-va	0,42	0,73	28	45	36	(-)
8. T-va	0,46	1,48	18	13	35	+
9. I-va	0,28	1,08	38	63	34	(-)
10.Uf-va	0,28	0,83	24	52	2	isoline
11. B-ia	0,24	1,18	54	95	28	(-)
12. A-va	0,18	1,18	38	89	33	isoline

Table 3. *Individual dynamics of heart rate indicators in female volleyball players in four microcycles of the competitive training period*

Indicators	Sportswoman No. 4				Sportswoman No. 7			
	Microcycle				Microcycle			
	I	II	III	IV	I	II	III	IV
ΔX (s.)	0,24	0,26	0,08	0,20	0,16	0,48	0,42	0,40
MO (c.)	1,03	1,08	0,93	1,08	1,28	1,38	0,73	0,78
AMo (%)	34	19	45	26	90	25	28	22
VI (c.u.)	69	34	302	87	220	19	45	35
Δ Heart rate, bpm	10	33	10	20	7	28	36	36
T wave with an orthotest	(+)	(+)	(-/+)	(+)	(+)	(-)	(-)	(-)

The need for an individual assessment of changes in heart rate indicators is also indicated by the data in Table 3.

Attention is drawn to the different direction of changes in the quantitative indicators of the heart rhythm and the quality of the orthostatic reaction on the example of two athletes. In athlete No. 4, the sympathicotonic type of regulation (decrease in ΔX to 0.08 seconds and MO to 0.93 s, increase in AMO to 45% and VI to 302 units) is combined with a decrease in the growth of orthostatic tachycardia and initial signs of impaired repolarization of the heart ventricles. Such dynamics of indicators and orthotests can be assessed as a sign of regulation tension, as an unstable nature of adaptation.

In order to establish quantitative individual differences, a comparative analysis of the heart rate, electrocardiography data and the results of the ECG orthotest was carried out. Based on the study of the electrical activity of the heart and its changes under orthostatic impact, 32 female athletes were divided into three groups. The first group (13 people) was characterized by a normal ECG and a negative reaction to the ECG orthotest. The second group (11 people) - elongation of the electrical systole, compared with the proper one, or a sharp flattening of the T wave during the orthotest, its two-phase (- / +). For the third group of volleyball players (8 people), the initial signs of impaired repolarization of the ventricles of the 1st degree and negative T wave during the orthotest were typical. The heart rate data in these three groups are given in Table 4.

The direction of changes in heart rate indicators indicates various physiological conditions. In volleyball players of the 1st group, the heart rate indicators correspond to the criteria for satisfactory adaptation, and in the 2nd and 3rd groups - unstable and unsatisfactory adaptation, respectively. In the majority of sportswomen in the competitive period, the normotonic and vagotonic type of regulation was preserved. When the regulation of the heart rhythm is strained, the “price of adaptation” to the conditions of competitive activity increases. The latter is manifested by a sympathicotonic variant of changes in heart rate indicators (unstable adaptation). So, ΔX significantly decreases, AMo and IN increase. Such changes are in certain accordance with the ECG data (Q-T prolongation, initial signs of impaired repolarization of the heart ventricles during an orthotest) and correspond to the criterion of initial signs of pre-pathological changes in these athletes.

The third group of female volleyball players is characterized by a quantitatively different direction of heart rate indicators compared to the second group. They have a “normalization” of the average values of all indicators (ΔX, AMo, AMo / ΔX and IN). However, a large range of fluctuations in the duration of the cardiac cycle (up to 0.42 seconds) and a decrease in the amplitude of the mode (up to 31.7%) were revealed. This direction, combined with impaired repolarization of the ventricles of the heart, corresponds to a state of overstrain of the mechanisms of regulation of the heart rhythm.

Table 4. *Heart rate indicators in female volleyball players of different groups*

Показатели	Groups ($\bar{X}$, fluctuation limits)		
	I	II	III
ΔX (s)	0,27 (0,20-0,35)	0,15* (0,08-0,20)	0,27 (0,14-0,42)
MO (s.)	1,11 (0,88-1,40)	1,02* (0,96-1,18)	0,94 (0,73-1,18)
AMo (%)	36,7 (19,0-50,0)	52,4* (32,0-60,0)	31,7 (26,0-48,0)
AMo/ΔX	136,9 (73-208)	347,3* (160-562)	116,4 (55-240)
VI (c.u.)	68,7 (28-96)	161,4* (74-302)	69,2 (45-102)

* The difference is significant at the $p<0.05$ significance level according to the U criterion.

In order to substantiate the assessment of the functional reserve of volleyball players in terms of heart rate, a correlation analysis was carried out. Correlation analysis data revealed significant differences in the ratio of various indicators of heart rhythm depending on the nature of adaptation.

In healthy female volleyball players with satisfactory adaptation, a large number of significant relationships were found that characterize the neurohumoral regulation of the heart rhythm. There are close correlations between ΔX and VI (-0.59), AMo and VI (-0.79), the indicator of rhythm regulation plasticity (PRR) and VI (-0.49). Significant negative correlations between ΔX and VI (-0.59), the PRR indicator with the stress index AMo / ΔX (-0.49) and positive correlations between the magnitude of the increase in heart rate during orthoprobe with PRR (-0.76), indicate a high functional reserve athletes in this group.

Volleyball players with unstable adaptation showed a sharp decrease in the number of significant correlations. Significant associations of ΔX and AMo with other indicators of heart rate disappeared. Thus, in female volleyball players with unstable adaptation, physiologically determined connections in the heart rhythm regulation system are disturbed, which indicates a decrease in the functional reserve.

Volleyball players with unsatisfactory adaptation revealed a large number of significant correlations. Attention is drawn to the higher correlation coefficients of VI with ΔX (–0.92), with AHR (–0.91) than in healthy athletes, there were significant relationships between Mo and AMo (0.60), VI with ΔHR (–0.91). This direction of changes in correlation coefficients reflects the predominance of the central mechanisms of heart rate regulation and allows them to be considered as a compensatory-adaptive reaction to the impact of sports training factors, as a decrease in the degrees of freedom of the system [7]. The results of the correlation analysis convincingly testify to the legitimacy and validity of using heart rate indicators as criteria for assessing the functional reserve of female volleyball players in training microcycles. The formation of close correlations of heart rate indicators with unsatisfactory adaptation can be considered as a manifestation of the general pattern of transition to a more rigidly determined organization of the system in the event of any premorbid and painful condition.

Conclusion. Heart rate indicators depend on the period of training and the nature of adaptation to training and competitive loads, they are informative criteria for assessing the functional state of the circulatory system in female volleyball players in training microcycles. For an individual assessment of the nature of the adaptation disorder, the diagnostic value of the indicators increases with the complex use of variational pulsometry and an active ECG orthotest. Disturbances in the process of repolarization of the heart ventricles during the orthotest reveal types of overstrain of the neuroendocrine system functions in female volleyball players, types of stress cardiomyopathy and cause a differentiated choice of rehabilitation means in training microcycles.

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Comparative analysis of the general physical fitness of qualified polyathlonists

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Dr. Hab., Professor **T.A. Martirosova**[1]
Associate Professor **E.D. Kondrashova**[1]
Postgraduate student **A.S. Gorbachev**[1]
Master **P.A. Maleev**[1]
[1]Reshetnev Siberian State University of Science and Technology, Krasnoyarsk

Corresponding author: maleevpetr_skies@mail.ru

Abstract

Objective of the study was to identify differences in the indicators of physical fitness of polyathletes of the 1st sports category and masters of sports and to evaluate their impact on sports results.

Methods and structure of the study. More than 20 young men and juniors with the 1st sports category and 15 men who are active masters of sports in polyathlon took part in the scientific work. The research methods in this scientific work were the analysis of scientific and methodological literature, pedagogical testing, as well as mathematical and statistical data processing. As control tests, tests were selected that are most often covered in scientific research literature and used in the theory and practice of physical education and sports to determine the level of general physical fitness of athletes.

Results and conclusions. The analysis made it possible to establish the level of general physical fitness of qualified Krasnoyarsk polyathletes. In this scientific work, the reliability of differences between the studied parameters of polyathletes with the I sports category and polyathletes with the sports title of master of sports was evaluated, and a correlation analysis was carried out in order to identify the influence of the studied indicators on the sports results of athletes. The study allows us to correct the basis of scientifically based model characteristics for the further growth of the sports qualification of polyathletes in the Krasnoyarsk Territory, as well as to determine the main factors for the effective management of the training process of athletes of different age categories.

Keywords: *polyathletes of the 1st category, masters of sports, general physical fitness, reliability of differences, correlation analysis.*

Introduction. Polyathlon in the Krasnoyarsk Territory is gaining more and more popularity every year and is becoming a truly national sport. The history of the development of polyathlon in the Krasnoyarsk Territory originates from the GTO complex - a system of mass physical education that existed in the USSR and is being revived today in Russia [2]. In the region, the number of sites for the popularization of polyathlon, the preparation of a sports reserve for the national teams of Russia, from the 1st category to the masters of sports of international class, is increasing. Polyathlon departments of children's and youth sports schools of the Krasnoyarsk Territory are located in the cities of Krasnoyarsk, Divnogorsk, Zheleznogorsk, Zelenogorsk, Norilsk, in the districts - Taseevsky, Ermakovsky and Yenisei, as well as in the Evenki municipal district and closed administrative-territorial entity village of Solnechny. More than 1000 students are engaged in sports clubs in the cities of Achinsk, Lesosibirsk, Minusinsk, as well as in the Pirovsky district. The participation of athletes from the Krasnoyarsk Territory in the championships, cups and championships of Russia and the world in polyathlon is becoming more traditional and massive in terms of the number of participants.

The intensive development of polyathlon all over the world and the acquisition of a socially significant status by it, changes in the rules and refereeing of various disciplines of this sport, the emergence of new types of competitive disciplines, as well as the gradual "erasing" of the boundaries between summer and winter sports bring certain changes to the models of physical fitness of athletes, and also lead to the need to update a large amount of regularly updated data.

To achieve high sports results by people involved in sports training, model characteristics in the form of proper standards of physical and special fitness are a guideline for the pedagogical justification of the training process of athletes. Improving the efficiency of managing the training process of polyathletes is due to the constant improvement of the model characteristics of competitive activity, reflecting, among other things, physical, functional and psycho-functional readiness [3].

Objective of the study was to identify differences in the indicators of physical fitness of polyathletes of the 1st sports category and masters of sports and to evaluate their impact on sports results.

Methods and structure of the study. The study involved 20 young men and juniors with the I sports category and 15 men - active masters of sports in polyathlon. As control tests, which form the basis of pedagogical testing, tests were selected that are most often covered in scientific research literature and used in the theory and practice of physical education and sports to determine the level of general physical fitness of athletes. The complex of control tests with a sufficient degree of informativeness reflected the necessary general specialized physical fitness of athletes of the studied age and qualification [1].

Results of the study and their discussion. A comparative analysis of the physical fitness of qualified polyathletes revealed significant differences in control tests for assessing strength endurance - pull-ups on a high bar without time limit (184%) and flexion and extension of arms in a lying position (31.48%), a test for assessing maximum effort - bench press (66.66%) and speed-strength form - throwing a projectile at a distance (39.39%). Less significant changes in the results were noted in swimming at 100 meters (23.17%) and flexibility tests (13.33% towards I-dischargers). There were no significant changes in the results in the 100 meters (6.81%) and 3000 meters (7.57%), shuttle run 3 10 meters (5.79%) and long jump from a place (5.91%) and running (6.03%) (see table).

Correlation analysis made it possible to establish the degree of influence of the studied indicators on the sports result. According to the obtained results, Spearman's rank correlation coefficients determine the high impact on the sports result of such indicators as pull-ups on a high bar (R=0.95), flexion, extension of the arms in the lying position (R=0.86) and 3000-meter running (0. 81). A moderate correlation dependence of the sports result on the studied variables is observed in the tests - swimming 100 meters (R=0.73), running 100 meters (R=0.65), throwing a projectile for a distance (R=0.57) and jumping length from the spot (R=0.53). Low statistical significance of the influence on the sports result was noted in the long jump from a run (R=0.44), bench press (R=0.34) and forward bend from a standing position (R=0.27).

Conclusions. One of the most important areas for the development of polyathlon in the Krasnoyarsk Ter-

The results of a comparative analysis of the indicators of physical fitness of polyathletes of the 1st category and masters of sports

Type of control tests	I category	Masters of sports	Differences in indicators,%	p	R
	$\bar{X}$±m	$\bar{X}$±m			
Bench press, kg	60±1,33	100±1,33	66,66	< 0,05	0,34
Standing long jump, cm	237±1,31	251±1,05	5,91	> 0,05	0,53
Long jump with a run, cm	431±1,66	457±1,39	6,03	> 0,05	0,44
Throwing a projectile weighing 700 g at a distance, m	33±1,30	46±1,18	39,39	< 0,05	0,57
Run 100 m, s	13,2±0,23	12,3±0,15	- 6,81	> 0,05	0,65
Run 3000 m, min	10,30±5,7	9,52±4,62	- 7,57	> 0,05	0,81
Shuttle run 3×10 m, s	6,9±0,11	6,5±0,09	- 5,79	> 0,05	0,64
Tilt forward from a standing position, cm	15±0,41	13±0,37	- 13,33	< 0,05	0,27
Swimming 100 m, s	82±3,72	101±2,89	23,17	< 0,05	0,73
Pull-ups on the high bar (number of times)	25±1,17	71±1,32	184,00	< 0,05	0,95
Flexion extension of the arms in an emphasis lying down (number of times)	73±1,01	105±1,25	31,48	< 0,05	0,86

Note: $\bar{X}$ is the average value of the sample, m is the standard error, R is the level of parameter influence on the sports result, P is the level of significance.

ritory is the preparation of a sports reserve for the national teams of Russia and the Krasnoyarsk Territory.

The analysis of the research literature has made it possible to establish that the successful growth of the skills of athletes is possible only if there is specific knowledge of the laws of age dynamics and its results. As competition increases and new disciplines are introduced, both the system of the training process and the physiological prerequisites for achieving maximum sports results by polyathletes change.

In this regard, the problem of comparing the physical fitness of leading polyathletes is relevant and serves as the basis for the development of evidence-based model characteristics, further growth of sportsmanship, as well as a factor in the effective management of the training process of athletes of different age categories.

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Conceptual approaches to the training of chess referees

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PhD **A.I. Alifirov**[1]
[1]Russian State Social University, Moscow

Corresponding author: anat.alifirov@yandex.ru

Abstract

Objective of the study was to determine the main areas of training of judges for the sport of "Chess", in the conditions of physical culture and sports activities.

Methods and structure of the study. Within the framework of the scientific research, the following was carried out: analysis of the legal and statutory documents regulating the activities of sports judges, the organization of certification, control systems and the concept of their preparation; systematization and generalization of pedagogical experience in the implementation of organizational and refereeing activities, the practice of conducting physical culture and sports events in the sport of chess; requirements for the development of competencies based on theoretical training and refereeing practice, carried out on the basis of integral conceptual approaches; questioning to identify personal preferences of refereeing disciplines in chess; analysis of quantitative and qualitative indicators of the training of judges in the Moscow Regional Public Organization "Chess Federation of the Moscow Region" in the period 2018-2022.

Results and conclusions. Conceptual approaches to the training of judges in the sport of chess are implemented in the educational space of a three-level system for organizing referee seminars - municipal, regional and all-Russian. A general analysis of the data obtained made it possible to identify a temporary decrease in the quantitative indicators of the training of qualified judges in 2020, caused by the conditions of the pandemic, and an increase of more than 50% in the training of sports judges of the first, third categories and young sports judges in 2021.

The study of professional competencies and requirements for the training of chess organizers and referees creates intentions about the need to improve the system and program for training qualified personnel.

Keywords: *organization and refereeing of competitions*

Introduction. The domestic system of training judges and organizers in the sport of chess was formed under the influence of the achievements of Soviet and Russian chess players, world champions among men and women. The traditions of universal chess education, founded in the 20s of the 20th century, contributed to the creation of numerous chess clubs, sections, circles, chess schools, children's youth sports schools and sports schools of the Olympic reserve in all regions of the country [1]. The communicative and reflexive function of chess movement is provided by qualified refereeing staff, who are responsible for organizing and successfully conducting sports competitions. The Judicial Qualification Commission under the All-Russian Public Organization "Chess Federation of Russia" regulates the system of training sports referees at the municipal, regional and all-Russian levels, exercising control and certification of the necessary staff, lecturers, functionaries [2].

Objective of the study was to determine the main areas of training of judges for the sport of "Chess", in the conditions of physical culture and sports activities.

Methods and structure of the study. Within the framework of the scientific research, the following was carried out: analysis of legal and statutory documents regulating the activities of sports judges, the organiza-

tion of certification, control systems and the concept of their preparation; systematization and generalization of pedagogical experience in the implementation of organizational and refereeing activities, the practice of conducting physical culture and sports events in the sport of chess; questioning to identify personal preferences in refereeing chess disciplines and professional qualities of referees; analysis of quantitative and qualitative indicators of the training of judges in the Moscow Regional Public Organization "Chess Federation of the Moscow Region" in the period 2018-2022.

Results of the study and their discussion. At present, in Russia, the qualifications of judges are subject to requirements for the development of competencies based on theoretical training and refereeing practice, carried out on the basis of integral conceptual approaches:

- Synergetic, implying a continuous process of theoretical training, translation of knowledge of lecturers and seminar leaders;
- Acmeological, creating conditions for the development of professional competencies and objective driving forces of self-development;
- Informational, revealing the ability to search, systematize and process information from various sources;
- Value-oriented, establishing the meaning and functions of socially significant sports achievements, involvement in the organization of events;
- Systemic, defining the components, connecting elements of the transformation of the system of official competitions, tournament formats, selection principles for all-Russian and international competitions.

Conceptual approaches to the training of judges in the sport of chess are implemented in the educational space of a three-level system for organizing referee seminars - municipal, regional and all-Russian [3]. The intensity of holding referee chess seminars, in order to increase the level of theoretical training, is due to the need of municipalities for qualified personnel, as well as an acute shortage of referees of all-Russian qualifications serving competitions of a higher status. For example, let's consider the dynamics of quantitative and qualitative indicators of conducting referee seminars in the Moscow Region by the public organization "Chess Federation of the Moscow Region" in the period 2018-2022, presented in the table.

A general analysis of the data obtained made it possible to identify a temporary decrease in the quantitative indicators of the training of qualified judges in 2020, caused by the conditions of the pandemic, and an increase of more than 50% in the training of sports judges of the first, third categories and young sports judges in 2021. The formed staff of judges, approximately 70% satisfies the needs of the quantitative and qualitative staff for the events included in the unified calendar plan of the municipalities and the Chess Federation of the Moscow region. Also, competitions at the All-Russian level and federal districts are carried out by 16 sports judges of the All-Russian category. International competitions and tournaments with FIDE ratings are served by 98 licensed national arbitrators, 10 international arbitrators with international referee titles (IA) International arbiter category A - 2, (IA) International arbiter category C - 3, (IA) International arbiter category D - 3, (FA) FIDE category D arbiter - 2.

A conceptually important factor in the functioning of the system of competitions in the sport of chess is the planning and implementation of a unified calendar plan of events for municipalities, regional federations and the Ministry of Sports.

The following can be identified as the main areas of activity in the framework of the training of chess organizers and referees:

1. *Organizational and image.* The specificity of judicial and organizational activities at competitions is expressed in the implementation of educational, informational and promotional functions, as well as the creation of optimal competitive and out-of-competition conditions based on the legal framework. The issues of compliance of sports facilities, competition venues, provision of equipment and material and technical equipment, analysis of the contingent of the refereeing staff, participants and their needs for accommodation, accommodation, food, recreation, transfer, largely determine the image, the successful holding of physical culture and sports events, which the organizers have to predict.

2. *Physical culture and sports.* Demonstration of the achieved level of training is determined by performance at competitions - physical culture and sports events, in accordance with the goals and objectives of popularizing the sport, mass character or achieving high results. The tasks of the work of the panel of judges are to ensure compliance with the rules and regulations of the competition, taking into account the implementation of organizational resources and the comfortable state of athletes.

3. *Socio-communicative.* Chess under the auspices of the international federation FIDE unites 705 million people, and annually more than 1.3 million registered competitions are held in the world. Organizers and judges perform socially significant, connecting functions, taking into account the interests and needs of various contingents and categories of participants in the competition. An analysis of the survey conducted to identify personal preferences in choosing a chess discipline showed that 64% of judges would like to judge competitions with classical control, 20% - rapid chess and 16% - blitz.

4. *Information-cognitive.* Seminars, webinars, information retrieval resources for posting information, protocols, regulations on the official websites of regional and district chess federations, the Russian chess federation, as well as the ministries of sports in the regions serve as the source base for cognitive tools and methods for training referees.

5. *Volunteering.* Today, any sporting event is not complete without the effective work of volunteers. The scale of the event itself directly proportionally affects the number of volunteers involved from several tens to hundreds of thousands of people. The work of the volunteer corps helps to solve a huge number of organizational issues, create an unforgettable atmosphere and image of the host at the event, as well as the necessary mood for the participants and a sense of celebration for the guests and its spectators. The functional duties of volunteers include: work directly in the competition area and in areas intended for athletes; preparation of the competition area; ensuring security in the competition area; work in the competition office to provide players or teams with the necessary information; maintaining the playing area of athletes in proper condition; control over the provision of services to athletes, etc.

Conclusion. The study made it possible to identify conceptual approaches to the training of chess referees, to identify the main trends and areas of activity, to determine the methods of referees' competence, to form a worldview in relation to the practice of resolving typical situations in work at seminars. The study of professional competencies and requirements for the training of chess organizers and referees creates intentions about the need to improve the system and program for training qualified personnel.

Quantitative and qualitative indicators of the organization of referee seminars "Chess Federation of the Moscow Region" in 2018-2022

	Year of holding, S - number of seminars, N - number of participants, Q- qualitative composition of trained judges					
	2018	2019	2020	2021	2022	Total:
S	8	11	5	16	5	45
N	85	112	55	165	32	449
Q	Sports referee 1 Categories – 9 Sports referee 2 Categories – 18 Sports referee 3 Categories – 42 Junior sports referee - 1	Sports referee 1 Categories - 26 Sports referee 2 Categories - 26 Sports referee 3 Categories - 58 Junior sports referee - 3	Sports referee 1 Categories – 13 Sports referee 2 Categories – 7 Sports referee 3 Categories – 28 Junior sports referee – 3	Sports referee 1 Categories – 54 Sports referee 2 Categories – 23 Sports referee 3 Categories – 67 Junior sports referee – 14	Sports referee 1 Categories – 4 Sports referee 2 Categories – 5 Sports referee 3 Categories – 17 Junior sports referee – 5	Sports referee 1 Categories – 106 Sports referee 2 Categories – 79 Sports referee 3 Categories – 212 Junior sports referee – 26

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Features of competitive activity for instrumental and expressive leaders of student basketball teams

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PhD, Associate Professor **M.V. Eremin**[1]
Dr. Hab., Associate Professor **V.A. Kudinova**[2]
PhD, Associate Professor **M.N. Komarov**[3]
PhD, Associate Professor **V.I. Sharagin**[4]
[1, 3]Russian State Social University, Moscow
[2]Volgograd State Physical Education Academy, Volgograd
[4]Moscow State University of Psychology & Education, Moscow

Corresponding author: eremin-max@mail.ru

Abstract

Objective of the study was to identify the features of competitive activity among the instrumental and expressive leaders of student basketball teams.

Methods and structure of the study. In the work on the Cattell scale, indicators of leadership, emotional manifestation and performance were determined, basketball players were divided into instrumental and expressive leaders. Indicators of physical fitness were identified based on the results of the main test tasks, competitive activity - time played, shots from the field, free throws, passes and interceptions, rebounding the ball on one's own and another's backboards, fouls. The study involved 156 basketball players from Moscow universities.

Results and conclusions. The instrumental leaders showed higher results (5% significance level) in comparison with the performance of the athletes of the rest of the group of athletes in carpal dynamometry, pull-ups on the bar, long jump from a place, medicine ball throwing. Expressive leaders more effectively performed the 3x10 m shuttle run, made more field goals (15.4 shots), had the highest rate of shots effectiveness (48.5%), performed more assists (7.9 assists). The instrumental leaders intercepted balls more successfully (12.6 interceptions), made fewer mistakes when dribbling and passing the ball (7.4 errors). Significant differences in physical readiness and results of competitive activity by basketball players of student teams between instrumental and expressive leaders and followers were revealed, which should be taken into account in the training process and competitive activity.

Keywords: *basketball students, physical training, competitive activity, instrumental and expressive leaders.*

Introduction. The high efficiency of competitive activity in modern basketball requires taking into account all the factors of sports training [1, 3, 4]. A large reserve in this direction is the identification of the features of physical fitness and competitive activity of instrumental and expressive leaders [2, 4]. Taking into account the peculiarities of the competitive activity of instrumental and expressive leaders is an important condition for the success of a sports team. However, this area of competitive activity of basketball players remains poorly understood.

Objective of the study was to identify the features of competitive activity among the instrumental and expressive leaders of student basketball teams.

Methods and structure of the study. In the work on the Cattell scale, indicators of leadership, emotional manifestation and performance were determined, basketball players were divided into instrumental and expressive leaders. Indicators of physical fitness were identified based on the results of the main test tasks, competitive activity - time played, shots from the field, free throws, passes and interceptions, rebounding the ball on one's own and another's backboards, fouls. The study involved 156 basketball players from Moscow universities.

Results of the study and their discussion. Expressive and instrumental leaders are the main assistants to the coach in solving the problems of physical and technical-tactical training of university students involved in basketball. They help the coach implement modern means and methods of improving the sportsmanship of the players, discuss with the coach and athletes the ways to improve the quality of the game, help in educational work in the team. included in the first two groups). The share of instrumental leaders was 12.2%, expressive - 9.0%, and other basketball players - 78.8%.

Leadership qualities of instrumental leaders were assessed by experts on a ten-point scale at the level of 9.05 points, emotional qualities - 6.57 points, and their effectiveness - 8.89 points. Expressive leaders in terms of leadership had 6.50 points, emotional manifestations - 8.14 points, performance - 7.43 points. In the group of other participants, the analyzed characteristics were at the level of average values (4-6 points). Expressive leaders are sociable, sympathetic and good companions, instrumental leaders are hard-working, demanding, energetic, persevering and determined.

Comparative characteristics of indicators of physical development did not reveal differences in different contingent of the examined. The instrumental leaders showed higher results (5% significance level) compared to the rest of the group of athletes in carpal dynamometry (69.8 kg), pull-ups on the bar (10.2 times), standing long jump (298.5 cm), stuffed ball throwing (17.75 m), and expressive leaders more effectively performed shuttle run 3x10 m (9.6 s).

An analysis of the physical fitness of students involved in basketball shows that instrumental and ex-

Table 1. *Comparative characteristics of physical development and physical fitness of athletes of different typological groups*

Indicators	Typological groups		
	Instrumental leaders	Expressive leaders	The others
Body length, cm	189,4	190,6	188,5
Body weight, kg	81,5	82,2	82,4
Brush strength, kg	69,8	65,1	64,9
Pull-ups on the crossbar, number of times	10,2	9,4	9,2
Long jump from a place, cm	298,5	286,4	287,5
Jump up from a place, cm	65,8	63,3	62,1
Throwing stuffed ball, m	17,75	17,10	16,85
30 m run, s	4,31	4,34	4,38
Shuttle run3x10 m, s	9,7	9,5	10,0
Shuttle run 3x10 m with dribbling, s	11,4	11,5	11,8
3000 m run, s	747,4	748,5	753,1
Torso forward, cm	10,1	9,6	9,7

Table 2. *Indicators of competitive activity of basketball players from different typological groups*

Indicators	Typological groups		
	Instrumental leaders	Expressive leaders	The others
Time played, min	30,2	27,4	22,4
Field goals, number	14,7	15,4	11,5
The effectiveness of shots from the field,%	46,2	48,5	37,3
Free throws, number	7,4	6,0	4,5
Effectiveness of free throws, %	68,2	64,4	63,3
Effective passes, number	6,7	7,9	7,3
Interceptions of the ball, number	12,6	10,3	9,4
Assisting a foul, quantity	1,7	2,0	1,3
Rebounding the ball on the backboards, quantity	15,7	13,2	12,0
Dribbling errors, number	3,4	3,2	4,4
Errors in passing the ball, number	4,0	4,5	4,1
Personal remarks, quantity	2,5	2,6	3,0

pressive leaders have a higher level of development of physical abilities (Table 1).

In the course of 15 official games for the championship of the city of Moscow in basketball among university students, the game actions of each athlete were recorded. According to our data, team leaders spent more time in the game than other players (Table 2). The top players made more field goals, especially the expressive leaders (15.4 shots), they had the highest shot scoring rate (48.5%).

The instrumental leaders had the most free throws per game (7.4 shots), and their free throw efficiency was also higher (68.2%). The expressive leaders completed more assists (7.9 assists), while the instrumental leaders successfully intercepted balls (12.6 interceptions). Fewer errors in dribbling and passing the ball were made by instrumental leaders (7.4 errors). There were no significant differences in indicators of assistance to foul and personal remarks in different contingent of the examined.

Conclusions. The results of the study showed that the leaders of student basketball teams fulfilled the indicators of competitive activity much more effectively. Leadership is a necessary condition for the effective organization and coordination of interaction between basketball players of student teams in competitive activities.

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Age-related features of the manifestation of the level of anxiety in divers in the assessment of negative mental states

UDC 796.01:159.9

PhD, Associate Professor **E.A. Milashechkina**[1]
V.V. Milashechkina[2, 3]
D.A. Potapov[1]
[1]Peoples' Friendship University of Russia, Moscow
[2]Russian State University of Physical Education, Sports, Youth and Tourism (SCOLIPE), Moscow
[3]State budgetary educational institution of the city of Moscow "School No. 1788", Moscow

Corresponding author: ea.milash@yandex.ru

Abstract

Objective of the study was to identify age-related features of the manifestation of anxiety, aggressiveness, hostility in high-sport divers.

Methods and structure of the study. The scientific work involved 37 adolescents aged 11-15 years old engaged in diving at the Aquatika sports school in the city of Kazan (experimental group) and 59 adolescents not involved in sports (control group).

Results and conclusions. In the course of the study, water jumpers showed a high level of anxiety on all scales compared with the results of adolescents in the control group. The level of aggressiveness and hostility in adolescents of the experimental group throughout the entire period of ontogenesis under study is within the normal range, and in boys of the control group, hostility at the age of 12-14 is significantly higher than in adolescents of the experimental group. High levels of anxiety in water jumpers do not affect the manifestation of negative mental states of the individual.

Keywords: *divers, anxiety, aggressiveness, hostility, psycho-emotional state.*

Introduction. Jumping into the water is characterized by a constantly increased psychological background associated with the risk of injury when performing complex exercises. The psychological state of an athlete, his personal qualities, like a common person, directly affect his performance, the mood with which the work is performed, and, consequently, the results of activity [2]. The study of the psychological state of athletes helps to identify the positive and negative aspects of building the training process. At major competitions, almost half of the unsuccessful performances are associated with the deterioration of the mental states of athletes, the study of which is necessary for better preventive work [1, 4].

At the same time, the degree of anxiety, as well as the manifestation of negative mental states - aggressiveness and hostility, reflect vegetative reactions to various life situations, neurosis-like and psychosomatic disorders [3, 5].

Objective of the study was to identify age-related features of the manifestation of anxiety, aggressiveness, hostility in high-sport divers.

Methods and structure of the study. The work was attended by 37 male athletes who are part of the sports school for diving “Aquatika” in the city of Kazan, having a sports qualification not lower than the first adult category at the age of 10-15 years, as well as 59 students of a general educational institution of the city of Kazan at the age of 11- 15 years old, not involved in sports, who made up the control group.

Each individual person has personal and situational anxiety developed to varying degrees, so we used the methodology - “Anxiety Scale”, developed on the basis of Kondash’s “Scale of Socio-Situational Anxiety” (1973). The advantage of scales of this type is that they allow to identify areas of reality, objects that are the main sources of anxiety for a teenager, and, to a lesser extent than other types of questionnaires, turn out to be dependent on the developmental features of introspection in athletes. The Anxiety Scale was used as a method for diagnosing the level of anxiety. To determine the level of manifestation of aggressiveness and hostility, the technique developed by A. Bass and A. Darki in 1957, which was called the Bass-Darkey

method, was used. The questionnaire consists of 75 statements, in front of each of them the researcher had to put a mark on agreeing with it or disagreeing with it. Next, the number of points is calculated according to the scales of aggressiveness and hostility to interpret the result [3].

Results of the study and their discussion. Analysis of the results of the study revealed clear age-related differences in the indicators of general anxiety among divers of high sports qualification (Fig. 1). The maximum values, both in the experimental and control groups, were recorded at the age of 12-13 years. A decrease in the indicator of the level of general anxiety in the experimental group of athletes was detected at the age of 14, and in the control group - at the age of 14-15. Throughout puberty in the boys of the experimental group, the indicator of general anxiety was significantly higher than in the control group.

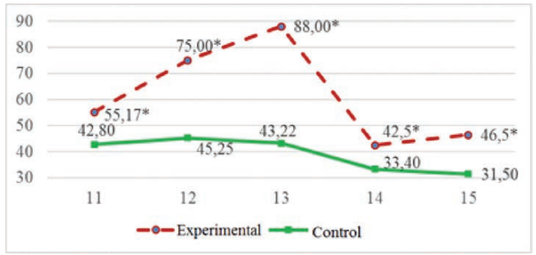

Figure 1. *Age-related changes in the level of general anxiety among divers, in points*

*Note** - significance of differences between the experimental and control groups ($p<0.05$)

The level of learning anxiety among divers (see table) is at a fairly high level. The maximum values, which are outside the norm, were observed in athletes aged 12-13 years. Comparison of indicators of the level of self-estimated anxiety among divers of high sports qualification of different ages revealed their increase in athletes aged 12-15 years. The highest values were recorded at the age of 12-13 years, which is significantly higher than the norm. As shown in the table, the highest levels of interpersonal anxiety in boys of both groups were found at the age of 12 and 13 years. However, among divers, anxiety is at a high level.

The data presented in the study indicate anxiety states on all scales in adolescents experiencing high-intensity physical activity, and this, in turn, can further increase emotional distress during the critical period of ontogenesis.

A. Bass, who adopted a number of provisions of his predecessors, divided the concepts of “aggression” and “hostility” and defined the latter as “a reaction that develops negative feelings and negative assessments of people and events. Therefore, we considered it necessary to use this indicator.

As a result of the data obtained (Fig. 2), the dynamics of the development of aggressiveness in the boys of the control group gradually increases and the maximum is reached at the age of 15, which is significantly higher than in the boys of the experimental group. And in water divers, the maximum values of aggressiveness are observed at the age of 14. However, in both groups, this figure is within the normal range.

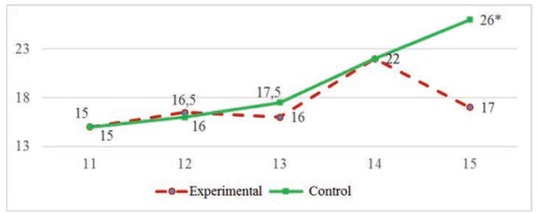

Figure 2. *Age-related features of manifestation of aggressiveness in water divers of high sports qualification in points*

*Note** - significance of differences between the experimental and control groups ($p<0.05$)

The level of hostility in adolescents from the control group reaches its highest values at the age of 13, is significantly higher ($p<0.05$) than in boys from the experimental group and goes beyond the normal range (Fig. 3). This can be explained by a more stable reaction to the influence of stimuli in boys involved in diving, as they, training and competing in competitions, are better adapted to external influences. And adolescents who do not play sports may be more hostile in a critical situation.

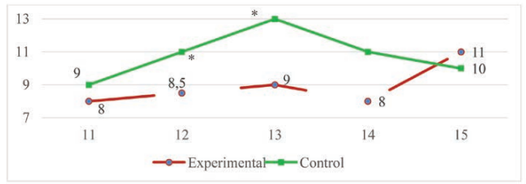

Figure 3. *Age features of manifestation of the level of hostility in water divers of high sports qualification in points*

*Note** - significance of differences between the experimental and control groups ($p<0.05$)

Analyzing the above, it can be said that teenagers involved in diving are less able to show aggressiveness and hostility in everyday life. And boys who do not go in for sports are less adapted to changing environmental

The level of anxiety according to educational, self-assessment and interpersonal scales among divers, in points

Age	Learning anxiety		Self-reported anxiety		Interpersonal anxiety	
	Control	Experience	Control	Experience	Control	Experience
11 years	13,33	17,33	14,33	16,08	15,20	21,75
12 years	15,25	26,20	15,23	25,20	14,75	23,60
13 years	14,61	25,33	14,17	25,33	14,44	20,00
14 years	10,89	13,50	10,17	13,00	12,39	16,00
15 years	10,45	12,50	10,58	17,00	10,46	17,00

conditions and are more able to manifest such negative mental states of the individual as aggressiveness and hostility.

Conclusions. In boys involved in diving, who have high sports qualifications, the level of anxiety in almost all age groups is significantly higher than the normative indicators, and higher levels of general anxiety were found in athletes aged 12-13, which may be associated with the stages of puberty of the body.

Boys who do not go in for sports are slightly more aggressive than teenagers who go in for diving. However, in both groups, this figure is within the normal range.

Hostility in adolescents from the control group is higher than in boys from the experimental group, and goes beyond the normal range.

High levels of anxiety in water jumpers do not affect the manifestation of negative mental states of the individual.

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Physiological reactions of the cardiovascular system in conditions of vestibular irritation in tennis players

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Dr. Biol., Professor **S.Yu. Zavalishina**[1]
PhD, Associate Professor **E.S. Kachenkova**[2]
PhD, Associate Professor **Yu.V. Zbrueva**[3]
Dr. Hab., Professor **G.N. Germanov**[4]
[1]Russian State Social University, Moscow
[2]Institute of Natural Sciences and Sports Technologies (Moscow City University), Moscow
[3]Astrakhan State Medical University, Astrakhan
[4]Russian State University of Physical Education, Sports, Youth and Tourism (SCOLIPE), Moscow

Corresponding author: alexm-77@list.ru

Abstract

Objective of the study was to identify the reaction of the cardiovascular system to vestibular irritation in tennis players with different lengths of sports experience.

Methods and structure of the study. 58 young tennis players (19.5±0.6 years old) were observed, regularly training for different periods: one year - 19 athletes, two years - 21 athletes, three years - 18 athletes. The control group (22 young men) consisted of clinically healthy volunteers (20.2±0.4 years) who had never been involved in sports before. The functional parameters of the heart and vascular system were recorded under conditions of vestibular load, using a rotational test with head tilts to the right and left. For data processing, Student's t-test was applied.

Results and conclusions. For the successful performance of motor actions in tennis, the level of development of the vestibular apparatus is very significant, which provides the brain with information about the localization of the body in space and the process of maintaining the necessary posture. Increasing the length of tennis training strengthens the cardiovascular system and stimulates vestibular stability. The maximum pulse stability was found in tennis players with three years of sports experience and the greatest experience in training situations associated with rapid movements at different angles. We can assume that playing tennis trains the cardiovascular system, ensuring the stability of its work under conditions of vestibular stimulation.

Keywords: *tennis, vestibular system, sports experience, cardiovascular system.*

Introduction. Dosed physical activity strongly stimulates metabolic and protective processes in the human body [2, 8]. An increase in motor activity enhances the functions of all internal organs [9]. The vestibular apparatus is always involved in the implementation of any movements, helping the body to maintain the optimum position in space and increasing the accuracy of the work of different muscle groups [7]. The normal functioning of the vestibular apparatus with its clear interaction with life support systems ensures the adequate implementation of any motor actions [10]. The level of development of the vestibular apparatus and the severity of its influence on the functioning of the cardiovascular system are of great importance for maintaining the optimum physical condition and ensuring high fitness in any sport [4, 6].

Objective of the study was to identify the reaction of the cardiovascular system to vestibular irritation in tennis players with different lengths of sports experience.

Methods and structure of the study. The study was conducted with the involvement of 58 young men (19.5 ± 0.6 years old) involved in tennis for various periods. Some of them systematically trained for one year (19 people), some for two years (21 people) and some for three years (18 people). The control group consisted of 22 completely healthy young men (20.2±0.4 years old) who had never been involved in sports before.

In the surveyed, the functional parameters of the cardiovascular system were recorded during stimulation of the vestibular receptors under the conditions of rotational tests according to the method of V.I. Voyachek. Changes in the cardiovascular system were registered for this sample by taking into account the pulse value and blood pressure figures. They were determined before and after the traditional rotational test (five rotations were performed within 10 s) and a modified test using head tilts to the right and left (five rotations within 10 s in a rhythm). Also, to increase the severity of the impact of the rotation process on the functional state of the vestibular apparatus, the time for performing a standard rotational test according to the Voyachek V.I. was doubled (performed 10 rotations for 20 s).

Results of the study and their discussion. The pulse value of tennis players with different sports experience was at the optimal level and reached 65.3±0.4, 62.7±0.68 and 60.1±0.42 beats/min, respectively. In the control group, this indicator was also normal, but slightly exceeded its values in athletes (73.4±0.87 beats/min).

The index of heart rate under the conditions of applied vestibular load in tennis players and in physically untrained young men of the control group showed an increase. In the course of the Voyachek test in the classical version, an increase in the number of heartbeats was found in tennis players who had one year of experience by 3.8 ± 0.56 beats / min, in those with two years of experience by 3.3 ± 0.61 beats / min, in those with three years of experience by 2.2±0.22 beats/min. In the control group, this value increased by 5.7±0.48 beats/min (see table).

Physiologically trained people are characterized by physiologically beneficial reactions of cardiac activity in conditions of a change in the location of their head in space, especially due to rotation. The development of adaptation of vestibular mechanisms in the course of performing movements in a tennis game is very effectively carried out under conditions of tilting the head to the side. In the study, it was noted that when the torso rotated with the head tilted in different directions, the reaction of the heart was different. Thus, the values of the pulse rate recorded under conditions of tilting the head to the right side were less than in conditions of performing the tilt of the head to the left.

The found differences in the severity of the pulse response in athletes with different sports experience were small, but turned out to be statistically significant. Obviously, this is due to a change in the degree of physical fitness among tennis players on the right side of the body (all those taken into the study were right-handed) as their sports experience increased. This can be explained by the need for frequent changes in the position of the head in space during tennis training, adaptation to which occurs with the growth of sports experience. So, with the experience of three years, the athletes had the least response of the pulse to the rotation in terms of tilting the head to the right (2.4±0.12 beats/min). Apparently, due to the higher experience of motor activity with elements of rotational influence, tennis players with a three-year experience had the greatest adaptation of the heart to sports loads [5].

In the study conducted among tennis players with different duration of sports experience, the dynamics of the pulse value was assessed under the influence of a rotational load of different duration. With a doubling of the period of vestibular influence, the pulse in physically untrained people increased without strict proportionality to the increase in the number of rotations. The dependence found in all groups of tennis players was inverse: the less pronounced was the reaction to the impact of five revolutions, the stronger it

Changes in the heart rate in tennis players under the influence of different variants of vestibular stimulation

Groups of surveyed	Increase in heart rate, M±m			
	Standard option	5 rotations for 10 s when tilted to the left	5 spins throughout 10 s when tilted to the right	10 spins throughout 20 s without lateral tilt
Control group (n=21), bpm	5,7±0,48	6,8±0,45	5,8±0,52	9,7±0,75 p_2<0,01
Tennis players with 1 year experience (n=19), bpm	3,8±0,56 p<0,01 p_1<0,01	4,9±0,32 p<0,01 p_1<0,01	3,8±0,29 p<0,01 p_1<0,01 p_2<0,01	6,2±0,53 p<0,01 p_1<0,01
Tennis players with 2 years of experience (n=21), bpm	3,3±0,61 p<0,01 p_1<0,01	4,2±0,36 p<0,01 p_1<0,05	3,0±0,27 p<0,01 p_1<0,01 p_2<0,01	5,7±0,42 p<0,01 p_1<0,01
Tennis players with 3 years of experience (n=18), bpm	2,2±0,22 p<0,01	3,2±0,18 p<0,01	2,4±0,12 p<0,01 p_2<0,01	4,6±0,39 p<0,01

Note: p is the significance of differences between the control and athletes, p1 is the significance of differences between tennis players with a three-year experience, on the one hand, and athletes with an experience of 1 and 2 years, on the other hand, p2 is the significance of differences in indicators with different head positions in space.

was to the influence of 10 revolutions (with one year of experience - 63.1%, with two years of experience - by 72.7%, with three years of experience - 2.1 times).

In athletes with one year of experience, during the standard test, the increase in heart rate reached 3.8±0.56 beats/min, and in the case of 10 revolutions, this figure was 6.2±0.53 beats/min. For those who had two years of experience, these figures were 3.3±0.61 beats/min and 5.7±0.42 beats/min, respectively. For tennis players with three years of experience, these parameters were respectively 2.2±0.22 beats/min and 4.6±0.39 beats/minute. It becomes clear that the reaction of the heart in tennis players with maximum sports experience is very economical. This intensifies the blood flow in the tissues of athletes under conditions of complication of sports load to a strictly necessary degree [1, 3].

The values of systolic blood pressure in tennis players with one year of experience (114.6 ± 0.49 mm Hg. Art.), with two years of experience (110.5 ± 0.63 mm Hg. Art.) and with three years of experience (109.5±0.45 mm Hg. Art.) were at the normal level. This indicator was somewhat higher in the control group - 126.3±1.28 mm Hg. Art. ($p<0.05$), being also within the normal range.

During rotational exposure, systolic blood pressure increased at any location of the head in space. The degree of increase in systolic blood pressure in physically untrained young men and in all groups of athletes was comparable: 4.3±0.49 mm Hg. Art., 4.0±0.45 mm Hg. Art., 3.8±0.41 mm Hg. Art. and 3.7±0.52 mm Hg. Art., respectively. The found changes in the level of systolic blood pressure under conditions of different variants of rotational impact in athletes of all study groups remained, despite changes in the position of the head in space, in athletes included in all study groups.

When performing a test with a two-fold lengthening of rotation, tennis players with different sports experience increased in systolic blood pressure, approximately 23.0% higher than in a standard test. The increase in systolic blood pressure with a twofold lengthening of the rotational impact in physically untrained was 72.0% ($p<0.01$) higher than in all groups of athletes.

The levels of diastolic pressure in all groups of tennis players did not differ significantly, reaching an average of 67.5±1.96 mm Hg. Art. (in the group of physically inactive 82.1±0.57 mm Hg. Art.). The severity of changes in the value of diastolic blood pressure in all types of rotational exposure slightly increased in all groups of tennis players. The obtained results give grounds to believe that as the tennis players' sports experience increases, the overall functional reserves and the severity of the adaptation of the heart and vascular system to the influence of any rotational loads increase.

Conclusion. Systematic tennis training increases the body's adaptation to vestibular loads and increases the functionality of the myocardium. Regular tennis training helps to reduce the response of the pulse to rotational movements with a change in the position of the head in space. In tennis players, as their sports experience increases, the functional stability of the work of the heart muscle increases under conditions of any vestibular stimulation. Probably, an increase in the experience of sports activities in tennis increases not only the overall fitness, but also the resistance of the heart to any irritation of the vestibular receptors that occurs during training.

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Peculiarities of the organism response to physical load in schoolchildren of the highest grades with insufficient body weight

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Dr. Hab., Professor **G.N. Ponomarev**[1]
PhD **N.L. Volkova**[1, 2]
PhD, Associate Professor **E.V. Kvashnina**[1]
[1]The Herzen State Pedagogical University of Russia, St. Petersburg
[2]Saint Petersburg State University, St. Petersburg

Corresponding author: g-ponomarev@inbox.ru

Abstract

Objective of the study was to reveal the results of the study of the level of physical fitness of schoolchildren with insufficient body weight.

Methods and structure of the study. The results of testing to assess the level of development of basic physical qualities are given, a comparative analysis is carried out with the results of testing schoolchildren with normal and overweight. It was found that with a relatively equal general level of physical fitness in schoolchildren with insufficient body weight, compared with schoolchildren with normal body weight, the former have a more pronounced disharmony in the development of physical qualities. A comparison of the reactions of the body to physical activity during physical education lessons in schoolchildren with insufficient and normal body weight is presented. The specific features of the impact of physical education lessons according to the standard school curriculum on the cardiovascular system of schoolchildren with insufficient body weight were revealed.

Results and conclusions. Underweight students in general did not show statistically significant differences in the level of physical fitness compared to students with normal body weight. The mean score on all tests is 4, compared to 4.06 for normal weight students. Overweight students have an average score of 3.34 on all tests. Thus, it can be concluded that underweight does not affect the level of physical fitness to the same extent as overweight.

Keywords: *physical fitness, body weight, underweight, physical activity, individual characteristics.*

Introduction. Human body weight characterizes biochemical, plastic, metabolic, hormonal and many other processes in the body. It is one of the main indicators of human physical development, an important criterion in determining nutritional status. Deviations of a person's body weight from normal indicators are a signal of a deterioration in his physical health.

In the context of physical education, a lot of work is devoted to the physical education of overweight people. In particular, it has been established that excess body weight is associated with a low level of physical fitness and performance [2]. On the other hand, quite a few works reveal the specifics of the physical education of people with insufficient body weight. There are research results proving the presence of specific features of the impact of physical activity on the body of people with insufficient body weight [3]. However, most of the works reveal this problem from a medical point of view and primarily consider the specifics of the diet with insufficient body weight, without paying attention to physical activity.

When analyzing special literature, it was found that, according to the results of studies, the number of people with deviations in body weight is approximately equal both towards excess and towards underweight [1]. Thus, the relevance of considering the specifics of physical education of people with insufficient body weight, against the background of the lack of research on this issue, becomes obvious.

Objective of the study was to reveal the results of the study of the level of physical fitness of schoolchildren with insufficient body weight.

Methods and structure of the study. The study was conducted at the bases of Educational Institution Lyceum No. 393 and secondary school No. 585 of the Kirovsky district of St. Petersburg in April 2022. The study involved schoolchildren of grades 10-11 (n=37), the inclusion criterion was the values of body mass index (BMI) corresponding to insufficient body weight. All study participants were assigned to the main physical culture group.

To assess the level of physical fitness, tests were used to determine the level of development of physical qualities:

a) strength - flexion and extension of the arms in the lying position (number of times);

b) agility - shuttle run 3 × 10 m (s);

c) endurance - 2000 m run (min);

d) speed - 100 m run (s);

e) flexibility - bending forward from a lying position on a gymnastic bench (cm).

All tests are included in the physical education program for schoolchildren of grades 10-11 and were evaluated on a 5-point system, taking into account regulatory requirements, in accordance with the sex and age of the respondents. The test results were also analyzed in comparison with the level of physical fitness of students with normal and overweight, assigned to the main physical culture group.

To determine the specific features of the reaction of the organism of schoolchildren with insufficient body weight to physical activity, pulsometry of a lesson in physical culture was carried out. The results of pulsometry of schoolchildren with insufficient body weight were analyzed on the basis of a comparison of the results of pulsometry of schoolchildren with normal body weight.

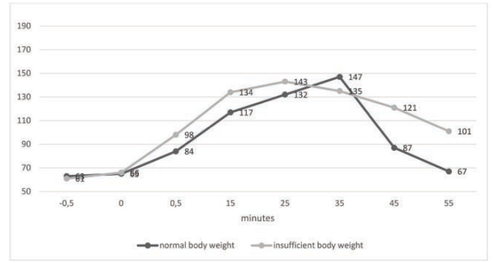
Results of the study and their discussion. Schoolchildren with insufficient body weight in general did not show statistically significant differences in the level of physical fitness, compared with students with normal body weight. The mean score on all tests is 4, compared to 4.06 for normal weight students. Overweight students have an average score of 3.34 on all tests. Thus, being underweight does not affect fitness levels to the same extent as being overweight.

The results obtained could indicate a sufficient training effect of the school program in physical education for students with insufficient body weight and the absence of the need to adjust it to their individual characteristics. However, despite the absence of statistically significant differences with students with normal body weight in the average score for all tests, there is heterochrony in the level of development of physical qualities in students with insufficient body weight. Thus, statistically significant ($p \leq 0.05$) differences are observed in the level of development of flexibility and speed. At the same time, schoolchildren with insufficient body weight showed higher results in the test for speed (4.3 points compared to 3.9 points for students with normal body weight) and lower in the level of flexibility development (3.6 points compared to 4.4). Also, underweight students performed better than normal weight students on the strength test. In our opinion, this may be due to the specifics of the test itself.

No statistically significant differences were found in the endurance test, however, for further development of physical education methods for people with insufficient body weight, it is worth paying attention to the lower average test values - 3.8 points, which is an indicator of a low level of endurance development. For schoolchildren with normal body weight, this indicator is at the average level - 4.2 points.

These differences in the level of development of physical qualities indicate a discrepancy between the content of the physical culture program and the individual capabilities of underweight schoolchildren. Or the planning of physical education for these individuals, it is necessary to pay more attention to the complexes of exercises for the development of flexibility and endurance.

When analyzing the results of pulsometry, the average values of the results of measurements of schoolchildren with normal and insufficient body weight were used (see figure). The main attention was paid to the results of measurements at the beginning (15 minutes) and the end (35 minutes) of the main part of the lesson, as well as measurements 10 minutes after the end of the lesson (55 minutes).



Graph of average values of pulsometry of a lesson in physical culture in schoolchildren with normal and insufficient body weight (bpm)

The results showed differences in the impact of physical activity on schoolchildren with insufficient body weight. So, with similar heart rate values 5 minutes before the start of the lesson (61 and 63 beats/min), underweight schoolchildren show a sharper increase in heart rate values at the beginning of the lesson. The difference in heart rate values is less noticeable in the middle of the main part of the lesson, however, by the end of the main part, the heart rate value significantly decreases in underweight schoolchildren. This can be caused either by the specifics of the slower adaptation mechanisms of the body to physical activity, or by the faster onset of the fatigue phase, which affects the effectiveness of physical exercises. This issue requires further study.

Particular attention should be paid to the slow recovery process of the body in schoolchildren with insufficient body weight in the final part of the lesson and 10 minutes after it. Despite the faster start of the decrease in heart rate values during the lesson, by the end of the lesson, in schoolchildren with insufficient body weight, the indicators remain quite high (121 beats/min, compared with 81 beats/min in schoolchildren with normal body weight). There is no complete recovery of heart rate even 10 minutes after the end of the lesson (101 beats/min), which indicates an excessive load in the school physical education program for students with insufficient body weight.

The obtained results of the study allowed to develop a number of methodological recommendations for inclusion in the content, load and organizational components of the physical education program.

1) Content component of the program:

- the use of strength exercises in lessons mainly with the weight of external weights, since own body weight (insufficient) cannot be an objective indicator of the level of strength development, and also in these individuals it is necessary to achieve hypertrophy of muscle tissue;

- an increase in the percentage of exercises in the program for the development of elasticity of the muscular and ligamentous apparatus, which is associated with low indicators of the level of development of flexibility in schoolchildren with insufficient body weight.

2) The load component of the program:

- limiting the intensity of long-term monotonous loads in schoolchildren with insufficient body weight, to optimize the work of the cardiovascular system during long-term work and the gradual development of the level of general endurance;

- the inclusion of predominant active rest (low-intensity aerobic loads) after high-intensity exercises, due to the peculiarities of the reaction of the cardiovascular system of schoolchildren with insufficient body weight to the load - this will contribute to a more effective recovery of heart rate and will contribute to the development of adaptive mechanisms of the body.

- the most appropriate would be to reduce the volume of exercises within one lesson by increasing the time of their implementation, a smaller number of muscle groups included in the work will reduce the recovery time of the body after exercise, and will also contribute to the development of general and special endurance.

3) Organizational component of the program:

- in the main part of the lesson, in order to achieve the maximum training effect, eliminate monotony in work and quickly onset of the fatigue phase, it is recommended to use mainly interval, variable methods, as well as the organization of classes in the form of a circular training;

- to achieve optimal recovery of the body, it is recommended to increase the duration of the final part of the lesson by reducing the time of the main part.

Conclusions. The theoretical analysis of the problem revealed the absence of scientifically based methods of physical education of schoolchildren with insufficient body weight.

As the study showed, the level of physical fitness of schoolchildren with insufficient body weight is generally satisfactory, however, there are statistically significant differences and disharmony in the level of development of certain physical qualities (flexibility and speed) compared to students with normal body weight. The reaction of the cardiovascular system to physical activity in schoolchildren with insufficient body weight has its own specifics and differs from schoolchildren with normal body weight. A physical education lesson according to a standard program causes unfavorable physiological changes in the work of the cardiovascular system in schoolchildren with insufficient body weight, which in the future may contribute to a decrease in their health, physical fitness and performance levels.

The developed methodological recommendations for the physical education of schoolchildren with insufficient body weight are based on the identified indicators of the level of their physical development, preparedness and the characteristics of the body's response to physical activity. These recommendations in the future should form the basis for the development of a full-fledged methodology for the physical education of these individuals. The orientation of the methodology should be focused not only on the development of the level of physical fitness and the preservation of the health of schoolchildren, but also contribute to the normalization of body weight.

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Ontogenetic features of physical fitness and functioning of the central nervous system of college students

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V.S. Milashechkin[1]
Dr. Biol., Professor **T.I. Dzhandarova**[2]
PhD, Associate Professor **I.N. Gernet**[3]
A.A. Rusanov[1]
[1]Peoples' Friendship University of Russia, Moscow
[2]North Caucasian Federal University, Stavropol
[3]Moscow State University of Sport and Tourism, Moscow

Corresponding author: vs.milash@yandex.ru

Abstract

Objective of the study was to identify ontogenetic tendencies of physical readiness and psychophysiological parameters of the central nervous system in the process of teaching female students in college.

Methods and structure of the study. In the course of the work, the following were determined: the time of a simple reaction to light and sound, a complex reaction to light, that is, a choice reaction and a reaction to a moving object in groups of college students aged 16-20. Physical tests were used to assess physical fitness.

Results and conclusions. The maximum increase in the time of the sensorimotor reaction at the age of 17 was revealed in girls during college education, which indicates the depletion of the adaptive capabilities of the CNS. At the age of 18, the parameters of the sensorimotor reaction to light and sound stabilize, and by the age of 20, there is some gradual decrease. By the end of training, there is a decrease in physical fitness indicators, which can adversely affect the state of health and motor functions of the body. According to preliminary data, physical fitness and psychophysiological parameters of the functioning of the central nervous system have different age dynamics during the training of college students.

Keywords: *college students, health, ontogenesis, sensorimotor reaction, central nervous system.*

Introduction. During the learning process, students experience various forms of external influences on their bodies [2, 5]. These are changes in the social environment and the regime of work and rest, and of course an increase in the teaching load. A special role in adaptive reactions to these changes is played by the nervous system, on the functioning of which the regulation of our entire body depends. Physical readiness, according to scientists, is a marker of the state of health of an individual [4]. Monitoring of changes in the functioning of the central nervous system in the learning process is very important for further assessment and prediction of the development of students' organisms [6]. It should be taken into account that at the age of 16-17 years, students complete the functional development of the central nervous system and physical development, which is also assessed by indicators of physical fitness. How this restructuring is completed depends on the efficiency of the individual's central nervous system, it becomes possible to predict his state of health, which can ultimately affect the quality of life [7]. In this connection, it is necessary to study the influence of various external and internal factors in the process of ontogenesis on the health of students in order to identify, control and level possible deviations in the functioning of the nervous system in [1, 8].

Objective of the study was to identify age-related changes in physical fitness and psychophysiological parameters of the central nervous system in the process of teaching female students in college.

Methods and structure of the study. The scientific work was carried out on the basis of the College of Hotel Business of the Moscow Branch of the Russian International Academy of Tourism. It involved girls 16-20 years old, who were divided into five groups according to age 16 (n=18), 17 (n=23), 18 (n=24), 19 (n=19) and 20 (n=17).

To determine the features of the functioning of the central nervous system (CNS), we used the Hardware and Software Complex "Sports Psychophysiologist", produced by LLC "Scientific and Methodological Center Analyst" in the city of Omsk. With the help of which the psychophysiological characteristics of female students were studied: the time of a simple reaction to light and sound, the time of reaction to a moving object and the reaction time of choice [3]. Physical fitness was assessed using physical tests: running 200 m (min), 30 m (s), long jump from a place (cm), raising and lowering the torso from a prone position (number of times).

Results of the study and their discussion. When considering the results of the time of a simple reaction to a light stimulus, an increase in this indicator was found in female students of 17 years old compared to the result of female students of 16 years old, then there is a significant decrease by 18 years old and an increase at 19, 20 years old (Figure 1). The presented dynamics is also preserved in terms of a simple reaction to sound, reaction time to a moving object and a choice reaction (Figure 1, 2).

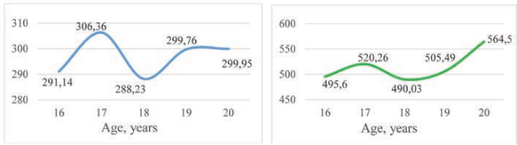

Figure 1. *Simple reaction time to light (left) and sound (right), ms*

The results of the study indicate a decrease in the indicators of the activity of the central nervous system in the second year of study, which may indicate an increase in the load on the central nervous system as a result of the adaptation of the leading systems of the body to external changing environmental conditions during this period and, as a result, the deterioration of the adaptive abilities of the body of female students. In the third year of study, the minimum values of reaction time were recorded, which indicates the highest level of functioning of the central nervous system among the studied age groups. In the last year of study (19, 20 years) there is an increase in the time of sensorimotor reactions, that is, there is a decrease in the adaptive capabilities of the CNS. This may be due to the specifics of the learning process in the last year: a decrease in physical activity, large volumes of industrial practice, pre-diploma practice, preparation for the defense of the final qualifying work. All these factors can negatively affect the psychomotor reactions of the body.

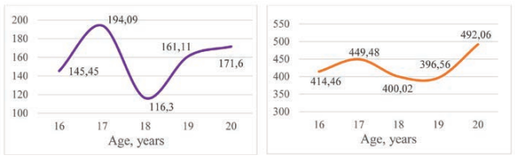

Figure 2. *Response time to a moving object (left) and selection response (right), ms*

Age features of female students' physical readiness are presented in Table. 1. In the 2000-meter run, which reflects the development of general endurance, the best results were demonstrated by female students aged 17-18, and then we observe a deterioration in this indicator. Although this physical quality, according to the sensitive periods of the development of physical qualities, should develop further. In tests for the development of speed, abdominal strength and speed-strength abilities, the best results were shown by girls aged 17 years. By the age of 20, the results became noticeably worse. That is, by the end of training, girls experience a decrease in physical abilities.

Conclusions. As a result of the study, the maximum increase in the time of the sensorimotor reaction at the age of 17 in girls while studying at college was revealed, which indicates the depletion of the adaptive capabilities of the central nervous system, especially in terms of reaction time to a moving object, where the fall was 33.4%. At the age of 18, the indicators of the sensorimotor reaction to light and sound stabilize, and by the age of 20, there is some gradual decrease. At the same time, there is an improvement in physical indicators at the age of 17-18, and by the age of 20, physical fitness gradually decreases, which indirectly indicates a decrease in physical activity against the background of an increase in the intensity of the educational process. That is, the time of the sensorimotor reaction can be considered as a marker of the functioning of the central nervous system of the body. A decrease in physical fitness indicators by the end of training can adversely affect the state of health and motor functions of the body. Physical readiness and psychophysiological parameters of the CNS functioning, according to preliminary data, have different age dynamics during the period of college students' education.

In our opinion, it is necessary to recommend students to reconsider the mode of work and rest, to additionally engage in health-improving forms of physical culture in order to level the negative learning process on the central nervous system and improve their health in general.

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Age features of female students' physical fitness

Age, years	Physical tests			
	2000 m run	30 m running	Standing long jump	Raising and lowering the body from a supine position
16	11,17±1,32	5,10±0,08	176,22±4,85	71,14±4,78
17	11,12±1,08	5,09±0,06	178,04±4,54	74,37±5,11
18	11,05±1,01	5,10±0,06	174,18±4,96	72,54±5,02
19	11,24±1,17	5,11±0,07	169,47±4,55	67,65±4,45
20	11,47±1,24	5,34±0,10	165,07±3,87	60,78±4,28

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9.

Adaptive potential of the cardiovascular system of medical students on the basis of load testing

UDC 616.1-078:613.73

Dr. Biol., Associate Professor **A.K. Martusevich**[1, 4]
I. V. Bocharin[1, 2]
Dr. Med., Associate Professor **M. S. Guryanov**[1]
Postgraduate student **A. O. Kashirina**[3]
[1]Privolzhsky Research Medical University, Nizhny Novgorod
[2]Nighny Novgorod State Agricultural Academy, Nizhny Novgorod
[3]National Research Lobachevsky State University of Nizhny Novgorod, Nizhny Novgorod
[4] I.M. Sechenov First Moscow State Medical University, Moscow

Corresponding author: bocharin.ivan@mail.ru

Abstract

Objective of the study was to assess the adaptive potential of the cardiovascular system of medical students based on stress testing.

Methods and structure of the study. 127 first-year male students of the Volga Research Medical University participated in the scientific experiment. The age of the subjects was 18-19 years. For ECG recording and analysis of hemodynamic parameters, including those characterizing heart rate variability, the Medical Soft sports testing system (MS FIT Pro variant, Russia) was used. As a tool for stress testing, physical exercises of the GTO complex were used.

Results and conclusions. The informativity of the generated load testing algorithm in monitoring the adaptive reserves of systemic hemodynamics is demonstrated. The use of a functional test with two types of load in medical students generally indicated that they had an adaptive response to them. At the same time, a number of indicators demonstrate the tension of regulatory mechanisms, which can be considered as a prenosological state. In addition, the specificity of hemodynamic reactive patterns for the considered variants of physical activity was revealed.

Keywords: *hemodynamics, cardiovascular system, adaptation, testing, students.*

Introduction. The most informative way to analyze hemodynamic parameters in students is to assess the adaptive potential of the cardiovascular system by heart rate variability (Vasti E. et. al., 2020; Veternik M. et. al., 2018). It is assumed that the use of dosed standard physical activity can act as a means of monitoring the functional state, tolerance to them, as well as adaptive reserves of hemodynamics (Ponomareva I.A., 2019; Duprez D.A., Cohn J.N., 2008; Thomas B.L., Viljoen M., 2019).

Currently, it is possible to monitor the state of the adaptive reserves of the body using special diagnostic hardware systems, one of which is the MedicalSoft sports testing system (Martusevich A.K. et al., 2020; Bocharin I.V. et al., 2021), as well as use the exercises of the All-Russian physical culture and sports complex of the TRP, which has been relevant in the Russian Federation since 2014, as a program and regulatory basis for the physical education of the population at all stages of education.

Objective of the study was to assess the adaptive potential of the cardiovascular system of medical students based on stress testing.

Methods and structure of the study. Scientific work was carried out with the participation of 127 first-year male students of the Medical University (age - 18-19 years). The study excluded students who were distinguished by age, student-athletes, as well as students with a special medical group for physical education and / or cardiovascular diseases. All subjects were included in the study after signing informed consent.

The survey was conducted in the middle of the school day, during the intersessional period, in full accordance with the standard rules for the procedure for taking an electrocardiogram (ECG). For ECG recording and analysis of hemodynamic parameters, including those characterizing heart rate variability, the Medical Soft sports testing system (MS FIT Pro variant, Russia) was used [Bocharin I.V. et al., 2021; Martusevich A.K. et al., 2020]. Standard hemodynamic pa-

rameters, statistical and spectral parameters of heart rate variability were used for monitoring. Data analysis was performed in accordance with age standards. To study the effect of physical activity on the cardiovascular system, exercises of the GTO complex were used in the following sequence: shuttle run - three segments of 10 m each and after a two-minute rest, flexion and extension of the arms in the lying position in the amount of 35 repetitions.

Results of the study and their discussion. An indicator that integrally characterizes the reaction of hemodynamics to dosed physical activity is the level of blood pressure. The value of systolic blood pressure (SBP) in students at rest remained in the physiological range, while physical activity contributed to a pronounced increase in this indicator ($p<0.05$). At the same time, a more significant increase in SBP occurred during push-ups, but no significant differences were found between individual exercises.

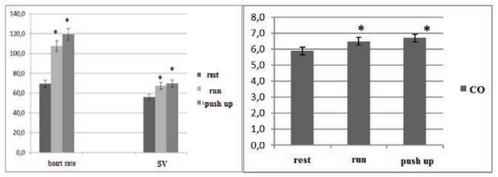

Figure 1. *The level of heart rate (HR), stroke volume (SV), as well as cardiac output (CO) in students at rest and during exercise ("*" - differences relative to the level characteristic of the state of rest, statistically significant, p<0.05)*

There was an increase in heart rate (HR) and stroke volume (SV) after the completion of dosed physical activity, which is undoubtedly associated with an increase in SBP due to increased myocardial oxygen demand and increased blood flow in the systemic circulatory bed ($p<0.05$). Adaptive rearrangements of the cardiovascular system are observed, and, as in the case of blood pressure, the indicators approach the peak of their values after push-ups (Fig. 1). At the same time, in the initial state, the level of heart rate and SV is determined in the physiological range. It should be noted that after performing the first exercise (in the intermediate recovery period), the subjects' performance decreased to values close to the state of rest, which may indicate rather high adaptive reserves of students' hemodynamics. It is also necessary to take into account the dynamics of blood pressure, as a functional indicator of the degree of consistency in the implementation of the pumping function of the myocardium and the precapillary system, as well as the adequacy of the response of any of these components to changes in the other.

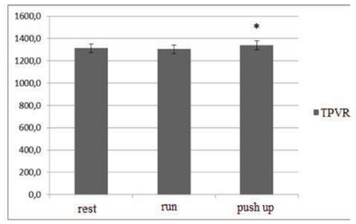

Figure 2. *The level of total peripheral vascular resistance in students at rest and during exercise ("*" - differences relative to the level characteristic of the state of rest, statistically significant, p<0.05)*

The next parameter to be assessed was the level of cardiac output (CO), which is close to SV in its diagnostic value and also characterizes the pumping function of the heart (Fig. 1). Undoubtedly, both options cause a significant increase in the parameter ($p<0.05$ for running and push-ups relative to rest). It should be emphasized that with an increase in the intensity of the load (from running to push-ups), an adequate increase in CO was observed, as evidenced by a higher value of the indicator after doing push-ups compared to running (at the level of a trend; $p<0.1$).

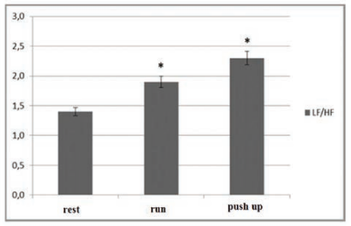

Figure 3. *The level of the spectral index of vegetative balance in students at rest and during physical activity ("*" - differences relative to the level characteristic of the state of rest, statistically significant, p<0.05)*

The contribution of total peripheral vascular resistance (TPVR) to the formation of systemic blood flow was assessed by calculating the corresponding parameter. At rest, the indicator approaches the upper limit of the age range (Fig. 2). After the running exercise, the parameter remained at the initial level, which visualizes good adaptive reserves of the students' body to short-term intense loads. At the same time, longer physical exertion (in the form of push-ups) contributes to an increase in the indicator ($p<0.05$ relative to the state of rest). These shifts are associated with a tendency towards centralization of blood circulation under conditions of increased myocardial oxygen demand, which may reflect latent disadaptation, but for an adequate assessment of the adaptive potential under these conditions, the dynamics of recovery processes should be additionally taken into account.

The revealed trends are also consistent with the nature of the shifts in the autonomic equilibrium index (LF/HF), calculated on the basis of the spectral analysis of the heart rate (Fig. 3). The stress response developing in the process of a nonspecific reaction to physical activity causes an increase in sympathetic stimulation of the myocardium, which manifests itself in a significant increase in the index of vegetative balance in both exercises used relative to the state of rest ($p<0.05$). At the same time, push-ups, as a longer and more intense load, cause a more pronounced increase in the value of the indicator compared to running ($p<0.05$). This characterizes the presence of partial specificity of adaptive responses to various types of exercises.

Conclusion. The study made it possible to demonstrate the informativity of the generated load testing algorithm in monitoring the adaptive reserves of systemic hemodynamics. The use of a functional test with two types of load (short high-intensity and long-term strength) among medical students in general indicated that they had an adaptive response to them. At the same time, a number of indicators (spectral index of autonomic balance and total peripheral vascular resistance) demonstrate the tension of regulatory mechanisms, which can be considered as a prenosological state. In addition, the specificity of hemodynamic reactive patterns for the considered variants of physical activity was revealed, and the test with a series of push-ups modifies the estimated parameters more significantly.

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Special physical training in frame ranning sport disciplines of persons with lesions of the musculoskeletal system

UDC 796

Dr. Hab., Associate Professor **I.N. Voroshin**[1]
Associate Professor **I.V. Dmitriev**[1]
PhD, Associate Professor **A.V. Maslennikov**[1]
A.A. Mironov[1]
[1]Lesgaft National State University of Physical Education, Sports and Health, St. Petersburg

Corresponding author: voroshin_igor@mail.ru

Abstract

Objective of the study was to identify the main directions and content of special physical training in the disciplines of frame-running sports of people with musculoskeletal disorders.

Methods and structure of the study. At the first stage, the leading athletes of the world, specializing in the studied disciplines, took part in the ascertaining experiment. This experiment was carried out to identify the main muscle groups involved in a competitive exercise, and also identified special physical qualities, the development of which is a paramount task in the physical preparation of a runner on a frame running. At the second stage of the ascertaining experiment, the leading athletes of Russia, specializing in the disciplines under study, took part in order to determine pedagogical tests that can comprehensively assess the level of development of special physical qualities of an athlete specializing in frame running disciplines.

Results and conclusions. It has been established that at a competitive distance of 100 m in frame running disciplines, special physical qualities are speed-strength qualities, explosive strength, speed endurance, strength endurance. The main muscle groups that need to be developed during special physical training are the hip flexors, lower leg flexors, knee extensors, and hip extensors.

As a result of the studies carried out in the course of the ascertaining experiment, a set of pedagogical tests was determined, with the systemic use of which it is possible to identify the dynamics of the special physical fitness of athletes in the studied disciplines.

Keywords: *Paralympic athletics, frame running, special physical training, pedagogical control.*

Introduction. The frame running disciplines until 2022 were called “race running” (frame running). Their development began in the 90s of the twentieth century, when a fundamentally new movement device was invented for people with significant spastic manifestations in the muscles of the legs, arms and / or body, which realized their desire to move not in wheelchairs, but with the help of their legs [one]. Frame rann (race rann) is a three-wheeled balance bike with a bicycle saddle and chest support. Over time, competitions began to be held on the run - 100m running, first under the auspices of CRISPA, and since 2018 already under the auspices of the IPC - four disciplines were included in the medal program of the European Championships in Paralympic Athletics-2018. Then the medals in these disciplines were played at the World Championships 2019, at the European Championships 2021. Despite the popularity and international recognition of these disciplines as an integral part of Paralympic athletics in our country, the recognition process was delayed due to bureaucratic barriers. But despite this, in order to create effective sports competition by Russian athletes at the next Summer Paralympic Games, it is already now necessary to create a scientifically based training methodology.

Objective of the study was to identify the main directions and content of special physical training in the disciplines of frame-running sports of people with musculoskeletal disorders.

Methods and structure of the study. At the first stage, a stating pedagogical experiment (n=8) was performed, during which, using biomechanical analysis, the involved main muscle groups were identified. The biomechanical analysis was performed on the basis of a video recording made at the 2020 and 2021 Russian Championships in Athletics for Persons with MSD impairment, as well as on the basis of a video recording made by the organizers of the World Championships in Paralympic Athletics 2019, which is in the public domain. During the biomechanical analysis in these disciplines, the functional features of the athlete associated with his defeat were taken into account - the method of accessible locomotions was used (according to I.N. Voroshin) [2].

At the second stage of the research, in order to determine the complex of pedagogical tests capable of assessing the level of development of special physical qualities of athletes specializing in the studied disciplines, from 2020 to 2021, a stating pedagogical experiment was carried out under the conditions of a natural training process. The personal trainers of the athletes of the experimental group (n=10) were interviewed. Based on the data obtained and further analysis, 11 candidate tests were selected, after which a correlation analysis was carried out on the level of dependence between the results of pedagogical tests and the results of a competitive exercise - running a frame early at a distance of 100 meters. When choosing tests for the assessment complex, we took into account only those that have a high and very high degree of correlation in terms of the value of the Pearson correlation coefficient ($r \geq 0.7$) [3] with the result of running one frame early at a distance of 100 meters.

Results of the study and their discussion. Running on a frame was previously carried out with the help of cyclic movements of the legs, while athletes have a significant spread in the angular characteristics of locomotion. The greatest difference was found in the flexion angles in the knee and ankle joints, which, in addition to the amplitude of locomotion, is also reflected in the angular velocities. It was revealed that the greater the value of spasticity in the muscles of the back of the thigh, the lower the speed of flexion in the knee joint, while the athlete performs a significant tilt of the body forward - from 31° to 55°, which reduces the load on this muscle group.

For comparison, athletes with ataxia, athetosis, are able to use the muscles of the back of the thigh more effectively, for this their landing is more vertical - tilting the body forward from 15 ° to 30 °, while the length of steps is 15-17% longer. At the same time, such athletes, on average, have a reduced frequency of performing movements - 15-22% when compared with athletes who have spastic manifestations in the muscles of the legs.

Almost all athletes of the experimental group perform an active top-down-back foot placement, however, in some athletes, the effectiveness of this locomotion is reduced due to the presence of spasticity with constant critical pronation of the forefoot. The average length of steps in distance running among the athletes of the experimental group has significant variations - from 156 to 218 cm, which is explained by both anthropometric and nosological features. During the distance running, the athletes of the experimental group performed from 48 to 74 running steps. Running on frame running for a distance of 100 meters is performed with maximum intensity. Leading male athletes run a distance of 100 meters in 16-17 seconds (data for 2019), while performing from 48 to 65 steps. Women run this distance in 18-20 seconds (data for 2019), while performing from 61 to 74 steps.

Based on the foregoing, we can conclude that the main sources of energy supply during competitive activities in these sports disciplines will be creatine phosphate and anoxic (first) part of glycolysis (glycolytic power). Therefore, speed-strength qualities, explosive strength, speed endurance, strength endurance should be attributed to special physical qualities in frame running disciplines.

When developing a set of pedagogical tests capable of assessing the level of development of special physical qualities of athletes specializing in frame-running disciplines of sports for persons with musculoskeletal disorders, we proceeded from the fact that the number of tests should be minimal, but at the same time, the necessary complexity of assessing the development of special physical qualities should be maintained. . We also proceeded from the fact that the selected tests should be relatively safe when performed by athletes with certain musculoskeletal disorders and available for use as part of the training process [3].

When selecting pedagogical candidate tests, we were also guided by the fact that each test must meet four or more criteria of similarity with a competitive exercise - a similar structure for performing basic locomo-

tions; identical muscle groups involved in the exercise; similar amplitude and identical direction of movement; similar duration of effort; similar speeds of the main locomotions; similar modes of muscle work [3].

One athlete in the course of the ascertaining experiment performed several sections of tests in basic, pre-competitive, directly pre-competitive, competitive mesocycles of training. Competitive exercise was performed in conditions close to competitive ones.

An analysis of the correlation between the results of pedagogical tests and sports results in the disciplines of frame running sports of people with musculoskeletal disorders showed that in order to assess the special physical fitness of athletes specializing in these disciplines, it is advisable to use the following tests in a complex way: running a frame early 50 meters from the start (n=64, r=0.73); running a frame early 80 meters from the start (n=53, r=0.92); semi-squat in the simulator "Smith Machine", the number of times in 15 seconds with weight: men - 50 kg, women - 40 kg (n=54, r=0.86); "knee kicking", the number of times in 10 s (n=46, r=0.76).

It should be noted that the tests described above are able to be performed by athletes specializing in the frame-running disciplines of the sport of people with musculoskeletal disorders, the functionality of which allows them to complete a full running cycle on a frame early with both legs.

Conclusions. At the competitive distance of 100 meters in the disciplines of the frame running sport of persons with musculoskeletal disorders, special physical qualities will be speed-strength qualities, speed endurance, strength endurance, explosive strength. The main muscle groups that need to be developed during special physical training will be the hip flexors, calf flexors, knee extensors, and hip extensors.

We have determined a set of pedagogical tests, with the systemic use of which it is possible to reveal the dynamics of the special physical fitness of athletes in the studied disciplines: running a frame early at 50 m from the start; running on a frame early at 80 m from the start; half-squat in the Smith Machine simulator, the number of times in 15 seconds with weight: men - 50 kg, women - 40 kg; “knee kick”, the number of times in 10 s.

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Application of the pulley tower training complex by highly qualified athletes who complete a sports career with injuries of the musculoskeletal system

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Postgraduate student **V.V. Savelyeva**[1]
Dr. Hab., Professor **G.N. Ponomarev**[1]
[1]The Herzen State Pedagogical University of Russia, St. Petersburg

Corresponding author: valviksav@yandex.ru

Abstract

Objective of the study was to evaluate the effectiveness of the use of a complex of special physical exercises on the Pulley Tower multifunctional simulator for the prevention and correction of the musculoskeletal system and spine, for highly qualified athletes who completed their sports career with injuries to the musculoskeletal system.

Methods and structure of the study. The pedagogical experiment was conducted on the basis of the GYROTONIC studios in Moscow, the Moscow region and St. Petersburg for 12 months. The experiment involved highly qualified athletes (Master of Sports, International Master of Sports, Honored Master of Sports of Russia) involved in gymnastic sports (artistic gymnastics, artistic acrobatics, rhythmic gymnastics, figure skating) and sports games (hockey, volleyball, tennis). Age - from 15 to 27 years, in the amount of 92 people.

Results and conclusions. As part of the experiment, it was revealed that the proposed set of exercises on the Pulley Tower multifunctional simulator slows down the deterioration of the musculoskeletal system and spine of athletes after the end of their sports career. Restores the motor symmetry of the musculoskeletal system and spine during rotational movements, tilts to the right - to the left.

Keywords: *highly qualified athlete, the stage of completion of a sports career, a multifunctional Pulley Tower simulator, a set of exercises.*

Introduction. The growth of sports achievements, reaching a new level of sportsmanship, as well as early sports specialization makes us think and turn to the problem of diseases of the musculoskeletal system in high-class athletes, in order to maintain their health and improve the quality of life, at the stage of completing a sports career. During a sports career, athletes use the body’s ability to adapt to various loads to improve sports results (A.I. Shamardin, 2000; I.N. Solopov, A.I. Shamardin, 2003; Qian Wei, 2006; A.I. Shamardin, 2008), going beyond the capabilities of the body and functional systems. Sports training has a serious drawback: athletes of various sports, performing repeatedly a specific motor regimen, subject the same muscle groups, tendons, ligaments and joints to stress. Most often, training takes place against the background of fatigue, which additionally creates conditions for injuries and diseases of the musculoskeletal system [2].

Often the pain that appears in the back and limbs is not a reason to reduce the load, thereby provoking chronic diseases of the musculoskeletal system. At present, the problem of deterioration in the health status of athletes who have completed their sports career is becoming more and more urgent, when constant loads are sharply reduced or training sessions are stopped.

The state of the musculoskeletal system in athletes is determined mainly by three factors: qualification, sport and age. Therefore, at the stage of the completion of a sports career, it becomes important to prevent a readaptation deterioration in the state of the musculoskeletal system, the cause of which may be the cessation or a sharp decrease in loads; slow down the process of reducing the amplitude of movement, which can occur under the influence of specific morphofunctional changes associated with the process of deadaptation [2]; to slow down the regression of flex-

ibility, while maintaining, as far as possible, the optimal mobility of the main links of the musculoskeletal system [1]; to activate the non-dominant side of the athlete, thus smoothing out the functional dynamic asymmetry of the athlete that arose as a result of adaptive rearrangements [3].

Currently, there are few publications devoted to the problems of maintaining the musculoskeletal system of high-class athletes who have completed their sports career. Mostly studied diseases of the musculoskeletal system in the late post-sport period [4]. Studies show that sports veterans (40-60 years old), and these are the leading athletes in the team game sport - basketball, have back and ankle injuries - 67.2%, knee meniscus - 23.3%, Achilles tendon tear - 9.6%, osteochondrosis of the spine - 43.8%. There are 21% of post-traumatic, dystrophic and inflammatory diseases of the musculoskeletal system in high-class athletes who have received injuries during sports training.

Objective of the study was to evaluate the effectiveness of using a complex of special physical exercises on the Pulley Tower multifunctional simulator for the prevention and correction of the musculoskeletal system and spine, for highly qualified athletes who completed their sports career with injuries to the musculoskeletal system.

Methods and structure of the study. The pedagogical experiment was conducted on the basis of the GYROTONIC studios in Moscow, the Moscow region and St. Petersburg for 12 months. The experiment involved highly qualified athletes (Master of Sports, Master of Sports of International Class, Honored Master of Sports) involved in gymnastic sports (artistic gymnastics, artistic acrobatics, rhythmic gymnastics, figure skating) and sports games (hockey, volleyball, tennis). Age - from 15 to 27 years, in the amount of 92 people.

The participants were divided into two groups (experimental (EG) and control (CG), 46 people each. The experimental group performed a set of exercises on the Pulley Tower multifunctional simulator (Fig. 1) three times a week for 45 minutes. using a goniometer consisting of two branches connected to a scale graduated from 0 to 180˚.When assessing mobility, the amplitude of active movement was measured.The average value in the exercises of each group was determined.

To measure the volume of the upper limb in the initial position, the arms hang freely along the body. Suggested movements: forward flexion, abduction, posterior flexion of the forearm. Flexion (raising the arm forward) in the shoulder joint occurred in the sagittal plane, and a goniometer was installed in the same plane to the outer surface of the shoulder. Abduction in the shoulder joint was performed without movement of the scapula. Extension was carried out in the sagittal plane. The goniometer screw was installed in the middle of the head of the humerus. The back flexion of the forearm was carried out with the shoulder pressed against the body, the angle of flexion of the forearm was measured.

To measure the volume of active movement of the hip joint, the starting positions were: supine position, prone position, lying on the side. Movements were carried out: flexion of the leg, extension of the leg and abduction of the leg.

To measure the mobility, flexibility and symmetry of movements between the left and right sides of the spine, the starting positions were: standing against a wall and sitting on a bench. Movements were carried out: forward and backward tilts, tilts to the right and left, rotational movement to the right and left.

When tilting forward and backward, the subject stood sideways to the wall, on which a vertical line had previously been drawn. The angle between the vertical line and the inclination forward and backward was measured. When tilting to the side, the subject stood with his back to the vertical line, and the angle between the vertical line and the tilt to the right and left was also measured. When performing a rotational movement to the right and left, the subject sat on the bench, fixing it between the legs, the measurement was carried out from above, the angle between the initial position and rotation to the right and left was measured.

To determine the flexibility of the hamstrings, the “sit and reach” test (D.R. Hopkins, W.W. Hoeger, 1986), a modified version of the test, was used to eliminate the influence of insufficient mobility of the shoulder girdle and proportional differences between the length of the arms and legs [4]. The subject sat with his back to the wall, legs together, extended forward, feet unbent. A box with a sliding measuring scale is installed at the feet. For each subject, a zero point was established on the segment of the distance of the fingers to the box, based on proportional differences in the length of the limbs. Tilt forward.

Based on a comprehensive assessment of the state of the musculoskeletal system and spine, athletes who completed their sports careers were given the necessary recommendations for further training, doing exercises at home, and the training load was adjusted depending on the individual adaptive capabilities of the body.

A set of special physical exercises on a multifunctional simulator is aimed at muscle relaxation, restoring muscle balance, maintaining the level of physical condition, improving posture and symmetry, getting rid of muscle cramps, and reducing pain after injuries. The sets of exercises were divided into three blocks. The first block included exercises for the spine, the second block of exercises was aimed at the shoulder girdle and the third block contained exercises for the pelvic girdle.

1. *Exercises for the spine.* It is performed sitting on the bench of the Pulley Tower training complex. Options for the position of the hands: each hand on the “handle”, both hands on the same “handle”, sitting with his back to the “handles”, sitting sideways to the “handles”. The position of the hands changes the effect on the muscles of the back and the position of the spine. – I.P. sitting legs apart, hands on the “handles” in front of you, back straight. Hold hands on the “handles” of the simulator. Inhale and slowly push the handles forward in a circle. Fix the stretch and return back. The movement is performed with straight arms, with maximum extension of the spinal column forward.

2. *Exercises for the shoulder girdle*. It is performed while sitting on the bench of the Pulley Tower training complex, leaning on a special backrest. The upper loops are dressed on brushes. Weight - 5 kg. Variants of execution: alternately with the left and right hand, simultaneously with two hands, in different directions with both hands, with a look up, down, with bent elbows, with straight arms. Movement options: up, down, circular movements in front of you with one hand, two hands together, alternately, circular movements above your head. I.P. sitting legs apart, back straight, arms extended in front of you, perform circular movements with your hands.

Table 1. *Assessment of changes in the musculoskeletal system and spine (degrees)*

The results of changes in the mobility of the musculoskeletal system							Symmetry / asymmetry			
Movement name EG KG			Initial data		After 12 months		Initial data		After 12 months	
			EG	KG	EG, degree	KG, degree	EG	KG		
Shoulder joint, degrees	Bending the arm forward	Right	136,42	139,2	134,9	125,1	9,8	15,2	6,9	18,8
		Left	126,6	124,03	128,0	106,3				
	Retracting the hand to the side	Right	131	133,42	131,0	121,3	12,4	12,4	7,8	13,2
		Left	118,6	121	123,2	108,1				
	Flexion of the arm behind the back	Right	160	156,6	149,8	143,6	13,4	12,9	3,3	12,1
		Left	146,6	143,7	146,5	131,5				
Hip joint, degrees	Bending the leg lying on the back	Right	146,5	147,9	145,7	143,2	4,1	6,9	3,6	7,4
		Left	142,4	141	142,1	135,8				
	Leg extension lying on the stomach	Right	28,46	28,7	26,7	25,3	7,1	7,5	4,5	8,2
		Left	21,41	21,2	22,2	17,1				
	Side leg abduction	Right	47,26	47,7	44,6	42,8	9,4	9,1	4,3	9,6
		Left	37,9	38,6	40,3	33,2				
Spine, degrees	Standing bends	Forward	168	168,8	164,0	162,7	×	×	×	×
		Back	42,23	41,97	40,3	37,2				
		Right	46,34	46,14	44,8	42,1	8,3	7,9	5,5	8,4
		Left	38	38,21	39,3	33,7				
	Bench rotation	Right	37,3	37,51	35,3	34,2	6,0	6,4	1,1	7,1
		Left	31,3	31,1	34,2	27,1				
Hamstring, cm	Sit down and reach out	Feet together	21	21,21	23	15	×	×	×	×

3. *Exercises for the pelvic girdle*. They are performed lying on the bench of the Pulley Tower training complex, the upper loops are put on the feet, weight 15 kg. Foot movement options: unbend, bend. Leg position options: legs together, legs apart to the sides, alternately lifting the legs up, knees straight, knees bent. I.P. lying down, legs raised up 45 °, knees straight, feet unbent: exercise “bike”, “frog”, “scissors”.

Results of the study and their discussion. Table 1 shows the results of changes in the mobility of the musculoskeletal system of highly qualified athletes who have completed their sports career. The results are calculated as a percentage of the baseline. The baseline values were obtained from the report card of the last competitions in General Physical Training and Special Physical Training of athletes. For 12 months, the dynamics of changes in the functional state of the musculoskeletal system and spine in athletes of the experimental and control groups was monitored. As part of the experiment, it was revealed that the proposed set of exercises on the Pulley Tower multifunctional simulator slows down the deterioration of the musculoskeletal system and spine of athletes after the end of their sports career. Restores the motor symmetry of the musculoskeletal system and spine during rotational movements, tilts to the right - to the left.

Conclusion. The use of a complex of special physical exercises on the Pulley Tower multifunctional simulator is an effective and important tool for correcting the state of the musculoskeletal system of athletes who have completed their sports career by gradually slowing down the process of reducing the amplitude of movement and maintaining optimal mobility of the main links of the musculoskeletal system.

Figure 1. *Multifunctional training complex Pulley Tower*

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Assessment system of process activity of students in practical lessons in physical culture and sport

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PhD, Associate Professor **A.S. Boldov**[1]
Dr. Hab., Professor **V.Yu. Karpov**[2]
PhD, Associate Professor **E.A. Alenurov**[3]
PhD, Professor **K.K. Skorosov**[4]
[1]Moscow State University of Psychology & Education, Moscow
[2,3]Russian State Social University, Moscow
[4]Penza State University, Penza

Corresponding author:boldovas@gmail.com

Abstract

Objective of the study was to substantiate the system for evaluating the effectiveness of students' process activities in the framework of practical classes in physical culture and sports.

Methods and structure of the study. In the analytical study, methods of analysis and synthesis, generalization and modeling, and the axiomatic-inductive method were used.

Results and conclusions. The authors have developed criteria for the process activity of university students in mastering the disciplines of the physical culture and sports block, taking into account inclusion, not only as achievement evaluation determinants of individual semesters, but also in the dynamic development of target performance.

Keywords: *students, physical culture, sport, inclusion, process approach, criteria, pedagogical system.*

Introduction. The process approach is an interconnected and interdependent application in educational activities of a set of processes (development, education, upbringing, training), in which the student simultaneously acts as an object and subject of interactions, and the teacher can be both a responsible owner and an achievement resource for effective performance [6] . In the field of physical culture and sports activities of universities [4], the process approach is used when teaching new motor actions and educating physical qualities, thus contributing to the development of the cognitive-axiological sphere of students and their involvement in the process of physical education [1, 7].

At this stage of development of higher education, there is an urgent need for a criterion-based assessment of the formation of physical culture of the personality of future specialists on the basis of individual inclusive educational strategies [5], which concerns not only students with special educational needs, but also the entire contingent composition [4]. With this approach, it becomes necessary to evaluate the process component of mastering the disciplines of physical culture and sports, physical culture and health improvement and health saving blocks (modules) of work programs along with the resulting one [1].

Objective of the study was to substantiate the system for evaluating the effectiveness of students' process activities in the framework of practical classes in physical culture and sports.

Methods and structure of the study. The following methods were used in the study: analysis and synthesis of scientific and methodological literature, analytical generalization and modeling of the system of criteria-based assessment of process activity, axiomatic-inductive method of structuring process activity criteria.

Results of the study and their discussion. The modern structure of the system of physical culture and sports activities in universities can be considered from the perspective of three components: theoretical, practical and acmeological [2]. In turn, the practical component can be represented in the form of two elements: a practical elective discipline in physical culture and sports (328 academic hours) and extracurricular sectional work, including sports, sports-applied, health-improving and rehabilitation and adaptive areas, taking into account the characteristics and

Indicators of the process activity of the practical component of physical culture and sports activities of students

Indicators	Criteria level of process activity		
	Low	Medium	High
Class attendance	Less than 50% attendance at practical classes	50% to 75% attendance at practical classes	More than 75% attendance of practical classes
Job satisfaction (reflection)	Negative level of reflection of the average values of the course of studies	Indifferent level of reflection of the average values of the course of studies	Positive level of reflection of the average values of the course of studies
Physiological pulsometry curve	Average heart rate values do not exceed 50% in accordance with age	Average heart rate values in the range of 50-70% according to age	Average heart rate values in the range of 70-90% according to age
Motor occupation density	The average values of the individual motor density of the training course do not exceed 50%	The average values of the individual motor density of the training course are in the range of 50-70%	The average values of the individual motor density of the training course are in the range of 70-90%

value orientations of students. To determine the effectiveness of process activity in the physical culture and sports work of the university [1], four indicators were determined: class attendance, satisfaction with the lesson, the physiological curve of pulsometry and the motor density of the lesson (see table).

To unify the assessment system, in our opinion, it is necessary to rank the criteriality of process indicators at three levels (low, medium and high). In the “class attendance” indicator, it is possible to use the classic percentage ratio based on the results of semester activities, as well as their dynamics from semester to semester. In the indicator “satisfaction with the lesson (reflection)”, it is possible to use the reflection index [3], calculated according to the results of students’ secret voting after each lesson. The indicator “physiological curve of pulsometry” can be calculated on the basis of data from individual heart rate monitors (fitness bracelets) according to the average values during each session based on the calculation of the classical Haskell-Fox formula for the intensity of physical activity with the corresponding percentage. The “motor density of a lesson” indicator is calculated on the basis of data from fitness bracelets or expert pedagogical observations of a teacher at each lesson based on the average value for a semester course.

In the aggregate assessment of the level of process activity of students, in our opinion, it is worth being guided by the following criteria:

• All four indicators of process activity are of equal importance in the final semester assessment of physical culture and sports activities of university students.

• When a student reaches high criterion levels for two or more indicators, it is permissible to set the highest differentiated grade for semester progress.

• When a student reaches high criteria levels for the first indicator, provided that there are no low levels of process activity, it is possible to set an average differentiated assessment of semester progress.

• When a student reaches at least the first and more average levels of indicators, in the absence of the highest levels of criteria-based assessment, it is possible to set a sufficient differentiated assessment of semester progress. In addition, a sufficient assessment of semester progress can be given to a student with achieved single criteria for high and/or low level process activities. In the absence of differentiation of the semester assessment, this criterion level will be the threshold for setting sufficient progress in the discipline.

• When a student reaches only low criterion levels of process activity, the student is given an assessment of the insufficiency of semester progress.

Conclusions. The proposed criteria for the process activity of students in physical culture and sports classes can be used in the practical activities of the departments of physical culture, physical education and sports to assess students’ achievements.

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Influence of sports exercises on student flexibility indicators

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PhD, Associate Professor **O.S. Krasnikova**[1]
PhD, Associate Professor **A.V. Korichko**[1]
Yu.N. Savelyeva[1]
[1]Nizhnevartovsk State University, Nizhnevartovsk

Corresponding author: oskrasnikova@yandex.ru

Abstract

Objective of the study was to reveal the influence of sports activities on the indicators of flexibility among representatives of student youth on the basis of a comparative analysis.

Methods and structure of the study. During the experiment, students of the 1st and 2nd year, engaged in sports-oriented groups, took part in the following areas: cyclic sport (swimming), mixed (volleyball) and acyclic, power (athletic gymnastics). To study the degree of influence of sportsized areas on flexibility indicators, 102 students were tested at the end of the semester. Flexibility was assessed according to five standards: symmetrical indicators, mobility of the shoulder joint and spinal column were studied.

Results and conclusions. A comparative analysis of the indicators of students attending various sports areas showed that the greatest effect of developing flexibility is achieved in the process of swimming. The impact of the aquatic environment on the body and the cyclical nature of the work have a beneficial effect on flexibility indicators, including leading to harmonious development. As a result of playing volleyball, the flexibility of the left side of the body is actively developing and the mobility of the shoulder joint of the right hand is increasing. There is an asymmetry in the development of the flexibility of the right and left sides, both in boys and girls. Ineffective in the development of flexibility, athletic gymnastics was noted, as indicated by the testing data of representatives of student youth. Excessively developed strength abilities stimulate an increase in the diameter of the muscle fiber, which negatively affects the manifestation of flexibility in those involved. With the help of a comparative analysis in the studied sportsized areas, significant gender differences in the development of flexibility were found. In particular, the indicators of female representatives' flexibility are better developed in comparison with young men who go in for volleyball and athletic gymnastics. The exception is young men involved in volleyball, in which the indicators of mobility of the shoulder joint of the right hand prevail with similar values of girls. There were no gender differences in the results of symmetrical tests among representatives of the sportsized direction of a cyclic nature (swimming).

Keywords: *sportization, swimming, volleyball, athletic gymnastics, flexibility, student youth.*

Introduction. The promotion of sportization, as a form of mass sports activities for various categories of the population, is seen in the actualization of the process of physical education of student youth. Sports training, which began in school years, should be continued in the classroom in the elective disciplines of physical culture and sports. The choice of a sports-oriented direction offered to students will contribute to the promotion of a sports approach in the physical education of students [5].

Student age is a favorable period for achieving the optimal level of motion control, the formation of qualitative characteristics of motor actions and the improvement of physical abilities. The conditional choice of a sports-oriented direction will contribute to the formation of the physical culture of the students' personality. The specific features of the sport will have a targeted impact on the improvement of the physical qualities of those involved, which does not always contribute to solving the problem.

Objective of the study was to reveal the influence of sports activities on the indicators of flexibility among representatives of student youth on the basis of a comparative analysis.

Methods and structure of the study. The experiment involved 102 1st and 2nd year students of the Nizhnevartovsk State University, who are engaged in sports-oriented groups. Three areas of sports activities were selected: cyclic sport (swimming), mixed (volleyball) and acyclic, power (athletic gymnastics). The choice of a sports direction was carried out by the students on their own, but it was assumed that they had practical skills to continue practicing a particular sport. Flexibility indicators were determined after a semester period of classes in each sporting direction. Flexibility was assessed according to five standards, among which symmetrical standards were used to analyze the possibilities of the right and left sides of the body, as well as the mobility of the shoulder joint and the flexibility of the spinal column. The choice of tests was determined by the structure of frequently performed motor actions in the process of studying the studied sports areas.

Research results. The data obtained indicate a positive effect of swimming lessons on students' flexibility indicators (Tables 1, 2). In almost all tests conducted, the best results of the study were recorded, in comparison with representatives of other areas. In symmetrical tests, no significant differences were found among students attending swimming, which indicates a uniform development of this quality. Gender analysis allows us to speak about a significant difference only in the flexibility of the articular-ligamentous apparatus of the shoulder joints, as well as the muscles of the chest and back, which are more developed in girls (moving away from the wall - 58.42 at $p < 0.01$ and arm twist - 66.75 at $p< 0.01$).

In the process of practicing volleyball, there is a significant effect on the mobility of the shoulder joint and the elasticity of the muscles of the upper shoulder girdle on the right side. In particular, a variety of game actions in volleyball, including the abduction of the hand to perform the serve and attacking actions, lead to the formation of asymmetry in the development of flexibility, which is expressed in reliable values. Asymmetry was also established when tilting to the side, which indicates a high tone of the oblique muscles and muscles of the back of the right half of the body, which does not allow the tilt to the left to be performed correctly in representatives of both gender groups. However, the frequently performed swing for attacking actions and serving contributes to an increase in the amplitude of the shoulder joint of the right hand more in boys than in girls (bringing the hands behind the back, right from above, respectively Mb=9.44 and Mg=7.21).

In the process of doing athletic gymnastics, rep-

Table 1. Indicators of flexibility in girls attending sports destinations, M±m

Test tasks Volleyball n=19		Sports destinations			Student's t-test		
		Swimming n=18	Athletic gymnastics n=11	Volleyball Swimming	Volleyball Athletic gymnastics	Swimming Athletic gymnastics	
Flexibility of the spinal column to the sides, (cm)	to the right	27,07 ±1,27	27,83 ± 1,02	22,72 ± 1,19	0,47	2,78**	2,94**
	to the left	24,05 ±1,12	28,02 ±1,09	21, 43 ±1,38	2,54**	1,49	3,71**
Reduction of hands behind the back, (cm)	Right top	8,43 ±1,18	13,92 ±1,05	4,94 ±1,69	3,48**	1,75	4,36**
	Left top	7,21* ±0,91	11,08 ±1,45	2,49* ±1,84	2,26*	2,07*	4,18**
Flexibility of the upper shoulder girdle, departure from the wall, (cm)		51,79* ±1,73	58,42* ±1,18	47,81** ±1,95	3,17**	1,75	4,07**
Shoulder mobility, arm twist (cm)		71,07* ±3,53	66,75** ± 2,49	87,93** ±2,83	1,00	3,64**	4,68**
Flexibility of the spinal column, forward bend (cm)		7,06 ±1,81	9,43 ±1,52	4,50 ±1,58	1,02	1,17	2,05*

Notes: * - Significance by Student's t-test at $p<0.05$, ** - Significance by Student's t-test at $p<0.01$.

Table 2. Indicators of flexibility in young men attending sports activities, M±m

Test tasks Volleyball П=18		Sports destinations			Student's t-test		
		Swimming П=21	Athletic gymnastics П=15	Volleyball Swimming	Volleyball Athletic gymnastics	Swimming Athletic gymnastics	
Flexibility of the spinal column to the sides, (cm)	to the right	27,94 ±1,08	28,1 ±1,03	19,42 ±1,43	1,21	3,64**	4,93**
	to the left	23,61 ±1,02	26,02 ±1,14	18,73 ±1,36	1,58	2,87*	4,11**
Reduction of hands behind the back, (cm)	Right top	9,44 ±1,47	10,35 ±2,29	2,75 ±2,39	0,33	2,38*	2,30*
	Left top	5,33* ±1,91	8,31 ±2,08	-3,56* ±1,91	1,06	3,29**	4,20**
Flexibility of the upper shoulder girdle, departure from the wall, (cm)		42,72* ±2,36	44,56* ±1,95	22,31** ±2,28	0,60	4,22**	5,42**
Shoulder mobility, arm twist (cm)		95,58* ±3,25	80,7** ±4,03	101,27** ±4,22	2,87**	1,07	3,53**
Flexibility of the spinal column, forward bend (cm)		7,25 ±2,86	6,83 ±1,03	2,44 ±1,82	0,34	1,42	1,81

Notes: * - Significance by Student's t-test at $p<0.05$, ** - Significance by Student's t-test at $p<0.01$.

resentatives of student youth have the lowest rates of flexibility development. The reason is seen in the excessive development of strength abilities, an increase in the muscle diameter, the absence of amplitude movements in working with simulators and the insufficiency of means of pedagogical influence that contribute to the development of this quality. By analogy with other sporting areas, there are gender differences, so the representatives of the female half involved in athletic gymnastics have better developed flexibility indicators.

Conclusions. As a result of a comparative analysis of sportsized areas, a specialized impact of the type of sports activity on the development of flexibility among students was revealed. Despite the fact that flexibility is not the dominant physical quality in the sports studied by us, the performance of motor actions stimulates its development.

It has been established that swimming lessons contribute to the effective development of flexibility and create the best conditions for the harmonious development of the flexibility of all muscle groups. Asymmetry is observed in volleyball players, which is due to the biomechanical structure of frequently performed motor actions. Representatives of the power direction deserve special attention, since developed power abilities lead to a deterioration in the demonstration of flexibility among young people. Low rates were noted among boys in comparison with girls in all sportsized directions.

The data obtained make it possible to correct the process of physical education of students, taking into account the specifics of sportsized areas and to develop pedagogical technologies for a directed impact on the education of flexibility.

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Distance lessons of physical education at the higher education institution in comparison with the traditional form of training

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PhD **F.F. Kostov**[1, 3]
Postgraduate student **A.S. Ugryumov**[3]
PhD, Associate Professor **G.A. Yakovlev**[2, 3]
[1] The Herzen State Pedagogical University of Russia, St. Petersburg
[2]Russian State Hydrometeorological University, St. Petersburg
[3]Higher School of Economics, St. Petersburg

Corresponding author: g-ponomarev@inbox.ru

Abstract

Objective of the study was to evaluate the possibilities of a distance form of practical training in physical culture to maintain the level of physical activity of students.

Methods and structure of the study. The scientific work was carried out on the basis of the National Research University "Higher School of Economics" St. Petersburg in the period from February 2020 to the present and was aimed at studying the physical activity of students, as well as assessing their opinion about their level of physical fitness and the possibility of maintaining online physical education. culture and sports. The survey involved 210 students at the Higher School of Economics in St. Petersburg. Of these, 76 students (36.2%) - the 1st year, 66 students (31.4%) - the 2nd year, 60 students (28.6%) - the 3rd year and eight students (3.8 %) – 4th course. Physical education classes at the university were organized as follows. Starting from February 2020, practical classes in physical education were not held in full-time mode, but were replaced by theoretical ones in a remote format. As a result, the physical activity of students has dropped sharply. In the 2020-2021 academic year, students have the opportunity to choose between theoretical classes, participating in a practical online physical activity class with HSE teachers, and providing a subscription to a sports club. In the 2021-2022 academic year, this organization of classes has been preserved.

Results and conclusions. Practical physical education classes in a remote format allow maintaining the level of physical activity of students, however, face-to-face classes, due to the availability of sports equipment, group forms of communication and direct contact with the teacher, remain the undisputed leaders and have the best healing effect.

Keywords: *Physical activity, distance learning, pandemic.*

Introduction. Currently, many universities in the country are using a blended learning format, the possibilities of which were expanded during the period of restriction of the usual living conditions due to the spread of the coronavirus covid-2019. As educational practice shows, the theoretical part of the curriculum can be mastered by students remotely. However, the organization of practical classes, in particular, in physical culture and sports, still updates the face-to-face format of their conduct. Nevertheless, in some universities, distance learning is maintained in all academic disciplines, including such practice-oriented ones as physical culture and sports.

In this regard, the problem of organizing physical education at a university in the form of online practical classes for students of non-sporting specialties is of particular relevance, despite the fact that physical activity is not a professional value for these groups of students [1, 5].

Objective of the study was to evaluate the possibilities of a distance form of practical training in physical culture to maintain the level of physical activity of students.

Methods and structure of the study. The scientific work was carried out on the basis of the National Research University Higher School of Economics St. Petersburg from February 2020 to the present and was aimed at studying the physical activity of students, as well as assessing their opinion about their level of physical fitness and the possibility of maintaining online education in physical culture and sports. The survey involved 210 students at the Higher School of Economics in St. Petersburg. Of these, 76 students (36.2%) - the 1st year, 66 students (31.4%) - the 2nd year, 60 students (28.6%) - the 3rd year and eight students (3.8 %) – 4th course.

Physical education classes at the university were organized as follows. Starting from February 2020, practical classes in physical culture were not held in full-time mode, but were replaced by theoretical ones in a remote format. As a result, the physical activity of students has dropped sharply [2]. In the 2020-2021 academic year, students have the opportunity to choose between theoretical classes, participating in online physical activity classes with HSE teachers, and providing a subscription to a sports club. In the 2021-2022 academic year, this organization of classes has been preserved.

Results of the study and their discussion. The results of a survey of students on the issue of self-assessment of the level of their physical fitness showed that 23 students (11%) consider their level of physical fitness to be high, 118 students (56.2%) assess it as average and 69 students (32.9%) define it as low.

A survey on self-assessment of their level of physical activity showed that 20 students (9.5%) consider it high, 102 (48.6%) - average and 88 (41.9%) consider their level of physical activity low.

To the question "How do you assess your current physical condition", only 19 students (9%) chose the answer "excellent". The answer "good" was given by 61 students (29%), the answer "average" was chosen by 72 students (34.3%), the answer "satisfactory" was used in 47 cases (22.4%), and their current physical condition was "poor" 11 students (5.2%).

The answer to the question "How do you assess your current mental state" also represented a 5-point rating scale. The response frequency was as follows: "excellent" - 21 times (10%), "good" - 63 times (30%), average - 41 times (19.5%), "satisfactory" and "poor" - 53 (25 .2%) and 32 times (15.2%), respectively.

Approximately 40% of the students surveyed are in good health (38% - the physical component and 40% - the mental component). At the same time, 27.6% of students feel below average in the physical component and 40.4% of students in the mental component.

According to WHO recommendations, one should be physically active at least two to three times a week [3]. The study of the frequency and regularity of physical exercises revealed that the majority of students (41.9%) - 88 people were engaged less than once a week. 52 students (24.8%) studied at least once a week. Thus, physical exercises for 140 students (66.7%) cannot be called regular and give a lasting positive effect. And only 70 students (33.3%) studied really regularly, of which 54 people (25.7%) studied two or three times a week, and 16 (7.6%) more than three times a week.

The introduction of remote practical classes in physical culture somewhat improved the picture of students' physical activity, but this indicator is still far from the level of face-to-face classes. The biggest difference was found among those studying less than once a week: 19% before the pandemic and 41.9% in the 2020-2021 academic year.

In addition, the result of 33.3% of those who regularly exercise from two to three times a week is at odds with the students' self-assessment of their level of physical activity, when 58.1% of the respondents speak of an average or high level of activity. This may be due both to students' misunderstanding of the importance of regularity and continuity of physical exercises, and to classifying their daily activities as voluntary physical activity. Therefore, this issue requires further clarification.

The study of the dominant type of physical activity among students in distance learning clarified some details of the regularity of classes. 32 students (15.2%) did not exercise at all. These can be students with disabilities and students who prefer certification in the form of an online test on the educational platform of the university. The majority of students most often studied on their own 110 (52.4%), which does not negate the possibility of attending classes with a teacher or trainer, albeit in a smaller number. If we compare the total number of the above preferences (142 answers 67.6%) with the indicators of low regularity of classes among students (140 answers 66.7%) and their self-assessment of the level of physical activity, it becomes clear that the majority of those surveyed not only do not know about the norms of physical activity, but they are not aware of their ignorance.

The same students who studied regularly, most often conducted classes either with teachers of the Department of Physical Education of the National Research University Higher School of Economics in St. Petersburg (39 students - 18.6%), or with a trainer (29 students - 13.8%). It is worth mentioning that before the pandemic, 60.2% of students preferred classes with teachers from the Higher School of Eco-

nomics in St. Petersburg, and 51% of them studied regularly [2].

Since, starting from the fall of 2020, all HSE St. Petersburg physical education classes are held remotely, it was important to evaluate the opinion of students about the importance of face-to-face classes. To the question “Do you think face-to-face classes would increase your interest in physical education classes at the HSE?” 68 students (32.4%) answered in the affirmative and 46 (21.9%) admitted this possibility. For 10 students (4.8%), the form of organization of the lesson does not matter, since their interest is already high, and 39 students (18.6%) are indifferent to the format of education due to low interest in physical activity, another 47 (22.4%) would prefer to continue doing it on their own. Thus, the majority of students (59.1%) spoke in favor of conducting classes in full-time format.

Conclusions. The introduction of practical physical education classes in a remote format made it possible to increase the level of physical activity of students at the Higher School of Economics in St. Petersburg, but it was not possible to return to pre-pandemic levels.

Face-to-face classes, due to the availability of sports equipment, group forms of communication and direct contact with the teacher as a controlling person, remain the undisputed leaders and have the best healing effect.

Students lack self-discipline and understanding of the basics of physical culture, in particular the importance of the regularity and continuity of physical activity. And the pandemic has only exacerbated the problem.

From the point of view of preserving and increasing health, as well as promoting a healthy lifestyle and educating students in this matter, returning to full-time form is the best condition for a number of the reasons described above.

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Developing the physical potential in university students through training in specialised sports groups, based on the case study of fitness and sport aerobics (aerobic gymnastics)

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Lecturer **E.V. Plaksina**[1]
Lecturer **Zh.V. Esik**[1]
[1]Novosibirsk State University of Economics and Management, Novosibirsk

Corresponding author: kat_fitnes@mail.ru

Abstract

The study of physical and psychological profile of students at the stage of their admission to the university with a view to introducing experimental training methods in sports groups, based on the case study of fitness and sport aerobics (aerobic gymnastics). The article studies two first-year students' groups at the beginning and at the end of the academic year. The first group was trained on the standard Physical Education programme (reference group). The second, experimental group, was trained on the specialised Fitness and Sport Aerobic (Aerobic gymnastics) programme. The measurements of physical working capacity test using PWC170 test, the measurement of pulmonary capacity body mass index and the psychological anxiety level test were made.

The obtained data make it possible to prove the effectiveness of physical education classes in specialised sports groups, to perfect the curriculum and raise university students' motivation for physical education, prevent the deterioration of youth health, largely related to the lack of physical activity, to reveal the physical potential of students by taking into account their individual and psychological characteristics and abilities.

Keywords: *Physical education, physical potential, teaching methods in physical education, motivation of students, psychological stability, health improvement, fitness and sport aerobics, aerobic gymnastics.*

Introduction. Recently, experts in the field of physical education have noted the problem of students' losing interest in physical education and the deterioration of students' health. To date, university physical education curriculum does not differ much from the school curriculum on the discipline. The analysis of students' attendance showed that almost half of the students systematically skip scheduled classes. In the survey, the students when asked to give the reason for absences, named mostly "lack of interest in the subject". University curriculum on the subject largely copies the school curriculum. When asked the question "What kind of physical education classes would you like to attend?", almost all the respondents answered that they would like to be trained in a specific sport — basketball, volleyball, aerobics, athletic gymnastics, etc.

For the improvement of health and development of students' physical potential, first of all, their systematic attendance is required, which is impossible without their interest in the subject and intrinsic motivation. Therefore, first and foremost, physical education classes should be interesting for students. One of the possible options is the formation of groups specialising in a particular sport. Students' groups should be formed in accordance with the desire of students to be trained in a particular sport.

Physical education is aimed at developing a holistic personality, harmonising their spiritual and physical forces, activating the readiness to fully realise their essential strengths in a healthy and productive lifestyle, their professional activity in constructing the necessary socio-cultural comfortable environment, and being an integral element of the university edu-

cational space.

Physical Education classes are an integral part of the development of a personality, a future specialist, therefore it is essential to make students interested in the subject, work towards high students' attendance, because it's only through systematic training that high physical, moral and mental results, psychological stability can be achieved and the students' health can be improved. [2,3,4]

Objective of the study was to show the effectiveness of teaching physical education classes to university students in groups specializing in particular sports, based on the case study of fitness and sport aerobics (aerobic gymnastics), its effectiveness being measured by the the high attendance, interest in classes, internal motivation to achieve results, acquisition and improvement of physical skills, general improvement of the body.

Research objectives:

1. To conduct a study on functional indicators (lung vital capacity, body mass, PWC170 test) and to identify the level of general anxiety at the beginning and end of the academic year in two groups: 1) a reference group was trained on the standard Physical Education programme, 2) an experimental group of students was trained on the specialised Fitness and Sport Aerobics (Aerobic gymnastics) programme.

2. To analyse the dynamics of the growth of indicators (pulmonary capacity body mass index, PWC 170, anxiety level) for the year.

3. To conduct a comparative analysis of the study results in two groups from the point of view of the effectiveness of health improvement and unleashing the physical potential of students.

Methods and structure of the study. During the study the method of analysis of scientific and methodological literature, methods of biomedical research (functional tests), medical and statistical analysis were used.

In the practical part of the study, a pedagogical experiment was conducted, in which 48 female students of the 1st year of the SIM RANEPA branch took part. At the beginning of the year, tests and measurements of all female students of the same year were carried out. At the beginning of the academic year two groups were formed: a reference group trained on the standard physical education programme (25 people), and an experimental group trained in groups specializing in fitness and sport aerobics (23 people). Monitoring the current state of students of both groups was carried out at the end of the academic year. The measurements of the following parameters were taken: height-body mass index, lung vital capacity, after which pulmonary capacity body mass index of each student was calculated.

Classes specializing in fitness and sport aerobics as well as other physical education classes were held twice a week and lasted for two academic hours. They included basic elements and jumps of fitness and sport aerobics (M arch, Jog, Skip, Knee Lift, Kick, Jack and Lunge, jog, knee lift, kick, jumping jack) separately, then combined into choreographic connections, where more steps rather than jumps prevailed. Additionally, the connections included a variety of hand movements. The connections were performed to rhythmic music of 128-135 beats per minute on the floor and on a step platform. Also during the lesson, special exercises of fitness and sports aerobics were used for strength and conditional training, for the development of flexibility corresponding to the level of those involved. Classes were conducted by Ekaterina V. Plaksina, trainer-teacher of the Physical Education and Sports Department, Master of sports of Russia in sports aerobics (aerobic gymnastics) and Master of sports of Russia in rhythmic gymnastics.

Measurement of pulmonary capacity body mass index: first, body mass was measured, then the lung vital capacity (LVC) was measured. A dry lung tester was used to determine the LVC. The study was performed 2-3 times with an interval of 30-60 seconds. The best result was recorded (in milliliters).

The PWC170 test was also conducted (a step test), showing the performance of the cardiorespiratory system, which reflects the body aerobic capacity more objectively.

The level of anxiety was measured. Assessment of the level of state and trait anxiety (according to Spielberger - Khanin scale) was made. This test is a reliable informative way of self-assessment of the level of anxiety at the moment (state anxiety) and trait anxiety (as a characteristic of a person).

Qualitative characteristics were evaluated on a 5-level scale using computer software: high level, above average, medium, below average, low. The Monitoring the Students' Health computer software was developed by a team of scientists from Novosibirsk State Pedagogical University. The scale is formed by the average value of the attribute value from the sum of points for completed tasks, and the result is reflected in the corresponding diagrams below. [1]

Results of the study and their discussion. The analysis of indicators of functional fitness and physical development of female students at the beginning of the academic year revealed: in the parameter of the pulmonary capacity body mass index, the number of students with the low level (14%) and the average level of the index prevailed, 7% of students had a below average level, and 25% of students had an average level, the number of students with the above average index was 25%, 30% of students had a high level of pulmonary capacity body mass index. At the end of the year, in the experimental group, 33.5% of students reached the high level of pulmonary capacity body mass index, and the number of students with a low level and below average (4,7%) decreased, which shows a positive trend. In the reference group, the number of students with the low level of pulmonary capacity body mass index decreased by 3,5% compared to the beginning of the academic year, the number of students with the level below average decreased by 0,9%, with the average level increased by 5,4% compared to the beginning of the academic year, the number of students with the level above average increased by 2,2%, with the high level decreased by 2,2%. These indicators are not significant and there is practically no growth in the pulmonary capacity body index of students of the reference group during the year.

We observe these parameters in Figure 1 below:

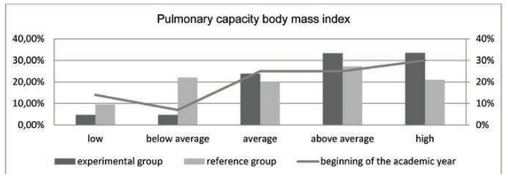

Figure 1.

In Figure 2, the parameters based on the results of the PWC170 test are presented.

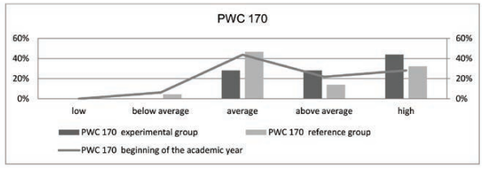

Figure 2.

According to the results of the study, by the end of the academic year in the experimental group, in relation to the beginning of the academic year, the PWC 170 indicators at a low and below-average level did not change and remained at zero, the number of students with the average level decreased by 15,75%, while with the above-average level increased by 6,2%, and the number of students with the high level increased by 15,8%, which proves the effectiveness of the method in the experimental group. This is due to the inclusion of aerobic exercises, complex coordination movements at a high speed.

At the end of the academic year in the reference group, the PWC170 indicators did not significantly change in relation to the measurements of the beginning of the academic year. The number of students with the below-average level decreased by only 1,75%, the indicators of the average level increased by 2,95%. The number of students with the above-average level decreased by 4,8%, while the high-level indicators increased by only 1,1%. Thus, according to the results of the conducted studies, there is no significant improvement in the PWC 170 indicators in the reference group.

The level of anxiety is shown in Figure 3.

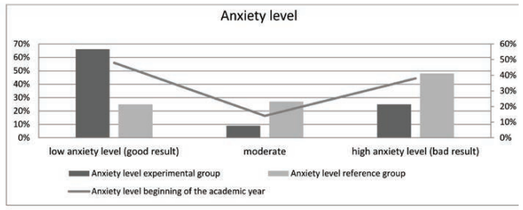

Figure 3.

The assessment of the level of state and trait anxiety in both groups at the beginning of the academic year shows that 48% of students had low anxiety, 14%-moderate, 38% — high.

At the end of the year in the experimental group, the number of students with low anxiety increased by 18%, with the moderate anxiety increased by 5%, while the number of students with the high level of anxiety decreased by 13%. The obtained results of the study in the experimental group show a high level of anxiety reduction in students, and consequently, an improvement in the mental health and emotional state of students.

In the reference group, by the end of the academic year, there were 22% fewer students with the low anxiety level, while indicators of moderate anxiety increased by 13%, and indicators of high anxiety increased by 9%.

Thus, we can conclude that during the year, the first-year students of the reference group, due to the burden of responsibility and an increase in the academic load during the year, acquired a high level of anxiety. Changing the adolescent life perception to a more mature one increased their overall level of anxiety. While the students of the experimental group, thanks to classes in the chosen sport, in the same conditions significantly reduced the level of anxiety, which proves the beneficial effect of fitness and sports aerobics classes.

Conclusions. Classes in specific kinds of sports, in our case in the group of fitness and sport aerobics, can solve the above tasks most beneficially. This study has shown high effectiveness of sports classes. During the year, the students improved not only their physical performance, but also reduced their anxiety levels. Anxiety is a problem of a modern person, and for a young person experiencing the stress of entrance exams, sessions, a new way of life is the most relevant. Physical education classes in specific kinds of sports can solve the problem in the best possible way. Students learn to work in a team, make friends, feel the support of their team, their coach, learn to set goals and achieve them, develop endurance and stamina, increase the level of responsibility to themselves and the team, develop and increase self-esteem. Accordingly, students are emotionally well, stress-resistant, have a high level of self-control, do not suffer from depression and anxiety disorders. Thus, this study shows the importance of the physical education as a discipline and the effectiveness of the methodology of classes in specific kinds of sports.

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Formation of the physical and sports environment of the university as a condition for regular participation of students and teachers of vi-xi stages in implementation of standards of the VFSK GTO

UDC 796.011

PhD **V.V. Bobkov**[1, 2]
Dr. Hab., Associate Professor **L.G. Ryzhkova**[3]
PhD, Associate Professor **I.V. Lazarev**[4]
PhD, Associate Professor **S.Yu. Tatarova**[5, 6]
[1]National University of Oil and Gas "Gubkin University", Moscow
[2]Federal Scientific Center of Physical Culture and Sport (VNIIFK), Moscow
[3]Russian State University of Physical Education, Sports, Youth and Tourism (SCOLIPE), Moscow
[4]Russian State University for the Humanities, Moscow
[5]Plekhanov Russian University of Economics, Moscow
[6]MIREA - Russian Technological University, Moscow

Corresponding author: vitaly-X5@yandex.ru

Abstract

Objective of the study was to evaluate the effectiveness of holding multi-day GTO festivals and organizing academic and independent physical education classes with students, in accordance with the types of tests of the VFSK GTO of the VI stage.

Methods and structure of the study. The scientific work was attended by students and teachers of the Russian State University for the Humanities in the amount of 1363 participants, among whom were representatives of male and female, belonging to the VI-X stages of the VFSK GTO by age. Physical culture lessons were based on the principle of circular training based on the method of continuous exercise. All types of tests were divided into three groups: in the hall, at the stadium, applied. Starting from April and until the end of the semester (end of May), the university held the GTO Festival, based on the results of which a detailed analysis of the quantitative and qualitative indicators of the performance of the GTO tests was carried out.

Results and conclusions. Most of the students (82%) and the teaching staff of the Department of Physical Education (100%) took part in the GTO Festival at the Russian State University for the Humanities, of which 67% of the participants improved their performance in tests during repeated testing, and 23% met the standards for gold, silver and bronze marks of Excellence. Holding a multi-day GTO Festival allows solving a very important problem related to the possibility of re-executing test tests. When holding the GTO Festival at the university, students have the opportunity to independently choose the most suitable moment for themselves to complete the tests. The close interaction of the departments of physical education of universities and the Testing Centers of the GTO "MOSGORSPORT" of Moskomsport allows solving the problem of attracting more students to the events of the VFSK GTO with the assignment of distinctions, as well as promoting a healthy lifestyle among the youth.

Keywords: *VFSK GTO, golden badge of distinction, elective physical culture, preparation and self-training of students, GTO Festival, physical fitness testing, standards and tests, GTO testing center, «MOSGORSPORT» of Moskomsport.*

Introduction. Today, attracting students to actively participate in the implementation of the GTO standards is becoming one of the priority areas of sports and educational work of the university [8, 9]. A number of universities included in the 5/100 program introduce special scholarships that are issued to students for receiving the golden GTO distinction [3]. It is important to note the fact that in order to receive a gold badge, it is necessary to complete nine types of test tests, demonstrating not only good physical qualities, but also a confident possession of applied skills and skills, such as swimming, shooting, skiing, which cannot be achieved without making adjustments to the content of physical education classes.

Objective of the study was to evaluate the effectiveness of holding multi-day GTO festivals and organizing academic and independent physical education classes with students, in accordance with the types of tests of the VFSK GTO of the VI stage.

Methods and structure of the study. To solve the problem associated with an increase in the number of students with GTO grade VI insignia, an elective course (optional) was added in the 2020/2021 academic year, within which work was carried out to

prepare students for the GTO tests. For the second half of the spring semester, it was planned to hold a multi-day GTO festival on the territory of the university, organized with the participation of "MOSGORSPORT" of Moskomsport.

The study involved 1347 students of the 1st-3rd courses, male and female, corresponding to the VI level, and 16 teachers of the Department of Physical Education, age related to the VI-X levels of the VFSK GTO. Physical culture lessons were built on the principle of "circular training" based on the method of continuous exercise, with a focus on developing those motor qualities, skills and abilities that are necessary to perform test tests [1, 9]. Classes were held in three directions, which made it possible to divide students into three large groups according to the types of testing: in the hall, at the stadium and applied (Table 1).

This set of tests was chosen taking into account the material and technical conditions of the university and ensured, in case of successful completion (four mandatory and five optional tests), obtaining a gold badge of distinction. Students with a sports category in any sport, in order to receive a gold GTO badge, must complete one standard less (4 + 4). For the period of preparation for the GTO Festival, students were offered free attendance at classes in any of the departments, subject to mandatory attendance at least eight classes in each (a total of 24 classes per semester). For the period of remote (hybrid) work of the university, students performed independent training programs using mobile fitness applications [3]. The duration of preparation for the GTO Festival was two semesters (from September to May). The central event was the holding of the GTO Festival at the Russian State University for the Humanities, timed to coincide with the 90th anniversary of the VFSK GTO. Starting from April and until the end of the semester (end of May), representatives of the Testing Centers of the GTO "MOSGORSPORT" of the Moscow Sports Committee attended the classes, who assisted the department in the adoption of standards (Fig. 1).

During the GTO Festival, the teacher, before the start of each lesson, warmed up using special preparatory exercises, after which the employees of the GTO Testing Center took control standards. The results of the tests that satisfied the students were entered into the personal account of the test participants. If for some reason the result did not suit the student, then he had the opportunity to retake the test, after the mandatory completion of the training program, consisting of eight lessons.

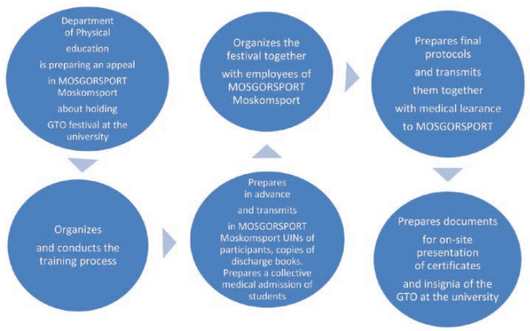

Figure 1. *Algorithm of interaction between the university and Moskomsport on the organization of the GTO Festival*

Based on the results of the GTO Festival, a detailed analysis of the quantity and quality of tests performed, the percentage of students and teachers' involvement in the performance of tests of the GTO complex, the number and quality of retakes of test tests, and the results of performance, expressed in the number of awarded GTO distinctions, were carried out.

Results of the study and their discussion. According to the results of the GTO Festival among students and teachers, protocols were drawn up for 1363 participants who completed one or more tests (Table 2, Fig. 2).

Table 1. *Groups of exercises in areas, in accordance with the types of testing*

GTO test groups * by type		
Educational departments		
In the gym	At the stadium	Applied
1. hanging pull-ups on a high/low bar; **2. flexion and extension of the arms from the lying support;** **3. tilt forward while standing on the gymnastic bench;** 4. lifting the torso from a supine position; 5. long jump from a place with a push with two legs; 6. shuttle run 3×10 m	**1. 30m run;** **2. 60 m run;** **3. 2 km run (women);** **4. 3 km run (men);** 5. Nordic walking 3 km (teachers of level X)	1. swimming 50m; 2. shooting from electronic weapons (10 m)
***Compulsory tests are indicated in italics**		

Table 2. *Number of participants and results*

Types of GTO tests		Number of completed type of GTO test / %	Number of retakes (after 45 days) Gold	Execution result		
				Silver	Bronze	
In the gym	1. shuttle run 3×10 m	1124 / 82 %	711	227	549	121
	2. Long jump	988 / 72 %	621	328	236	589
	3. Pull-ups (boys)	422 / 30 %	221	122	192	54
	4. Flexion and extension of the arms in emphasis lying on the floor	921 / 67 %	385	370	239	43
	4. Pulling up from the hang on the low bar	299 / 21 %	98	59	22	45
	5. Tilt forward	1363 / 100 %	722	374	259	352
	6. Torso lift	1363 / 100 %	322	257	354	283
At the stadium	7. 30m run	622 / 45 %	355	122	254	346
	8. 60m run	525 / 38 %	202	194	124	75
	9. 2 km run	388 / 28 %	121	92	71	112
	10. 3 km run	422 / 30 %	154	115	12	59
	11. Nordic walking	10 / 100% (ППС)	0	10	0	0
Applied	12. Swimming 50m;	202 / 14 %	96	172	46	40
	13. Shooting from electronic weapons	722 / 52 %	511	202	245	323

Analyzing the results of 1363 subjects, it was noted that the most difficult GTO tests are:

- test for flexibility in men - "forward bend from a standing position on a gymnastic bench" - 12% of the boys completed it with a gold badge;
- applied test - "shooting from electronic weapons" for all categories of subjects;
- endurance test - "running for 2 (3) km" for men and women - 18% of boys and 15% of girls met the standard of the gold mark [4, 6];
- swimming was performed by the smallest number of participants (202 – 14%).

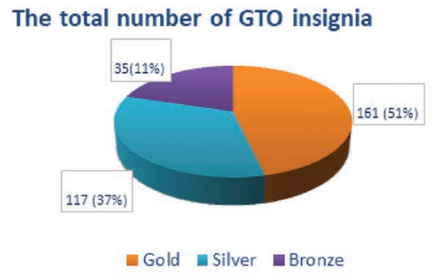

Figure 2. *The total number of badges of distinction issued as a result of the GTO Festival*

Conclusions. Most of the students (82%) and the teaching staff of the Department of Physical Education (100%) took part in the GTO Festival at the Russian State Humanitarian University, of which 67% of the participants improved their performance in tests during repeated testing, and 23% met the standards for gold, silver and bronze marks of Excellence.

Holding a multi-day GTO festival allows solving a very important problem related to the possibility of retaking tests, when, due to one or two unsuccessfully completed tests, a participant ends up without a badge of distinction. During the multi-day GTO Festival, students have the opportunity to independently choose the most suitable moment for themselves to participate in the tests and, thus, start testing in optimal physical condition.

The close interaction of the departments of physical education of universities and the Testing Centers of the GTO "MOSGORSPORT" of Moskomsport allows solving the problem of attracting more students to the events of the VFSK GTO with the assignment of distinctions.

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Characteristics of the profile of the corporate culture of the organization of higher education of physical culture orientation

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Dr. Hab., Professor **V.G. Tyutyukov**[1]
PhD, Associate Professor **A.L. Kramarenko**[1]
Postgraduate student **A.V. Ivanov**[1]
PhD, Associate Professor **P.V. Borodin**[2]
[1]Far Eastern State Academy of Physical Culture, Khabarovsk
[2]Far-East State Medical University, Khabarovsk

Corresponding author: borodinpetr@mail.ru

Abstract

Objective of the study was to determine the profile of corporate culture, which is characteristic of a peripheral educational organization of higher education (EOHE) with a physical education orientation and to establish trends in achieving its preferred configuration.

Methods and structure of the study. The scientific work was carried out using the OSAI methodology proposed by K. Cameron and R. Quinn (USA), which allows you to determine the profile of the corporate culture of an organization as a sum of its main types: "clan", "adhocracy", "market", "hierarchy" in the existing and desired projections. The data obtained are compared with the averaged profiles of the corporate culture of higher education institutions (EOHE) in Russia, Europe and the USA, which makes it possible to determine the strategy for the formation of this cultural phenomenon in the academy. The object of the study was the cultural space of the EOHE of a physical culture profile.

Results and conclusions. The subject area of the study was a methodology that allows obtaining the value judgments of the respondents (pedagogical workers and workers of support services), on the basis of which both the existing type of corporate culture of EOHE and the strategic (preferred) one are established. The study of the problems of corporate culture educational organization of higher education in general was carried out in accordance with the methodological theory of structural and functional analysis (abstract theory of social systems by T. Parsons), which makes it possible to identify the necessary and sufficient conditions for the introduction of an appropriate typology of values and norms in the process of functioning of a social system.

Keywords: *corporate culture, OSAI methodology, types and profile of corporate culture, academy of physical culture.*

Introduction. The concept of "corporate culture" (CC) (in some cases it is identified with the concepts of "organizational culture" and "organizational culture"), today begins to enter the discursive space of higher education quite widely, becoming an important and attractive reference point for the management system of an educational organization and criteria for assessing its quality.

Such attention to corporate culture as a resource of an educational organization of higher education can be explained mainly by the following reasons [8]:

- constantly occurring transformations in the system of higher education and the urgent need to improve the quality of the educational services it provides;

- expansion of spheres of influence and external relations of the educational organization of higher education;

- the desire of domestic educational institutions of higher education to enter international rankings with higher positions in them.

Since about the 1980s, more attention has been paid to the theory of corporate culture than before. The practice of working with human resources that had developed by that time approached the stage of the necessary understanding of the accumulated and giving it a scientific form [5]. It was at this time that the cultural factor also began to be recognized as an effective tool for regulating the behavior and motivation of the staff of an educational institution of higher edu-

cation, updating their positive image and the image of their graduates.

There are quite a few definitions of the concept of “corporate culture”, which are generated by both foreign and domestic studies [2, 3, 5, 7, 9, etc.].

Based on the studied theoretical base, we have formulated the following generalized version of the definition of the concept of “corporate culture”. It appears to us as a systemic group phenomenon, the formation of which occurs in the process of adaptation to the external environment and in the course of internal integration, which is a set of value orientations and behavioral models characteristic of a larger number of employees of the organization, deeply aware of their involvement in the fulfillment of its mission, solving tactical problems and achieving strategic goals.

Appeal to the problem of corporate culture of educational institutions of higher education is updated by the fact that this is a necessity that corresponds to the realities of our time. In addition, this is an organic accompaniment of a paradigm turn associated with the formation of fundamentally new conditions for the life of educational organizations of this type, as independent and competing economic entities that implement a complex circulation of resources, educational services and incomes at their disposal, in order to achieve compliance with the modern level and the quality of graduate training necessary for an era dominated by globalization, digitalization and a knowledge-based economy [3].

Objective of the study was to determine the profile of corporate culture, which is characteristic of a peripheral educational organization of higher education (EOHE) with a physical education orientation and to establish trends in achieving its preferred configuration.

Methods and structure of the study. The scientific study was conducted in May 2021, on the basis of the Far Eastern State Academy of Physical Culture (Khabarovsk). The volume of the study sample was 88 people, including teaching staff (teachers) - 52 people and employees of the Academy’s support services - 36 people.

To determine the profile of the corporate culture characteristic of the Academy of Physical Education, the method proposed by American researchers Kim Cameron and Robert Quinn [4] with the name “Open Standard Questionnaire (OSAI)” was chosen. This technique involves the identification of four dominant types of QC, appearing as a “framework of competing values”, which can be represented to varying degrees in one organization or another, with the possible dominance of any of them. These types of CC are based on establishing the prevalence of the presented competing values and are presented as: type A - “clan”; type B - “adhocracy”; type C - “market”; type D - “hierarchy”.

In a generalized version, the leading indicators of these types of corporate culture can be identified as the following:

Type A (“clan”) - the organization is a large family in which traditions are honored and subordination is observed;

Type B (“adhocracy”) - the organization team is characterized by periods of temporary situational consolidation, providing a dynamic and creative “production” based on freedom and personal initiative;

Type C (“market”) - firm, demanding leadership reigns in the organization, focusing on acceleration, reputation and success;

Type D (“hierarchy”) - the organization is characterized by excessive formalization and structure, everything is imbued with a concern to ensure the achievement of staff employment.

Results of the study and their discussion. The current popularity of the concept of “corporate culture” in the field of “higher education” management is dictated by the fact that modern society, in principle, gravitates towards corporate patterns and higher education is forced to appeal to corporatism in order to establish itself as a successful player in the educational services market, capable of training personnel who could provide achievement of corporate goals [8].

A study conducted to identify the profiles of corporate culture characteristic of the academy made it possible to establish the following.

At the time of the study (current state), the corporate culture of the academy, of the entire set of respondents involved in it, on average is seen (see Table 1) as “clan” (32.46%), with a slightly smaller share of

Table 1. *Profiles of the current (real) and preferred (desired) corporate culture, characteristic of the Academy of Physical Culture*

Types of corporate cultures	Current profile state of CC	Preferred profile state of CC	Trends
A (clan)	32,46	34,03	+ 1,57
B (adhocracy)	17,32	20,73	+ 3,41
C (market)	19,66	25,19	+ 5,53
D (hierarchy)	30,56	20,05	– 10,51

Table 2. *Comparative data (in%) on the types of corporate cultures characteristic of universities in different countries*

Types of corporate cultures	Type of CC Far Eastern State Academy of Physical Culture		Type of educational institutions of higher education Europe	Type of educational institutions of higher education USA	Type of CC leading universities Russia
	As it is	Wish	As it is	As it is	As it is
A (clan)	32,46	34,03	24,2	24,2	30,1
B (adhocracy)	17,32	20,73	31,3	26,5	20,6
C (market)	19,66	25,19	25,6	30,2	21,9
D (hierarchy)	30,56	20,05	18,9	19,1	27,4

“hierarchy” (30.56 %) and even smaller shares of the “market” (19.66%) and “adhocracy” (17.32%).

The above allows us to assert that there is no uniquely dominant type of CC in the academy, since the gap between the leading positions of the “clan” and the “hierarchy” (A and D) is only 1.90%, while it is customary to consider differences of 10 points significant. and more [1]. Nevertheless, the type with the highest value (32.46%) characterizes the CC of the academy as one in which “clanism” prevails, and it is characterized by a lot of positive things: the cohesion of employees, the presence in the team of an atmosphere of eventful reality, devotion to the common cause.

The manifestation of a “hierarchy” in a significant proportion clearly cannot contribute to the development of the organization in the implementation of the strategy of entering the leading positions in the industry and the region.

In general, the preferred (desired) profile of the corporate culture of the academy should remain predominantly “clan” (34.03%) with a sufficient share of the “market” (25.19%) and with somewhat smaller shares of “adhocracy” (20.73%) and “ hierarchy” (20.05%).

Thus, in relation to the current state of the corporate culture profile at the academy at the time of the survey, in the variant desired by the respondents, it should appear in such a profile, which is characterized by an increased (by 8.53%) value of the “market” and increased share values “adhocracy” (by 3.41%) and “clan” (by 1.57%), and a very reduced (by 10.51%) share of the “hierarchy”.

Generalization of literature data and data of current electronic resource information (when following the CC model established by C. Cameron and R. Quinn) made it possible to establish (Table 2) that the leading US universities leading the world rankings are primarily characterized by the features of a “market” (focus on results, purposefulness, rivalry, competition), then “adhocracy” (leadership, development of new resources, uniqueness), “clan” (traditions, solidarity, devotion to a common cause, corporate spirit) corporate culture.

The combination of all this guarantees them flexibility, readiness for change, stability based on a team that shares the goals and values of the organization. The corporatism of the European higher education is primarily based on the traditions of freedom, creativity, encouragement of personal initiative (elements of “adhocracy”), increasing reputation, strengthening the image, determination to win, the introduction of information technology (features of the “market”), cohesion, pride in the cause of the organization , an emphasis on specific actions and achievements (the culture of the “clan”). Typical for the leading Russian universities is the dominance of “clan” and “hierarchical” culture. This type of CC is characterized by the difficulty of perceiving “external” goals formed in competitive or innovative development paradigms.

Conclusion. Based on the results of the study, the profile of the corporate culture existing in the academy was determined, in which “hierarchy” and “clan” prevail. The first of them does not contribute to the creation of a creative atmosphere in the team and does not encourage innovation. It is likely that the leadership of the academy should manage the formation of the CC, taking into account the data characteristic of the international higher education. At the same time, one should probably not forget that “clanism” is the foundation of the traditions of an educational organization, a favorable moral climate, cohesion and comfort. In addition, a special team building program should work at the academy.

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