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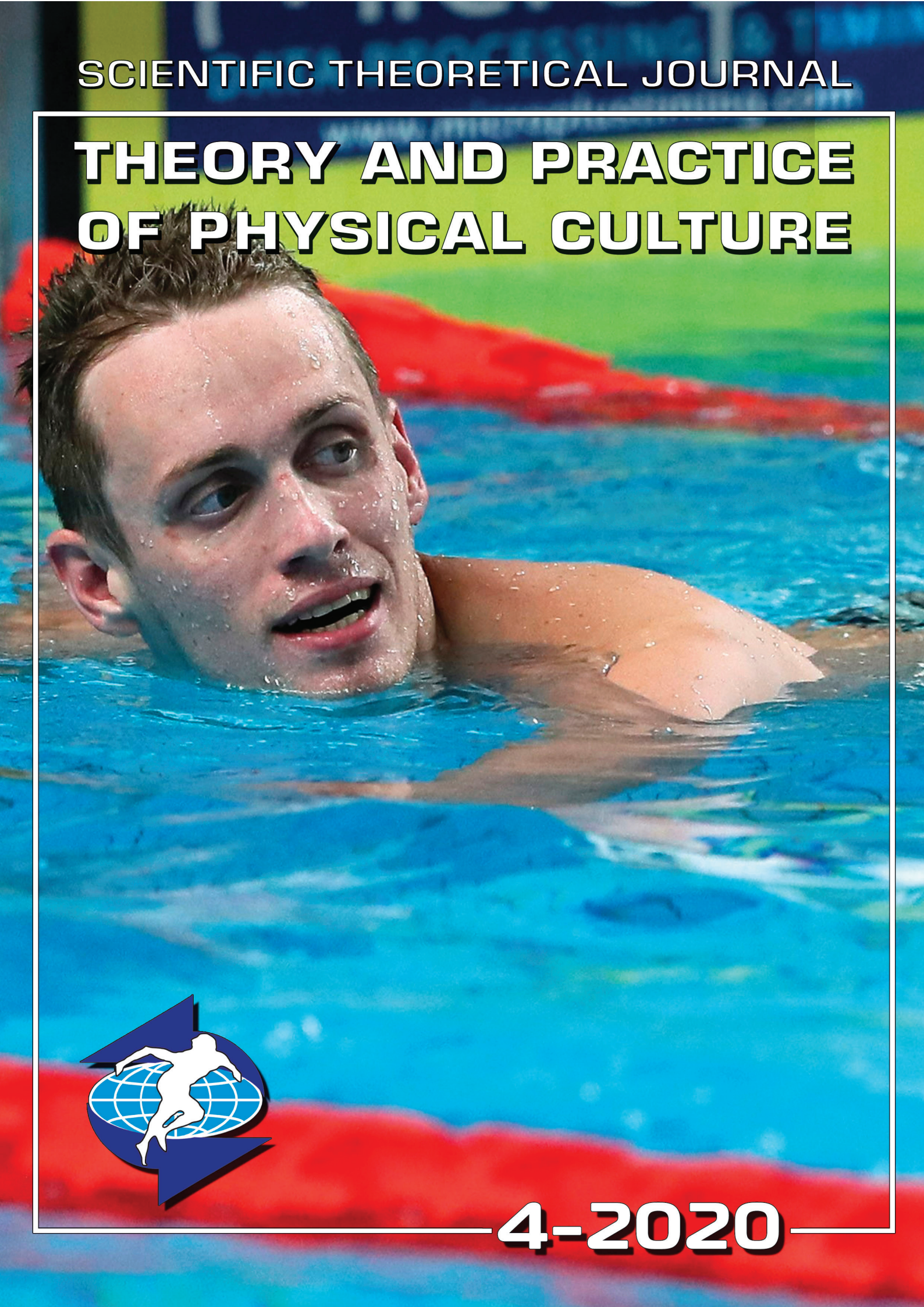

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Contents

VOCATIONAL PHYSICAL EDUCATION LEVELS: CURRICULA INTEGRATION CONCEPT

UDC 796.077.5

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Annotation

Objective of the study was to scientifically substantiate the pervasive content of vocational physical education with due succession in structuring of educational materials at different levels of student course.
Methods and structure of the study. We analyzed the subject matter of the disciplines being included in the curricula of various levels of student course under Block 1: for higher education - a total of 56 disciplines; for secondary vocational education - a total of 23 disciplines, and 3 professional modules.
Results of the study. Each level of student course includes a discipline that terminates the educational cycle (not a cycle of disciplines), i.e. all disciplines are logically completed with a "mega-discipline", which contributes to the formation of basic qualities of a future specialist. At the same time, at the basic level, there are also mega-disciplines of the lower level, the knowledge domain of which expands and breaks down into independent disciplines, historically derived from the main course units. Originating from a mega-discipline in vocational education, they culminate in a mega-discipline of the highest level. This is how a full educational cycle terminates. The principle of succession implies that academic disciplines are to be preserved in an integrated curriculum, as provided by the standards for the levels of student course in the secondary vocational and higher education systems, and that their content is expected to be developed on the basis of previous education levels. The principle of continuity implies the absence of temporary gaps in the process of mastering academic disciplines of the professional module and part of the educational relationships formed between the participants. Almost all disciplines are studied continuously. Continuity of the educational process creates an effect of logical completeness of the student course.
Conclusion. At Churapcha State Institute of Physical Culture and Sports, they built up the pervasive content of vocational physical education based on due succession in structuring of educational materials. At the same time, they ensured the completeness and inherent value of each training stage.

Keywords: *integration, vocational physical education, continuity, succession, curriculum, interdisciplinary basis, special vocational education, academic education.*

Background. Modern physical education service is multidimensional i.e. may be provisionally categorized into at least general, special and vocational physical education service. General physical education service is provided (as a process and result) by schools, gymnasiums, colleges, technical schools and universities. Special physical education services are provided by the children and youth sports schools varying in the types and missions. As to the vocational physical education service, it may be defined as more specific and designed on a sound socio-philosophical, biomedical, psychological and pedagogical basis so as to effectively control the physically educated personality formation process and sports trainings – and successfully employ the physical education service resource for the therapeutic, rehabilitation, military training and other missions. The vocational physical education service is provided by the secondary education system (schools, colleges, technical schools) and higher education establishments. Traditionally every education stage sets for the trainees a certain social service goal that largely overlaps the primary goal of the next training stage; whilst the stage mission is always to secure a reasonably complete education. The system, however, allows those who have not completed the prior education stage to qualify for the next education stage – that means that the entrants to either stage may widely vary in their background trainings.

Objective of the study. Was to provide a theoretical basis for an integrated vocational physical education curricula with a clear hierarchy and harmony of the education service stages.

Methods and structure of the study. We analyzed the education curricula in module 1 of the standard academic education curriculum including 27 obligatory, 17 basic and 12 optional disciplines; and the secondary vocational education curriculum broken down into the GHSE (general humanitarian and socio-economic cycle including 8 disciplines; NS (natural sciences and mathematics cycle including 3 disciplines); and GVD (general vocational disciplines – 12 disciplines in 3 modules). We used the V.V. Zhebsainom's method for analysis.

Integration may be interpreted as the process and result of an inextricable unification of many elements, i.e. "a system movement and development process with the growing elementary interactions and their intensities, with the mutual elementary connection intensified and the relative independence of the elements restricted" [4]. It is not enough for an analysis to track the connections as such from their point of emergence to their established relationships. It is important to understand exactly how this connection occurs. The concept of integration may equip us with the knowledge and method to design a didactic process for an integrated system.

The existing academic teaching practices need to updated on a creative basis pursuant to the Concept of the Federal Education Service Development Program for 2016–2020 approved by the Government of the Russian Federation Decree No. 2765-r dated December 29, 2014 and to comply with the new-generation FSES that give a special priority to the general cultural and vocational competences. A teacher is expected to excel the educational service by the efforts to encourage the students' cognitive qualities and thinking skills, motivate them for learning, and help develop their vocational competences in the general cultural domain.

Integrative processes in the educational system are manifested in every service component. Education curricula integration means the unification of the educational service elements, modules and components in every disciplinary field and across them. The initiatives to ensure interdisciplinary connections in the curricula may include: coordination of subjective knowledge; coherence and continuity of the curricula; integration and harmonization of the educational materials around the core ideas and fields for cognition.

In the early 1990s the national educational system experiences a mass supply of various integrated courses which were designed to bridge the well-known serious gaps and deficiencies in the traditional educational service, particularly the fragmentation of the academic disciplines that gave virtually no chance for the students to develop a holistic world outlook, etc.

For the last few years, the national research community has come up with many study reports on the education service integration in the general and vocational education systems (V.S. Bezrukova, A.P. Belyaeva, M.N. Berulava, V.V. Guzeev, Y.S. Tyunnikov, O.M. Kuznetsova, L.D. Fedotova, N.K. Chapaev et al.). The study reports have analyzed different integration levels on the whole and the training material integration solutions in particular, with every of these integration levels implying a certain degree of interconnections of the educational service elements.

In addition, due consideration should be given to the horizontal and vertical correlations of the integrated objects, with the horizontal integration links established between the studied disciplines, their elements, human progress aspects (intellectual, spiritual, moral, labor, physical, aesthetic, communicative, etc.), individual personality qualities, key education technologies, models, methods, teaching tools etc. Subject to the vertical integration are vocational education service levels, general and vocational objects, different social roles accessible in every life stage, individual qualities etc. Vocational education service integration by an educational establishment implies the following:

- Integration of educational curricula, with a special priority to the staged education process continuity and harmony; and
- Interdisciplinary integration, with the relevant connections.

The national educational system has accumulated valuable experience of successive educational curricula in the secondary vocational to academic education model in related specialties. This experience and training model gives a frame solution for the problem since the study fields of the secondary vocational and academic education systems are the same for the related specialties.

Results and discussion. The Churapcha State Institute of Physical Culture and Sports (CSIPCS) faculty has successfully implemented an experimental integrated Continuous Regional physical education Service Curriculum that covers the preschool, school and university physical education service domains. Content of the experimental physical education service curriculum was formed via integration of the ethnic and federal physical education curricula [1] into an integrated network of continued education designed to form a holistic personality, with a special attention to the ethnic physical education domain. The experimental physical education service curriculum includes the following 4 stages:

Stage 0 is the preparatory preschool physical education service stage for the early physical development;

Stage 1 is the elementary school (grades 1–4) physical education, with the school securing a gradual transition to the developmental education service, and with the children encouraged to opt for certain sports groups;

Stage 2 is the basic physical education (grades 5–8) with sports classes composed since grade 5 and with every student specialized in the preferred sport;

Stage 3 is the pre-vocational training stage (grades 9–11) with an advanced pre-vocational training service; and

Stage 4 is the vocational training (vocational physical education) period.

This particular integrated physical education specialist training model secures integration of two general vocational physical education service stages namely: secondary vocational education plus the academic bachelor (stage 1) and master (stage 2) education levels. The integrated physical education curriculum was developed based on an analysis of the internal logics and requirements of the

relevant state education standards, since they formulate the federal requirements for the vocational education service in every stage.

Every discipline in the staged education curriculum is expected to build up the required specialist's qualities, competences and skills, although the practical disciplinary inputs may differ. Some disciplines will form only a minor part of the future specialist's competences and skills. For example, the Physical Education and Sports Theory and History discipline at the special vocational physical education stage forms competences in the Fundamentals of the Physical Education and Sports Theory and Practice at the academic education level. On the other hand, there are a few secondary vocational to academic education-level and academic-level disciplines that form almost every specialist quality – for example the Vocational Sport with Training and Competitive Event Management Service Basics discipline at the secondary vocational to academic education level and Sports Training Technologies in Vocational Sport discipline at the academic level.

Thus every level includes some discipline that consolidates and finalizes the education cycle (different from a cycle of disciplines), i.e. a cycle of disciplines is logically crowned with this "mega-discipline". Even the prime-level disciplines are consolidated by the lower-level mega-disciplines which subject areas include the elementary independent disciplines as dictated by the historical segmentation (for example, Pedagogy discipline in the secondary vocational to academic education). Such discipline completes the educational cycle. The key difference of the secondary vocational to academic education and academic education curricula is the interpretation of the subject areas in terms of mega-discipline Pedagogy and pursuant to the secondary vocational to academic education / academic education service missions and goals.

The Churapcha State Institute of Physical Culture and Sports faculty developed the integrated curriculum on the common principles of consistency and concretization of general didactic units in mega-disciplines and other disciplines, plus the following principles:

Succession principle that implies that the integrated curriculum includes the secondary vocational to academic education / academic education disciplines, with their contents being developed based on the prior education levels.

Continuity principle that secures the time gaps in the vocational module being bridged, with virtually all disciplines studied on an uninterrupted basis. Continuity principle in the studies ensures the academic subjects being logically complete and harmonized so that the teacher and student could: highlight the basic didactic units in the educational materials; generalize them; develop a holistic perception of the educational material; and successfully form a systemic knowledge base for practical service.

Conclusion. The Churapcha State Institute of Physical Culture and Sports faculty has successfully developed and implemented the integrated vocational physical education curricula with a clear hierarchy of the educational service stages so that every stage secures a complete and values-centered education.

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REGIONAL PHYSICAL EDUCATION AND SPORT TRAINING SYSTEM BUILDING CONCEPT FOR SAKHA REPUBLIC (YAKUTIA)

UDC 351.855.3:796

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Annotation

Objective of the study was to develop a concept for building a regional system of physical education and sport and recreational activities aimed to improve the physical condition of the population in the North.
Methods and structure of the study. The study involved general and specific theoretical and empirical methods of research. The proposed system includes a combination of scientifically grounded means, methods and technologies of physical activities of the population of different age groups, which reasonably integrates with the educational and household activities of the people of the Sakha (Yakutia) Republic. The study was carried out in three stages in accordance with the state orders of the Ministry of Education and Science of the Republic of Sakha (Yakutia) and Ministry of Sports of the Russian Federation from 2011 through 2018.
Results of the study. The data obtained during the study revealed a new scientific understanding of the essence of physical culture as a tool to improve the quality of life of the population in the North through the prism of a system approach to the physical education and sport activities. The ascertaining experiments we had conducted served as a prerequisite for the development of the concept and the system itself, since our findings helped prove the dependence of life quality on man's physical condition, determine the motivational and value orientations of different socio-demographic groups of the Sakha Republic (Yakutia) in terms of their physical condition and physical education and sport activities, assess the effects of the climatic and geographical environmental conditions in the North of the Russian Federation on physical health of the population and characteristics of psychophysical condition of the population of the central regions of the Republic of Sakha (Yakutia).
Conclusion. The proposed system was introduced into the work of preschool, secondary and higher vocational education institutions, departments of physical education and sport, health and fitness clubs working with adults in the rural municipal districts and the city of Yakutsk of the Republic of Sakha (Yakutia), and was proved to be relevant and effective.

Keywords: *concept, system, physical education and sports, Republic of Sakha (Yakutia), physical health, physical fitness.*

Background. Presently the lifestyles on the Russian North are being transformed with the share of physical labor rapidly contracting and physical inactivity being increasingly typical for every age group; with the socio-economic progress and urbanization processes in the area associated with serious environmental damages, unhealthy nutritional habits and other negative factors. As reported by the national statistics of 2018 with the life quality ranking list (based on comprehensive analyses of 70 life quality rates in every social sphere), the Republic of Sakha (Yakutia) was ranked number 72 among the Russian Federation constituents. Challengers of the Northern climate with its hardships such as extreme cold, rapid changes in air temperatures, electromagnetic fields and atmospheric pressures – are known to be of serious effect on the individual adaptability resource and physical health on the whole. These extreme and combined health risks are known to trigger multiple pathologies and health disorders [7, 11, 13].

Leading Russian scientists have always emphasized the need for physical activity for better adaptation to the modern lifestyles, with every initiative to protect and improve physical, mental and social health viewed as prerequisite for successful professional service and good living standards of the national population. Local physical education and sport service infrastructure is commonly considered among the key mechanisms for the public health improvement initiatives as it provides a sound foundation for the communal physical progress and health centered activities [1–6, 8, 9, 12].

Objective of the study was to develop a regional physical education and sport / health service building system for the Russian North with a special priority to the communal physical health improvement aspects.

Methods and structure of the study. In our efforts to develop the regional physical education and sport/ health service building concept prioritizing the communal physical health improvement aspects, we were governed by the theoretical and empirical system development concepts offered by the leading national scientists and founders of scientific schools on system research theory and practice, namely I.V. Blauberg, E.G. Yudin and V.N. Sadovsky [2, 10].

Results and discussion. The regional physical education and sport/ health service system was designed on the following fundamentals:

– Focus, integrity, structuring and integration of the system components (modules) geared to improve the physical health standards;

– Consistent design, with a special emphasis on special projects to develop the communal physical education and sport infrastructure, methods and tools;

– Hierarchical design i.e. the ordered structure of the system components with the interconnection levels and a few subsystems geared to attain the system mission in terms for the communal modern physical education and sport service for every population group;

– Dynamism, i.e. the system responsiveness with its qualitative and quantitative parameters being easily adjustable when necessary;

– Adaptability of the system to the specific environmental conditions of the Russian North;

– Effectiveness of the system in physical fitness, life quality, functionality and psycho-emotional wellbeing protection and improvement aspects;

– Controllability of the system, with its design, applied tools, methods and provisions for the physical education and sport service being customizable to the group physical health rates; and

– Multiplication i.e. the system implementation experience and benefits dissemination in the other regions of the Far North.

The basic design principles of the regional physical education and sport/ health service system were as follow:

– Customization of physical health initiatives to the environmental factors of influence;

– Unity of motivations, values, ethnic cultures and traditions and the physical health methods;

– Correlation of the life quality with the physical health methods; and

– Consistency of the physical health test tools with their customization to the regional specifics; and

– Continuity.

The system content includes the relevant physical education and sports methods, tools and provisions to facilitate popular physical health initiatives in Yakutia using the most effective social communication channels for the local physical education and sport service promotion. The system has the following main functions: social, pedagogical and cultural. Being a part of the general social and individual culture, modern physical education and sport shall cater for the key social need – that is to facilitate the individual physical progress and thereby meet many social and natural needs and expectations. The regional system design concept was compliant with the common principles of the Russian physical educational system with a special emphasis on the cultural aspects of the physical education process with the relevant general cultural, socio-cultural and ethno-cultural values of the physical education and sport service to encourage progress in positive personal qualities, self-improvement and self-development aspects, motivations and healthy lifestyles.

The regional physical education and sport system consists of 4 units/ components, namely the diagnostic, information, physical health progress test/ control and implementation ones interconnected in their functionalities. These components may be also viewed as the subsystems with their internal and external connections and specific essential features as dictated by their joint mission.

The diagnostic unit of the system implies diagnostics of the local socio-economic, climatic, geographical factors of influence on the popular physical health standards; physical health monitoring methods to test and rate the life quality standards, motivations, values and priorities in the regional communities.

The physical health progress test/ control unit includes the psychophysical health test toolkit, with the periodical tests in every project stage/ age group as follows:

– Preschool population physical health tests and analyses to profile the physical health variations versus the regional "Canchaeri" health standards and the age-specific GTO Complex test standards;

– School population physical fitness tests based on the regional "Erel" standards and the age-specific GTO Complex test standards;

– Unsporting university population physical fitness tests based on the regional physical education and sport standards of our own design and the age-specific GTO Complex test standards;

– Sporting university population physical fitness tests based on the regional "Maarykchaan" standards and the age-specific GTO Complex test standards;

– Adult population physical health / physical fitness / functionality tests in communities to form the regional communal health database;

– Age group physical health / physical fitness and mental health tests and analyses using innovative test tools, software and equipment; and

– Communal physical health data processing and analyzing tools ranging from the individual health self-test/ control records to modern information and test technologies.

On the whole the physical health progress test/ control unit gives the key data to rate the communal/ individual life quality standards, health/ physical progress motivations and preferences and physical progress agendas and prioritize the physical education and sport models and tools.

The information component is designed for the physical education and sport service promotion through the local mass media organizations including television, radio; social/ education/ elucidation networks; healthy lifestyle promotion platforms; publications to cultivate a healthy demand for physical trainings and sporting lifestyles; programs to

help master the basics of modern hygiene, diets, labor and rest regimes; public awareness and consulting on a group/ individual basis; promo/ advertising materials (handouts, audiovisual, street ads etc.); health/ physical education and sport sections on official websites of the relevant organizations and institutions etc. It should be mentioned that our studies found a high popular demand (particularly in the middle–age and senior groups) for basic information on healthy lifestyles and popular physical education and sport services in the region.

We selected and classified the educational models and tools for the regional physical education and sport system based on the general principles of education and tutorship, with the core group including the traditional and supplementary physical education tools (with an emphasis on special selected national/ ethnic physical education traditions/ tools), general educational and specific physical education models.

Our multiannual practical research activity and educational experience have showed benefits of the education and upbringing models, methods and tools customizable to environmental specifics and socio–biological contexts by the regional/ communal physical education and sport service provisions. The optimal combinations of national and international traditions with gradually improved education materials reasonably factoring in the local ethnic/ national specifics – have proved beneficial in a few test regions. Generally the Northern ethnic groups are known to develop for their long periods of evolution large arsenals of the traditional physical education methods, active games and sports that may be rather beneficial for the modern communities when organically included in the modern physical progress/ health service models, particularly for children and adolescents, with a special priority given to the harmonized progress of the young people's motor qualities and skills.

Therefore, the physical health progress test/ control unit in the regional/ communal physical education and sport service system includes a wide variety of the physical education and sport methods, models and tools with the relevant provisions to facilitate physical progress and wellbeing in the Yakut education system, physical education and sport sector, health associations, industries and communities all over the Republic.

Conclusion. The regional physical education and sport/ health service building system for the Russian North with a special priority to the communal physical health improvement aspects analyzed herein has proved beneficial and enjoyed a growing public demand since it has been implemented in the regional preschool, secondary school and academic vocational education systems, local physical education and sport service organizations and communal physical education / health sport clubs in rural municipalities and in Yakutsk city in the Republic of Sakha (Yakutia).

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MORALITY CULTIVATION MODEL FOR PROFESSIONAL PROGRESS OF FUTURE PHYSICAL EDUCATION AND SPORT SPECIALIST

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Annotation

Objective of the study was to develop a model of formation of morality as a factor in improvement of professional skills of future physical education and sport specialists.
Methods and structure of the study. The educational experiment involved the 2nd- and 3rd-year students of the Physical Education and Sport Faculty of FSBEI of HE Ulyanovsk State Pedagogical University named after V.I. Ulyanov (n=36), who made up the Control and Experimental Groups, 18 students each. The Control Group subjects were trained according to the traditional physical education program. In the Experimental Group, the training process in the sport disciplines and professional-pedagogical sports skills perfection process were focused on the formation of personal qualities as required by the orientation of future professional activity.
Results of the study. We developed a model of formation of morality of future physical education and sport specialists; disclosed the contents of its main components. The results of expert evaluation of the students' personal and business qualities during the preparation for the role playing games and participation in them showed that the Experimental Group subjects had a higher level of formation of the leading personal qualities, organizational and pedagogical skills. The results of the educational experiment testified to the effectiveness of the model as applied to the process of training of the students of the Physical Education and Sport Faculty.
Conclusion. The search for the ways to effectively control professional becoming of graduates of the Physical Education and Sport Faculty should be viewed in conjunction with solution of personality formation issues. The problem of personal development of future physical education specialists is among the fundamental ones in the system of vocational training and arises from the need to understand personality traits of a future teacher, his value orientations, and behavioral characteristics.

Keywords: *morality, motivations, values, professional identity, graduates, Physical Education and Sports Department, professional service, model, professional sports specialist excellence.*

Background. University graduates may be viewed as a valuable human resource and progress driver for the national education system, modern technologies and industries, i.e. the future national intellectual elite. The human resource morality (that may be interpreted as the ability to establish healthy social relationship and assess every social event and phenomenon in the categories of right and wrong) largely determines the professional service quality in every professional service progress stage. When the individual morality of a physical education and sport service specialist is substandard, even when the professional competencies and skills are well developed, his/ her teaching or coaching service may never be productive and successful [1, 4, 5].

Objective of the study. Was to develop and test benefits of a morality cultivation model for professional progress of the future physical education and sport service specialists.

Methods and structure of the study. We sampled for the new morality cultivation model testing experiment the 2– and 3–year students (n=36) of the Ulyanovsk State Pedagogical University's Physical Education and Sports Department split up into Experimental and Control Groups (EG, CG) of 18 people each. The CG was trained as required by the standard curricula; and the EG was trained so as to cultivate high morality with valuable personality qualities of special benefits for the professional service in the vocational sport disciplines and professional sports specialist excellence (PSSE) disciplines.

Results and discussion. Trainings in the vocational sport disciplines and professional sports specialist ex–

cellence (PSSE) disciplines give a special priority to the key personality qualities of the future specialists including perseverance, integrity, decision-making, responsibility, willpower, and resource mobilization in the challenging professional service situations. It should be mentioned that the joint academic studies always develop in students the ability to recognize and appreciate valuable personality qualities in their teammates, differentiate the individual business-specific and personality traits, and, hence, develop their own pedagogical service styles customizable to the individual qualities of the trainees.

Underdeveloped morality is known to be associated with remissness and dishonesty in academic studies with the desire to gain for free, with minimal efforts, and these corrupt behavioral models cannot but later on manifest themselves in the professional service. It is not unusual for the theoretical and practical trainings to put the students in the situations of choice when he/ she may either honestly solve the problems in the self-reliant trainings with no control/ assistance from the teacher (as is the case in the cross-trainings and other independent training models) or abuse the situation to ease the workload. Particularly disruptive for the further professional growth and integrity is the fact that the dishonesty may become habitual and detrimental for the professional competences, skills, personality qualities and future career, values and lifestyle on the whole [2,3,5].

We have developed a morality cultivation model (see Figure 1 hereunder) for professional progress of a future physical education and sport specialist including the following components: professional service motivations; professional service goal-setting; plus the key personality qualities building methods and tools customizable to the service responsibilities. It is the professional service motivations that largely determine the student's attitudes to the academic studies and progress and his/her commitment for creative and cognitive research and growth. We have classified the Physical Education and Sports Department students' professional service motivations as follows:

– *Master, on a systemic basis, modern professional service competences for success*, with a special role played by the self-reliant supplementary studies. Motivated students actively contribute to every creative/ research project or event; and are highly successful in every academic work and initiative due to such moral qualities as determination, initiative, independence, responsibility, efficiency, discipline, etc.;

– *Master the professional knowledgebase and practical skills* to successfully qualify for a good well-paid job with the desired progress opportunities. Motivated students normally work hard and reputed as diligent executives demonstrating reasonably humble progress ambitions. Their moral qualities include conscientious attitudes to the studies, diligence, discipline, responsibility and independence;

– *Get higher education and find a good job.* This group tends to learn hard mostly for the academic credits. Their moral standards are generally lower than the above in terms of responsibility, diligence, professional ambitions and self-assertion agenda.

Goal-setting is one of the key components of the new model. A student's ability to set individual goals based on the actual motivations and needs for successful professional service helps form the key personality qualities including determination and responsibility. The goals depend on what the student's ambitions and expectations are in the professional service domain – Innovative teaching, national team coaching, management career, etc. Every of these specializations shall be supported by the relevant personality/ business qualities and driven by one of the

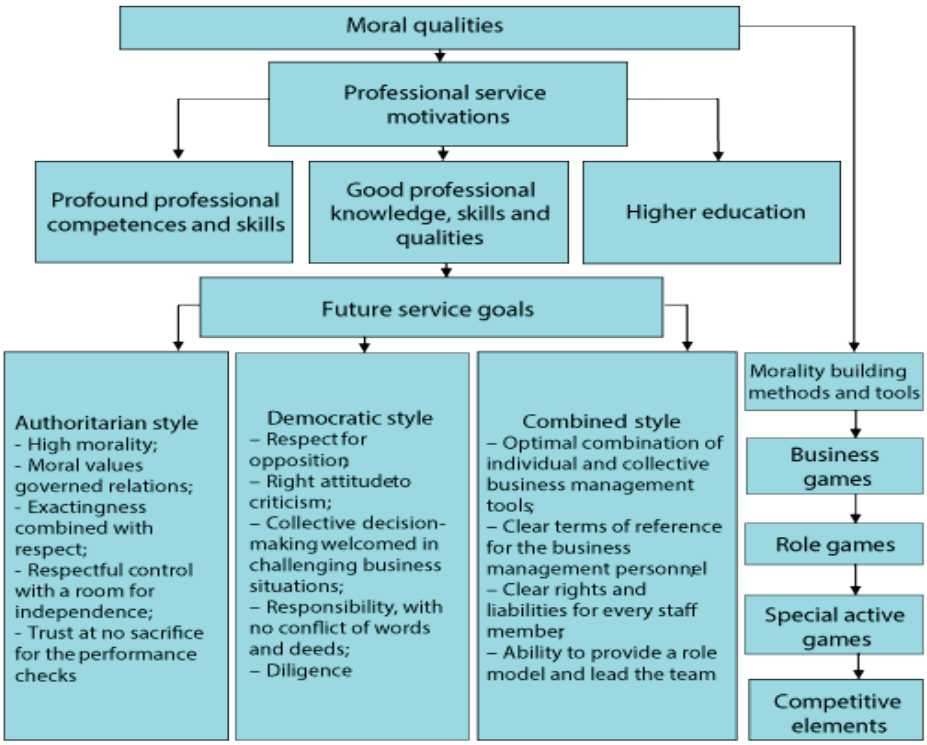

Figure 1. *Physical education and sport specialist morality cultivation model*

management styles i.e. authoritarian, democratic or combined. Each of them has its requirements to the personality qualities, whilst the actual choice of the style may be dictated by the professional service specifics and individual traits of the physical education and sport specialist. The academic trainings mimicking the sports management/ coaching practices with different didactical styles may be tested in a variety of active games and modeled situations. These games and models has proved beneficial for the personality qualities profiling, analyzing and improvement purposes when supported by the individual correction and excellence tools applicable in the academic trainings.

The physical education and sport service mimicking games offer a few roles for the students including "teacher", "excellent student", "top-skilled sporting student", "unhealthy student qualified with a special health group", "lazy student", "cheeky student", "student who lost his sports uniform", etc. The role games are strictly individual, with every actor expected to keep within the social frame of the role.

For example, the core idea of "I am a teacher" game is that a student runs a lesson acting as a teacher for the group widely varying in the personality qualities and academic progress rates. The game "I am a referee" trains the refereeing skills, with the student expected to be fair and expressly impartial dealing with the players and teams when settling the modeled conflict situations. A special attention will be given to the referee's authority with the ability to justify his viewpoint and win trust of the competing teams. The referee must show profound knowledge of the rules of competition, perfect restraint, composure, firmness, perseverance and integrity. Such role games have proved highly beneficial for the specific educational missions as they facilitate the morality cultivation process to consolidate character and style of the future teacher.

The model testing academic experiment had been run for an academic year. Business and role games were designed to develop specific personal qualities, attitudes, volitional aspects, worldviews etc., with every game modeling some professional-service-specific situations. Prior to the games, the students were briefed on the game goals, requirements and necessary preparations, plus were given recommendations on what individual qualities/ skills should be given a special attention in the professional service modeling practice. In reflections and collective analyses after every game, the individual successes and failures were constructively discussed, with every execution drawback analyzed and corrective measures spelled out in detail.

In the academic experiment, the EG and CG were tested in a business game and role game, with the average group qualities and skills tested by qualified teachers on a 5-point scale. The pre- versus post-experimental tests found the CG making progress from 3.21±0.24 to 3.51±0.24 points ($p>0.05$) in the business game; and from 3.42±0.19 to 3.69±0.22 points ($p>0.05$) in the role game; versus the EG that made progress from 3.48±0.26 to 4.15±0.32 points ($p<0.05$) in the business game and from 3.31±0.27 to 4.06±0.35 points ($p<0.05$) in the role game. Therefore, the new model testing academic experiment showed benefits of the morality cultivation toolkit as verified by the significant progress of the EG versus CG in the pre- versus post-experimental business game and role game tests.

Conclusion. A sound morality shall be ranked among the key prerequisites for successful professional growth of university graduates and their progress in every aspect in the practical education service. Modern academic education needs to prioritize not only the educational and professional competence building missions but also facilitate progress in the professionally valuable personality qualities of a future teacher based on the high moral and ethical standards.

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HEALTHY LONGEVITY AS NEW MULTIDISCIPLINARY RESEARCH AREA FOR PHYSICAL EDUCATION THEORY AND PRACTICE

UDC 796.011.3

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Annotation

Objective of the study was to substantiate the need to raise the theory and practice of physical education focused on the improvement of healthy longevity to the meta-subject/ interdisciplinary level.
Methods and structure of the study. Definition of the concepts "physical education" and "healthy longevity"; analysis of the articles by the foreign and domestic authors devoted to the phenomenon of healthy longevity published over the past 20 years; determination of the range of the most important and most cited publications based on the results of the most significant researches in the academic fields related to the problems of aging, mortality, life expectancy and longevity.
Results of the study. The analysis of the most significant longevity-related publications revealed that this topic is of interest to representatives of psychology, gerontology, medicine, sociology, political and cultural sciences. The publications of the domestic and foreign authors devoted to the phenomenon of healthy longevity were found to contain the following scientific prospects for addressing the problem: medical, sociological, psychological, politological, philosophical, pedagogical, cultural, gerontological, genetic, physiological, as well as combinations of these approaches. As follows from the literature analysis, over the past decade, there has been a growing trend among explorers of the phenomenon of healthy longevity towards rising to the interdisciplinary level, as well as a growing number of publications, which authors acknowledge a variety of factors affecting longevity or influencing the process of people's aging.
Conclusion. The study of healthy longevity can become a special direction in the theory and practice of physical education, a new branch of knowledge that combines the empirical data obtained by the representatives of natural and socio-humanistic sciences.

Keywords: *physical education theory and practice, healthy longevity, multidisciplinary approach, new research area, physical activity.*

Background. Modern theoretical and practical developments appear to increasingly provide grounds for the active longevity and inspire the relevant natural expectations fuelled by the eternal dream of humanity about immortality. Many natural sciences have been sensitive to these expectations in their recent studies. One of the key problems of such research efforts, however, is that longevity is never unhappy and unhealthy in the collective and individual expectations whilst neither health nor happiness are the biologically guaranteed phenomena and, therefore, the active longevity centered initiatives need special contributions from not only natural but also social and humanitarian sciences.

Objective of the study was to demonstrate the need for the healhty longevity research in the physical education theory and practice being desinged on a mutidisciplinary basis.

Methods and structure of the study. We analyzed for the purposes of the study the physical education concepts with concern to healthy longevity as addressed and presented by the national and foreign study reports for the last two decades, with a special attention to the most relevant and cited publications and findings on the key issues of aging, mortality, life expectancy and longevity.

Results and discussion. Multidisciplinary research projects and approaches with contributions from many sciences (genetics, physiology, psychology, sociology, cultural science etc.) offer great benefits as far as the phenomenon of longevity in concerned. Our analysis of the longevity-related research has demonstrated a growing interest in this issue from modern psychology (including the social psychology), gerontology, medicine, sociology (and sport sociology in particular), political science (particularly in the "life and power" aspects), and cultural science (in "culturally predetermined life expectancy" etc.).

Thus an article by A. Devereux-Fitzgerald, R. Powell, A. Dewhurst, and D.P. French in the Social Science & Medicine Journal (2016) explores correlations between physical

activity and healthy and happy longevity (note that faith and happiness are rather philosophical categories) [9]. The authors found that seniors tend to find joy and pleasure in social contacts that in their turn often motivate them for physical activity. Moreover, the study found that senior people often consider physical activity an effective tool to maintain their social connections. It is not unusual that doubts of senior people about their own physical capacities and the actual benefits of a reasonable physical activity were removed by their first functional and psychosocial improvements and other successes in such joint trainings. As soon as the sampled seniors realized the connection of their health progresses with the physical activity, they showed a growing commitment for the physical practices. It was also found that the growing knowledge of the own resource due to the well-designed physical trainings facilitated their competency and activity in other spheres of life. The authors conclude that commitment of the senior groups for special health events/ movement may not be guaranteed when supported by only focused campaigning to update them on the role of physical activity for healthy longevity. Much more promising in this respect are the efforts to emphasize the entertaining aspects of the habitual physical activity and its social connections related benefits – since such joy- and socialization-centered approach apparently brings fast benefits for the individual well-being.

One more article in Health Psychology Journal (2014) concludes that the individual belief in own ability to turn back to trainings, despite their irregularity and still non-perceived health benefits, was more important for the physically active lifestyle than the habit for physical practices as such [10].

Our analysis of the recent publications showed that the research community tends to increasingly tackle the longevity related issues on a multidisciplinary basis, with more and more researchers acknowledging the fact that longevity and aging process depends on multiple factors of influence. Thus a study report "Cross-Cultural Studies of Biological Aging" emphasized not only biological, but also cultural and environmental factors of influence on the aging processes [8].

One more study report identified many factors of influence on the senior people's physical activity including the demographic, psychological, social, environmental, interference/ external pressure determinants etc. Still underexplored on this list appear to be the genetic determinants and public policies related determinants. The study underlines the promises of an interdisciplinary research format to integrate the relevant theoretical (genetic, physiological, psychological) concepts and approaches [11].

Furthermore, V.H. Menec, S. Shooshtari, S. Nowicki and S. Fournier emphasize the importance of sociological and cultural contributions to the longevity research projects. They found that population of the most vulnerable and poor areas is much higher exposed to risks of many diseases including arthritis, diabetes, hypertension, heart failure, coronary heart disease, chronic lung disease, depression and stroke – than more developed nations; with the income gap particularly telling on the health standards of the 65-75 and 75+ year-olds [12].

Our analysis of the national research in the longevity related issues found the research community giving a special priority to the following aspects: medical [4], psychological [7]; socio-psychological [1]; philosophical and cultural [6]; with the healthy longevity related issues most often addressed by the national medical science and gerontology [2]; and still underexplored by the national adaptive physical education sector [3].

It may be fair to mention one more field of the interdisciplinary research at the junction of national pedagogy and psychology that self-identifies itself as a health science and even "health art'. Its proponents, however, have succeeded only in public declarations as yet and are known to erroneously see no difference between the "teacher's service to secure students' health" and the "self-reliant individual health protection activity' [5].

Conclusion. Modern physical education theory and practice need to address the issues of health and happy longevity on an interdisciplinary basis to harmonically integrate a wide diversity of research projects and visions in the efforts to meet the challenges for the physical education theory and practice in this field; with every research project in this field extensively using and combining the relevant synthesizing, integrating and generalization toolkits. Health longevity research may evolve into a special field for the modern physical education theory and practice and potentially into a new science to effectively combine empirical data on the issue generated by the modern natural and social sciences.

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PRESCHOOL FOOTBALL BASICS TRAINING MODEL: HEALTH BENEFITS

UDC 79+591.139

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Annotation

Objective of the study was to theoretically substantiate new directions in the organization of children's physical education contributing to the improvement of their health.
Methods and structure of the study. Sampled for the educational experiment were 16 boys aged 5-6 years and their parents aged 30-36 years, as well as 8 grandparents aged 48-64 years, all living in Ulyanovsk and engaged in the physical education activities in a family and street environment. They were divided into the Control (CG) and Experimental Groups (EG), 8 children and 4 adults each. The study involved the physiometric research methods and motor qualities tests. Among the sports games, mastering of the elements of which ensures the development of motor-coordination qualities and which are accessible to preschool children, football is by all means more preferable. The game elements were mastered by using the football techniques evaluated by the specially developed criteria (according to a 5-point system).
Results of the study. When comparing the growth rates of the indicators of technique of playing football and functional fitness indices in the process of physical education in the family and street environment, it was found that in the EG, the test rates were significantly higher in terms of all the studied technical fitness indicators. The functional indicators in the EG children also improved as opposed to a slight change in the CG.
Conclusion. Introduction of physical education in the family and street environment into the daily life of preschool children was proved to be effective, which was determined by the choice of the most common sports games, for instance, football, which elements had been well mastered by senior family members.

Keywords: *preschool football, physical activity, physical education service, physical fitness.*

Background. Modern physical education and sports offer a powerful developmental, educational and cultural resource for progress. Physical education and sports activity associated with a reasonable self-restraint and supported by fitness/ functionality tests includes health-prioritizing leisure-time active games for children and adults. Individual physical culture and sporting lifestyles need to be formed since the early days when the child enjoys physical activity knowing nothing of its developmental and health benefits. This underage need for physical activity driven by emotions is naturally associated with the willingness and fitness for physical progress and active muscle activity.

Objective of the study. Was to give theoretical grounds for and test physical progress and health benefits of a new preschool football basics mastering model.

Methods and structure of the study. Analysis of the relevant theoretical and practical study reports and our own studies have demonstrated that modern team sports may be ranked among the most efficient physical education and sports tools that may bring high health benefits conditional on habitual practices, good and steady motivations and optimal workloads on a positive psycho-emotional background. Based on the reference literature analysis and our own theoretical and practical experience, we found that the traditional household/ family sports offer the highest promises since it is natural for the family and neighbors to lure children in physical education and sports activity and healthy lifestyles. We also found the sampled preschoolers giving preference to football, apparently because this mass sport discipline leads in terms of popularity and accessibility.

Football may be defined as the health-enhancement anaerobic-aerobic sport discipline facilitating progress of the aerobic mechanisms of special benefits for children. The key football techniques include ball control, passing, tackling, dribbling and repossession [1]. Generally the active outdoor games and trainings with the stepped difficulty levels to spur up progress in physical fitness and qualities naturally developed in the ontogenesis help identify the genetically predetermined gifts, physical resource and potential progress paths and abilities [2, 3].

Prior to the new preschool football basics training model testing experiment, the preschool sample was tested for physical fitness and the basic football skills including ball control, dribbling, repossessions and shots on goal, with the performance rated on a 5-point scale using the following test criteria: ball control distance; size (diameter) of the dribbling spot; total moves in the repossession sequence and its time; and the total shots on goal with a success rate. The performance was scored as follows:

5 points: 5m straight-line ball control by both feet; dribbling within the marked spot; ball repossession by at most 10 precise moves for 1min; 5 accurate shots on goal out of 5;

4 points: 4m straight-line ball control by only one foot; dribbling within 20cm off the marked spot; ball repossession by 12-14 moves for 1min; 4 goals out of 5 attempts;

3 points: 3m straight-line ball control by only one foot; dribbling within 30cm off the marked spot; ball repossession by 15+ moves for 1min; 3 goals out of 5;

2 points: 2m straight-line ball control by only one foot; dribbling within 40cm off the marked spot; unsuccessful ball repossession attempt; 2 goals out of 5; and

1 point: ball control failure; failed dribbling after 3-5 moves; unsuccessful ball repossession attempt; 1 goal out of 5.

Results and discussion. The pre-experimental physical fitness and skills tests found no intergroup differences of the EG and CG ($p > 0.05$). The CG Physical Education course included hide and seek, tagged, plays with cubes in the sandbox, swings, carousel and moving board, under control of the families. The EG trainings were dominated by football practices, with the dads helping the children master the right kicking techniques, moves and postures, with a special attention to the foot position and angle on the ball, kicking point and ball aiming/ fly specifics, and particularly with encouragements like "well done!", "clever!", "very good ! ", "take your time", "don't hit so hard!" etc.

In the EG dribbling trainings, the fathers instructed their children that the key point is to wrong-foot the opponent by kicking light when pretending kicking hard, changing the movement line and never letting him guess where you go. The fathers corrected the techniques and offered next tasks as soon as the first signs of attention loss were noted. When mastering the ball repossession techniques, the fathers showed how it is done by the skilled footballers, what moves are critical for success, why hand contact is never allowed etc. The father was required to facilitate the child's progress by spelling out every move in the technique and praising every success and progress. Shots on goal were trained starting from 3m with a stepped growth of the shooting distance, with a special attention to the right shooting position, foot contact on the ball and the ball movement logics. After the football trainings, the EG was free to go for the favorite pastimes.

Post-experimental tests of the EG and CG were designed to find group progress after a one-year experiment, with account of the age-specific physical development patterns, natural changes in morphology and functionality in the ontogenesis; and the genetically predetermined specifics. The tests found that the systematic focused training of the EG were beneficial for progress in the sport-specific motor skills and coordination qualities with consideration for the natural ontogenetic progress: see the Table hereunder.

The pre- versus post-experimental tests showed benefits of the EG training model as verified by the EG versus CG significant progress in every football skill test. Thus in the ball control test the CG made progress form 2.03 ± 0.15 to 2.22 ± 0.18 points ($p > 0.05$); versus the EG progress from 2.05 ± 0.18 to 3.64 ± 0.31 points ($p < 0.05$). In the dribbling test, the CG made progress from 2.15 ± 0.16 to 2.48 ± 0.19 points ($p > 0.05$); versus the EG progress from 2.03 ± 0.13 to 3.32 ± 0.26 points ($p < 0.05$). The other tests showed much the same picture: meaningless progress in the CG versus significant progress in the EG.

We also tested the family assistants in the experiment for physical and functional progress. The tests found insignificant progress in the CG where the families were mostly passive - versus significant progress the EG where fathers had to rehearse every move in the training process and worked hard with the children. Thus the vital capacity (VC) tests in the CG found progress from 2.92 ± 0.26 to 3.01 ± 0.20 L ($p > 0.05$); versus the EG progress from 2.95 ± 0.19 to 3.39 ± 0.28 L ($p < 0.05$). The resting HR tests in the CG found progress from 75.3 ± 5.9 to 74.6 ± 7.5 bpm; versus the EG progress from 76.0 ± 6.9 to 71.8 ± 10.3 bpm ($p < 0.05$). Much the same progresses were found by the other physical fitness, health and functionality tests.

Conclusion. The preschool football basics mastering model tested by an educational experiment was found beneficial as verified by the EG versus CG progress in the physical development, physical fitness, motor skills and health tests. Systematic football practices of that kind may be recommended with assistance from the children's

Table 1. *Pre- versus post-experimental EG versus CG football skills tests, points*

Tested skills	Tests		
	Pre-exp. X±Sx	Post-exp. X±Sx	Progress, %
Ball control	2,03±0,15 2,05±0,18	2,22±0,18 3,64±0,31	8,66 43,69*
Dribbling	2,15±0,16 2,03±0,13	2,48±0,19 3,32±0,26	13,31* 38,86*
Repossession	2,24±0,17 2,17±0,19	2,34±0,15 3,08±0,21	4,38 29,65*
Shot on goal	2,32±0,17 2,33±0,21	2,41±0,20 3,71±0,26	43,38* 37,20*

*Note: CG and EG data in the numerator and denominator, respectively; *p <0.05*

families that were also tested with some progress in health standards as a result of the regular outdoor trainings. The age-specific physical trainings should be prudently customized to the actual interests and needs of the pre-schoolers, their physical fitness levels and developmental specifics. The football basics mastering model for the 5-6 year old preschoolers was also found entertaining and joyful for the children who were happy to train football in combination with the other popular outdoor active games, particularly with the highly authoritative and productive support from their families.

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CONCENTRATED TRAINING TECHNOLOGY FOR ACADEMIC ELECTIVE AEROBICS

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Annotation

Objective of the study was to develop a concentrated training technology that would enable to implement the principle of continuity of the training process and ensure an in-depth study of the discipline during aerobic practices.
Methods and structure of the study. The study involved monitoring of the effectiveness of the developed concentrated training technology, determination of the degree of adaptation of the 1st- and 2nd-year students to the proposed model during the aerobic practices, as well as a comprehensive assessment of the quality of training.
Results of the study. The final test results revealed a high level of knowledge, practical skills, ability to make use of the acquired competencies, positive dynamics of the students' physical, functional, psychoemotional test rates.
Conclusion. Concentrated training as a pedagogical technology, being one of the intensive teaching methods, enables to create balanced in content multilevel models of continuing education and implement them in the aerobic training programs, to build a learning path based on the individual characteristics of students.

Keywords: *aerobics, concentrated training, technology, students, physical education, healthy lifestyle.*

Background. Concentrated training may be defined as a special intensive education technology that requires the students to fast process and master the learning materials well – structured and classified within the timeframe of the regular curriculum. Essentially the concentrated training prioritizes the cognitive process continuity and integrity to: facilitate comprehensive learning; encourage students' independence and creativity; offer a wide variety of combined applied training methods and tools; and encourage cooperation of trainers and trainees [1, 2]. As far as the variety of modern concentrated training models tools is concerned, of special interest are the concentrated training application methods to supplement the academic physical education discipline. Elective aerobics course to supplement the physical education discipline offers high promises for practical concentrated training models since the modern physical education service prioritizes the mandatory variability of physical education classes conditional on the physical education service being harmonized and integrated.

Objective of the study was to develop and test benefits of an elective concentrated – training – based aerobics model to meet requirements of the progressive physical education service concept for students' physical progress in practical aerobics trainings.

Methods and structure of the study. We consider concentrated training among the highly promising modern innovative training methods due to its special benefits for the education service quality since the concentrated training:

- Helps harmonize and integrate the education service elements;
- Facilitates the learning process putting it on a sound and systemic basis since the learning material is offered in logical and complete modules/ units;
- Encourages motivations for trainings;
- Develops comfortable psychological climate due to the cooperative training service design with a special priority to the individual needs and progress agendas of the trainees; and
- Puts the training process on an individualized basis, with every student offered an individual progress trajectory [1 – 3].

The concentrated – training – based aerobics course was designed to include the following modules. *Information module* gives a theoretical knowledge of the training process design and management logics, elements and basics, physical qualities progress regularities; key muscle groups; and the aerobics benefits for a healthy lifestyle cultivation purposes. *Diagnostics module* is designed to test and analyze the physical fitness, performance, functionality and

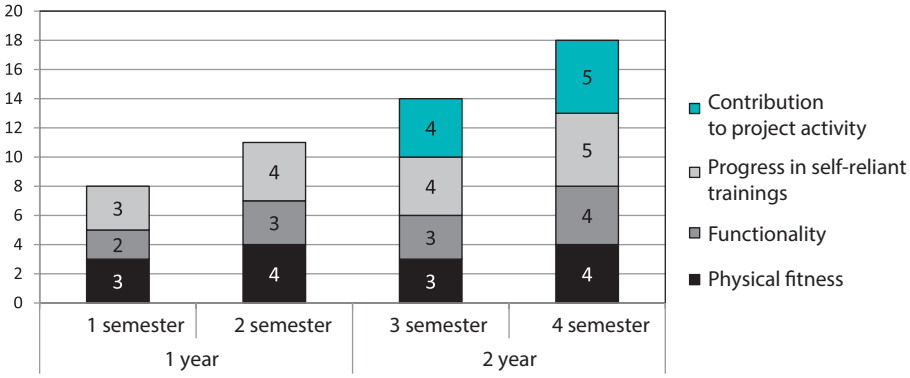

Figure 1. *Progress test rates of the sample in the concentrated-training-based aerobics model testing experiment*

psycho–emotional health of the trainees. *Content module* systematizes the knowledge, target motor skills and practical progress benchmarks to encourage motivations for habitual physical activity and healthy lifestyle. *Self-reliant training module* includes the teacher–consulted practices on an independent basis, with or without preliminary trainings, as provided by the relevant practical guidelines with the theoretical basics and special self–training tasks. And the *control module* offers a test set with the pre–training, interim and post–training tests for the progress control for the whole training period.

The above modules are designed to facilitate their integration in the concentrated–training–based course to ensure new quality for the training process, with every trainee making progress in the physical fitness, functionality and psychological fitness for a fully–fledged socializing process and future professional service. The modules offer reasonably integrated theoretical and practical training materials for the self–reliant progress with the systemic progress tests for the training system adjustments. The new concentrated–training–based aerobics model to supplement the academic physical education discipline was tested on the 1–2–year students.

The concentrated–training–based aerobics model with its harmonized modules secures the educational process integrity with due "immersion" of trainees and staged learning. The concentrated–training–based aerobics model was implemented on the following provisions:

Cooperative efforts of the teaching team highly knowledgeable and skilled in the aerobics training models and tools;

User–friendly access to the educational materials supported by the modern information technologies; and

Integration of the training theory and practice, with a synthesis of knowledge and skills.

The trainees' progress in the concentrated–training–based aerobics model was tested by the test tables for the functionality and physical progress rating purposes in the self–reliant and creative trainings [4–6], with the model benefits tested in the 1–2–year physical education classes.

Results and discussion. Given on Figure 1 hereunder are the progress test rates of the sample in the concentrated–training–based aerobics model testing experiment.

The final progress tests found the 1– and 2–year groups physical fitness growing by 19% and 23% and functionality growing by 21% and 18%, respectively; with 92% of the sample tested with a high ability to apply the knowledge, skills and competences in the self–reliant trainings, creativity–intensive tasks and project activities.

New training model benefits were tested, among other things, by a questionnaire survey of the sample to obtain the respondents' opinions on the concentrated–training–based aerobics model design and content. The survey found 95.9% of the sample satisfied with the model; 82.8% highly interested in the concentrated–training–based aerobics service; and 77.8% looking forward to continue the trainings in the 3rd academic year. It should be also mentioned that the survey found the following drawbacks of the model:

Fast accumulation of the training backlogs in case of grounded absences in a few training sessions;

Still limited room for application of modern computer technologies to facilitate preparations for the practical trainings; and

Shortage of visual practical guides and recommendations on the screens to support the trainings.

Conclusion. The new concentrated–training–based aerobics model with its innovative high–intensity education technology was found beneficial as it gives the means to put the physical education service on a balanced and multidimensional basis for permanent progress, and customize the trainings to the individual needs, skills and progress agendas. The new concentrated training technology was tested particularly beneficial for the aerobics trainings in large groups, with the practical sessions designed on a non–stop basis to ensure the time–efficiency within the academic physical education curricula, rapidly build up the theoretical knowledgebase and skill sets, meet the valid requirements to the physical education service permanence and integrity; effectively meet the individual physical progress needs of the students; motivate them for physical activation and progress; and establish a comfortable training climate for productive cooperation of the training service staff and trainees.

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INTEGRATED SPECIALIZATION IN ACADEMIC ELECTIVE PHYSICAL EDUCATION AND SPORTS: SYNERGIZING APPROACH

UDC 796.011.3

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Annotation

Objective of the study was to provide the scientific justification of the comprehensive specialization program, including cross-country skiing and orienteering sport for the implementation of the academic Physical Education and Sports curriculum.
Methods and structure of research. At the first stage, the conditions for classes and the necessary material and technical base were determined. To develop the Physical Education and Sports curriculum, the necessary skiing and orienteering skills were identified. For rating tool set, control tests were developed for assess orienteering skills, along with an analysis of the GTO complex materials to use these standards in assessing sports technical skills in skiing in university students as part of the academic discipline.
Results of the study. A curriculum has been developed based on techniques for mastering ski techniques and technical skills for cross-discipline orienteering, for improving skills in these sports. The control test for necessary rating tools were defined and tested meant to assess sports technical orienteering skills (cross disciplines).
Conclusion. The combination in the implementation of the academic Physical Education and Sports curriculum in two sports classes - cross-country skiing and orienteering sport - makes it possible to expand the range of interests of those students who want to practice year-round outdoor activities.

Keywords: *Physical Education and Sports, cross country skiing, orienteering sport, Federal State Higher Education Standards, progress rating test set.*

Background. The modern academic Physical Education and Sports curriculum needs to be reasonably versatile and optional to encourage sustainable interest in students and sound motivations for physical progress secured by the academic sports. Optional formats of the academic physical education and sports service are generally associated with positive emotional backgrounds to help the students satisfy the personal physical progress interests and health agendas for success in the future professional positions in national industries [1, 4, 5]. The academic physical education and sports service expansion efforts, however, are always limited by the available sports infrastructure, equipment and material/ technical resource, and this is the reason why some the modern optional physical education and sports curricula are still short of many popular sports disciplines.

Academic cross-country skiing sports are beneficial in this context in many aspects. Winter sports in general are known by improve immunity on a positive emotional background secured by the so-called landscape therapy that is known to improve health standards as the healthy outdoor practices strengthen the nervous system, improve sleep, mitigate depression and stress and enhance the overall psychological comfort [6]. Orienteering sport practices, apart of the landscape therapy, give prerequisites for the personality progress in many aspects since the sport discipline is highly demanding to the individual resources, natural gifts and progress models [2, 3].

Objective of the study was to theoreticall substantiate and test benefits of a cross-country skiing and orienteering sport integrating special model to supplement the standard academic physical education and sports discipline.

Methods and structure of the study. The first stage of the study was designed to make provisions and create necessary material and technical resource for the cross-country skiing and orienteering sport integrating special model. Later on we designed an updated physical education and sports curriculum based on the Federal State Higher Education Standards 3++. At this stage of the study we formed a set of sport-specific skill tests. At the final stage of the study, the progress rating test set was used to test progress in the orienteering sport, plus the valid age-specific GTO Complex test standards were analyzed and used to rate progress in cross-country skiing (within

the academic physical education and sports service) on a 5-point scale.

Results and discussion. Due to the natural geographic location related specifics, cross-country skiing curriculum is traditional for universities in the Siberian and Ural regions, and many of them rent or own ski bases, often in the forest zones, for the optional and standard physical education and sport service. Seasonal cross-country skiing trainings normally last for 3-4 winter months with deduction of the examination periods and holidays. The remaining training period can be used for the cross-country skiing techniques mimicking and conditioning trainings and orienteering sport trainings with a special priority to the orienteering technique excellence aspects at the same academic sports facility.

Most of the regional universities supply the trainees with the local maps for trainings, and the rest have easily solved this problem. As things now stand, more than 60 constituents of the Russian Federation have their regional orienteering sport federations that are always in position to support the university orienteering sport groups by necessary cartographic materials. The traditional cross-country skiing / orienteering sport service location within the same sports facility facilitates the year-round outdoor trainings at no sacrifice for the regular physical education and sports classes in compliance with the Federal State Higher Education Standards.

We developed the new cross-country skiing and orienteering sport integrating special model (see Table 1) to secure progress in every skiing style and basic terrain-specific orienteering techniques, with a gradual growth of the training workloads, to develop special physical qualities and fitness for the cross-country skiing and orienteering sport on the traditional concepts of the training system consistency, continuity and variability.

In practical terms, the cross-country skiing and orienteering sport integrating model includes two elements: basics training and categorical practical training, with the first one geared to master the basics of the elected sport with a special priority to the technique correction aspects; and the second intended to excel and automate the motor skills for competitive progress. Trainees are expected to master and excel the terrain-specific orienteering and cross-country skiing styles and techniques (classic and skating).

Progress of the students in practical academic trainings is rated by the general physical fitness and sport-specific skills rating tests as provided by the valid Federal State Higher Education Standards 3++ in the so called Progress Rating Testset. The valid physical education and sports curriculum assigns 54 hours for the test exercises. In addition, the universities often apply tests of the key/ vital physical qualities including speed, endurance, strength and flexibility tests, i.e. rating the largely inborn morphology- and functionality-dependent individual qualities critical for physical progress - that may and should be developed.

University faculties are entitled to freely select the above tests, although the practical academic experiences have prioritized the following tests: speed rating 100m sprint test; endurance rating 2000/3000m race test; dynamic leg strength rating standing long jump test; shoulder girdle strength rating pull-ups and push-ups test for the males and females, respectively; flexibility rating front bent (on a 20-25cm high gymnastic bench) test; plus a range of other physical fitness tests.

As for the sports-specific skills tests, they generally imply sports competitions - in cross-country skiing and orienteering sport in our case, with a special role played by the GTO Complex tests that are widely applied as a basis for the cross-country skiing skills test procedures. Thus our cross-country skiing and orienteering sport integrating special model equals the 5-, 4- and 3-point academic scores to the age-specific (18-25 year group)

Table 1. *Cross-country skiing and orienteering sport integrating special model to supplement the standard academic physical education and sports discipline: schedule and topics*

Topics	Semesters					
	1	2	3	4	5	6
Basics trainings: 66 hours	16	14	12	12	6	6
Training method, basics of body conditioning, sport outfits, sports equipment quality and application	4					
Classical cross-country skiing technique mastering	4	4	2	2	2	2
Skatting cross-country skiing technique mastering		2	2	4		2
Special endurance training by cross-country skiing stimulation methods in snowless periods	4		2		2	
Map reading and distance management skill trainings on the move; performance planning and management	4	8	6	6	2	2
Categorical practical trainings: 256 hours	38	42	42	44	44	46
General/ special strength endurance trainings using the traditional physical training methods	6	12	10	12	10	8
Special endurance training by cross-country skiing stimulation methods in snowless periods	12		14		14	
Special endurance intensive classical skiing technique excellence trainings	10	10	8	10	6	12
Special endurance intensive skatting skiing technique excellence trainings		4	2	4	2	4
Orienteering skills excellence trainings outdoors with the run speed phasing component	10	16	8	18	12	22
Total: 322 hours	54	56	54	56	50	52

GTO Gold, Silver and Bronze Badges, respectively. The cross-country skiing skills tests in our model are largely equivalent to the GTO Complext tests customized to the cross-country skiing styles. The freestyle cross-country skiing competitions may be run in the low- and moderately-difficul terrains reasonably safe from heavy winds. This means that the students are free to opt for classical or skating style and change the skiing style on the distance. In practical terms, the cross-country skiing tests may be designed as separate-start or mass-start events. For tests of the orienteering-sport-specific special fitness in the cross-country orienteering sport events, the model offers an average distance speed rating 1km straight race test, since this sport discipline implies runs between the check points located at varying distances.

Progres of the Siberian Federal University students majoring in orienteering sport has been rated on a 5-point scale by the above average speed rating 1km straight race test for three academic years. We used for the speed test a standard electronic test system commonly applied in the orienteering sport events. To obtain benchmarks for the tests, we analyzed the split-time competitive records of the beginner, advanced training and sport excellence groups.

As a result, we obtained the average speed benchmarks for distances in the moderately-difficult terrains in good weather conditions. The new model allows the actual test rates being adjusted for the few weather conditions using a few adjustment ratios on discretion of the trainer prior to the test competitive events. Distances should be planned so that the students could apply and demonstrate every practical orienteering, map reading and distance management skill on the run. The orienteering sport tests will be designed in this case only with separate starts with at least 1-minute intervals. The study found that an optimal straight orienteering sport skills test distances should equal 3.5-3.8 km and 3.0-3.2 km for males and females, respectively, with the checkpoints located as allowed by the terrain, area and weather conditions, although the actual practice gives grounds to recommend 6-8 checkponts. The orienteering sport skills trainings will be designed to gradually increase the distance run speed and imroove the error-free race routing and management skills. Given in Table 2 hereunder are the academic cross-country skiing / orienteering sport skill progress test standards harmonized with the valid Progress Rating Test set as provided by Federal State Higher Education Standards.

The cross-country skiing / orienteering sport skill tests shall be run on at least a yearly basis to fairly profile the students' physical fitness and physical development for the university education period. Every progress test shall be preceded by a warm-up phase and followed by an active relaxation practices, and that is the reason why a whole training session should typically be assigned for the tests.

Conclusion. The academic physical education and sports service supplemented by the optional cross-country skiing and orienteering sports expands the range of the optional physical progress and health services catering for the interests of those who prefer the year-round outdoor activities. The cross-country skiing and orienteering sport integrating special model supplementary to the academic physical education and sports discipline will help develop the sport-specific skills in the students, with the most gifted and successful offered competitive progress and mass sport leading opportunities. The valid Progress-Rating-Test-harmonized cross-country skiing / orienteering sport skills rating tests make it possible to rate the sports-specific physical fitness and progress in movement coordination and other critical technical and tactical aspects. The test data and analyses may be used to highlight the advantages and drawbacks of the academic physical education and sports methods and tools and motivate students for further physical progress and healthy lifestyles,

Table 2. *Cross-country skiing / orienteering sport skill progress tests standards (for cross-country events) harmonized with the valid Progress Rating Test set as provided by Federal State Higher Education Standards for the academic physical education and sports discipline*

	Tests	Semester	Points				
			5	4	3	2	1
Males							
1	5km ski race, s	1,3,5	23.30	25.30	26.30	28.00	Time non-fixed
2	3.5-3.8km orienteering sport event with 8 checkpoinst, min/km [K is a weather-specific adjustment ratio: K=1 no precipitation, frost, wind, icing etc.; K >1 for all other weather conditions]	2	7.30xK	7.50xK	8.10xK	8.30xK	
		4	7.20xK	7.40xK	8.00xK	8.20xK	
		6	7.00xK	7.20xK	7.40xK	8.00xK	
Females							
1	3km ski race, s	1,3,5	18.00	19.30	20.20	21.10	Time non-fixed
2	3-3.2km orienteering sport event with 6 checkpoinst, min/km [K is a weather-specific adjustment ratio: K=1 no precipitation, frost, wind, icing etc.; K >1 for all other weather conditions]	2	8.00xK	8.20xK	8.40xK	9.00xK	
		4	7.50xK	8.10xK	8.30xK	8.50xK	
		6	7.40xK	8.00xK	8.20xK	8.40xK	

conditional on the physical education and sports progress tests service being reasonably optional to avoid compulsory compliance of the test standards at any health cost.

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ADAPTATION OF ATHLETES' CARDIORESPIRATORY SYSTEM TO PHYSICAL LOADS

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Annotation

Objective of the study was to analyze the peculiarities of adaptation of the cardiorespiratory system of athletes engaged in endurance sports.
Methods and structure of the study. The study involved a set of non-invasive research methods. Besides, we tested the athletes' cardiovascular, external respiration and gas exchange systems.
Results of the study. Among the physiological determinants of the cardiorespiratory system are: inotropic, chronotropic, vascular and respiratory reactions, the activation of which depends on the functional loads. During active orthostasis, a whole array of cardiorespiratory functional elements take part in the compensatory-adaptive reactions, with no driving factor to be distinguished. Under physical loads from 50 to 200 W, there was a decline in the growth in cardiac output, which, depending on the athletes' age, was compensated by one of the cardiorespiratory system reactions: external respiration, blood circulation or gas exchange function. By the prevailing nature of individual reactions of the circulatory and respiratory organs, the types of adaptation of the cardiorespiratory system were identified. Under the maximum load (3 W/kg), a mixed type of reaction was observed, which was characterized by an increase to the individual limit of indicators of the chronotropic function of the heart, external respiration and, in some cases, stroke output.
Conclusion. The functional system structure is characterized by constant changes in the degree of involvement of its functional elements and peculiarities of their combination.

Keywords: *cardiorespiratory system, load, respiration, blood circulation, gas exchange, athletes.*

Background. Numerous studies made it possible to establish the cardiorespiratory system value typical for humans and animals. It is shown that this system develops and improves in the process of post-natal ontogenesis and motor activity [3–5]. The cardiorespiratory system is a private functional system [9], consisting of the circulatory and respiratory organs. It is studied in two ways:

– compensatory-adaptive reactions of the cardiorespiratory system to different functional loads;

– the state and functionality of the cardiorespiratory system aimed to provide oxygen to the body.

Objective of the study was to analyze the peculiarities of adaptation of the cardiorespiratory system of athletes engaged in endurance sports using a set of non-invasive research methods.

Methods and structure of the study. During the study, we simultaneously recorded the indicators of the cardiovascular system: heart rate (HR), stroke volume (SV), minute blood volume (MBV), blood circulation index (BCI), cardiac index (CI); external respiration rates: respiratory rate (RR), breathing capacity (BC), respiratory minute volume (RMV); gas exchange rates: oxygen utilization rate (O_2U). The central hemodynamic indices (HR, SV, MBV) were determined using the method of a differential rheography by W. Kubicek et al. (1974), modified by Y.T. Pushkar et al. (1977) and Y.S. Vanushin (2003). The external respiration rates (RR, BC, RMV) were determined using the method of pneumotachography, and the gas exchange function (O_2U) was evaluated by means of a calculation. For this purpose, the gas analysis of the exhaled air was carried out using a paramagnetic oxygen analyzer AK–5. The functional load was to change the spatial position of the body of athletes with the high total body sizes, perform muscular work on a cycle ergometer with a stepwise increasing load (from 50 to 200 W) with the power of 3 W/kg. The duration of each step was 4 minutes. The pedaling speed was 60 rpm.

Sampled for the study were 72 male athletes aged from 15 to 60 years, who were divided into 4 groups: Group 1 – 11 adolescent athletes aged 15–16 years; Group 2 – 22 young athletes aged 17–21 years; Group 3 – 20 athletes aged 22–35 years; Group 4 – 19 male athletes aged 36–60 years. All the athletes involved were engaged in such

endurance sports as cross-country skiing and middle- and long-distance running in the track and field athletics.

Results and discussion. The first direction – "Compensatory-adaptive reactions of the cardiorespiratory system to different functional loads" – was analyzed while the male athletes changed the spatial position of the body and performed the cycle ergometer exercise. This helped determine the leading compensatory-adaptive reactions of the cardiorespiratory system and the degree of their involvement under different functional loads (see Fig. 1).

Thus, when the body position changes, a whole array of cardiorespiratory functional elements take part in the compensatory-adaptive reactions, with no driving factor to be distinguished. Changes occurring in the cardiorespiratory system during active orthostasis can be conditionally deemed as minimum loads [7], and they are manifested as the compensatory-adaptive reactions aimed to eliminate the primary effects. At the same time, cycle ergometer exercises are performed with the involvement of such bodily systems as blood circulation, external respiration, and gas exchange function. The 200 W physical load can be regarded as a threshold load, based on which we identified the main systems and functions of the body of athletes engaged in endurance sports and their involvement in the compensatory-adaptive reactions depending on age. In some cases, we observed an increase in several indicators of the cardiorespiratory system. This was particularly evident in the group of athletes with the high total body sizes, who performed individually selected loads on the cycle ergometer, sometimes reaching 300 W, which was considered as maximum loading. Such physical loads lead to tension of the bodily organs, in particular the locomotor muscles and myocardium. The signals from these organs appear to cause adaptive adjustments. Determination of the reserve capabilities under intense physical loads enabled to suggest that two, and in some cases three indicators of the cardiorespiratory system are needed to meet the increased oxygen demand in the working skeletal muscles: HR, SV, and RMV. The correlation between the strength and HR values, along with the Frank-Starling low, is a fundamental mechanism of self-regulation of the heart, which ensures effective cardiac performance under increasing physical loads leading to increased HR and heart muscle strength.

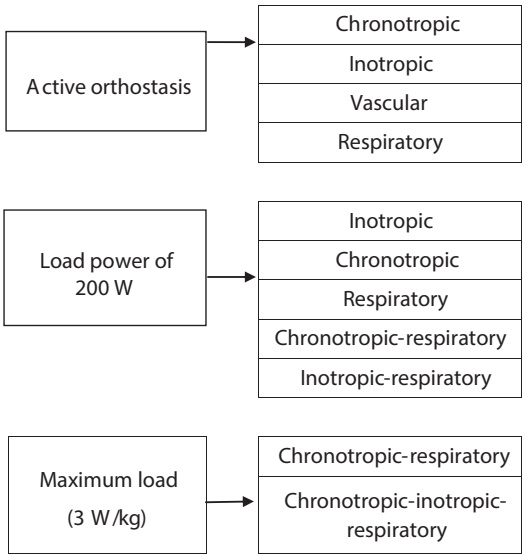

Figure 1. Schematic representation compensatory-adaptive reactions of the cardiorespiratory system to different functional loads

As regards the second direction, the oxygen supply to the body is determined by the degree of development of the oxygen regulation system and the optimal interaction of various links of the cardiorespiratory system, which includes external respiration, blood circulation, and gas exchange. Therefore, among the ways to improve the athletic performance, in endurance sports, in particular, is to enhance the cardiorespiratory system functionality.

Increased cardiac output is known to be the most effective mechanism of oxygen supply to the body. However, the results obtained [2] show a decrease in the MBV rates when transiting from one load mode to another, which, due to the shortening of diastole and insufficient cardiac muscle contraction, is achieved uneconomically – through the growth of HR with a limited increase in the cardiac output. Improvement of the heart functions, in this case, is limited by the intensity of the main processes that determine the contraction capacity of the cardiac muscle: excitation processes, interaction between excitation and contraction and relaxation, power supply of cardiac myocyte and power of the structures supporting these processes [8]. This suggests that there may be other mechanisms aimed to meet the oxygen demand of the body during muscle activity. One of the mechanisms is external respiration, reckoned by a number of researchers [6] among the factors that limit the possibility to achieve high sports results.

At the level of the respiratory system, adaptation is characterized by the maximum mobilization of external respiration, which is manifested in the increased lung ventilation due to the increased respiratory rhythm and respiration depth. It can be assumed that there is incoordination between the regional blood flow in the lungs and ventilation of the relevant areas of pulmonary tissue, as well as incoordination between respiration and movements [1]. The limiting factors here are the anatomical and functional possibilities of the organs of external respiration and functional possibilities of control of breathing [1].

The highest rates of lung ventilation were recorded in the groups of young athletes aged 15–16 years and adult athletes aged 36–60 years. Apparently, the mechanism associated with increased external respiration under physical load of increasing power performed on the cycle ergometer was prevalent in these groups, and physical working capacity is ensured by the considerable tension of the cardiorespiratory system. At the same time, there are various ways to achieve the maximum lung ventilation rates: in the group of youngsters – at the cost of increased respiratory rate; in the group of adults – at the cost of increased respiration depth. This fact can be explained from the standpoint of the age-specific characteristics since, by the age of 16, the morphofunctional formation of the respiratory system and the educational and training process should be oriented towards the development of the respiratory system potential, which will enable to increase the aerobic working capacity of the body. It should be noted that the data

on lung ventilation are not a criterion of a sufficiently high level of training, as the oxygen and energy costs of breathing increase. Under these conditions, adaptation to functional loads is best achieved by activating and improving the efficiency of the oxygen transportation and utilization system. This is confirmed by the high values of blood circulation and HR in the 17–21 year-old males. Due to the development of hypertrophy and increased speed and amplitude of contraction of the respiratory muscles [10], the VC and O_2U rates increased in the group of 22–35 year-old athletes characterized by the same oxygen consumption when performing physical loads of increasing power. It appears that the increase in the mitochondria mass of the skeletal muscles, there is a significant increase in the aerobic power of the body and improvement of the ability of the respiratory center to maintain excitation at the threshold level for a long time.

It is recommended to use a coefficient of comprehensive assessment of oxygen supply, consisting of the cardiorespiratory system indicators, to evaluate the athletes' compensatory–adaptive reactions to functional loads. The coefficient showed that there are large functional reserves in the groups of young and adult athletes aged 22–35 years, as well as the substitution of functions in the body of young and adult athletes aged 36–60 years under physical loads of 100–200 W. The significant decrease of the value of the coefficient of comprehensive assessment of oxygen supply to the body in the groups of young and adult athletes aged 36–60 years when performing the 200 W load on the cycle ergometer reflects a large "physiological cost" of oxygen supply to the working skeletal muscles. The identified age-specific peculiarities of oxygen supply to the body make it possible to target the functional loads during the training process and solve the problems of formation and development of motor qualities in different periods of ontogenesis more rationally.

Conclusion. The study of the cardiorespiratory system using a set of non-invasive research methods revealed that the functional system structure is characterized by constant changes in the degree of involvement of its functional elements and peculiarities of their combination. Among the physiological determinants of the cardiorespiratory system are: inotropic, chronotropic, vascular and respiratory reactions, the activation of which depends on the functional loads. During active orthostasis, a whole array of cardiorespiratory functional elements take part in the compensatory–adaptive reactions, with no driving factor to be distinguished. Under physical loads from 50 to 200 W, there was a decline in the growth in cardiac output, which, depending on the athletes' age, was compensated by one of the cardiorespiratory system reactions: external respiration, blood circulation or gas exchange function. Under the maximum load (3 W/kg), a mixed type of reaction was observed, which was characterized by an increase to the individual limit of indicators of the chronotropic function of the heart, external respiration and, in some cases, stroke output. Consequently, under the functional loads of increasing power, there arise complex adaptive relationships of cardiorespiratory parameters manifested in a variety of reactions.

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DYNAMICS OF PSYCHOPHYSIOLOGICAL CHARACTERISTICS OF HIGHLY QUALIFIED COMBAT ATHLETES AFTER HYPOXIC STIMULATION

UDC 796.03

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Annotation

Objective of the study was to test stability of sensory and motor functions in highly qualified combat athletes after hypoxic stimulation.
Methods and structure of the study. The experiment ran at the Muscular Activity Bioenergy Laboratory of the N.I. Volkov Sports Biochemistry and Bioenergy Department. Sampled for the experiment were 15 athletes aged 20 to 25 years. The study was conducted according to the standard laboratory program using psychophysiological and hypoxic tests.
Results of the study. The study found a pronounced ergogenic effect of hypoxic stimulation on the psychomotor system of athletes, associated primarily with the sport-specific peculiarities of the training and competitive activities and presence of chokeholds.
Conclusion. Based on the analysis of the table values, it was concluded that there were no pronounced negative changes in all the psychophysiological indicators under study. Despite increased fatigue of the visual analyzer resulting from hypoxic stimulation, there was a decrease in the reaction time and in the number of errors made when completing the tasks related to mental activity.

Keywords: *normoxia, hypoxia, sensory and motor functions, combat athletes, reaction time, light, sound, choice.*

Background. The interest in the psychophysiological characteristics of combat athletes stems from the factors causing different pathogenic mechanisms of hypoxic conditions, i.e. the use of submission holds (mechanical blockage of respiration; "blood constriction" by compressing carotid arteries and blocking the blood flow to the brain, etc.) and excessive functional loads [3, 4]. Load hypoxia, which results from excessive functional loads, leads to the disruption of oxidative phosphorylation in mitochondria and decreased activity of energy-dependent processes associated with acidosis and loss of energy substrates. Submission holds prevent an opponent from the effective realization of motor programs and cause unconsciousness, which leads to a negative impact on the competitive result and a reduction in the efficiency of motor programs. Therefore, an important element of athletic performance is the athlete's ability to execute motor programs, when hypoxic conditions occur [5, 6], at the level necessary to eliminate the influence of the factors causing these conditions.

Objective of the study was to assess the stability of sensory and motor functions in highly qualified combat athletes after hypoxic stimulation.

Methods and structure of the study. The experiment was run at the Research Laboratory of the N.I. Volkov Sports Biochemistry and Bioenergy Department at Russian State University of Physical Education, Sports, Youth and Tourism. Sampled for the experiment were 15 combat athletes (engaged in judo and mixed martial arts) aged 20–25 years and having various sports qualifications: from CMS to WCMS. All subjects gave their written consent to participate in the experiment with the use of hypoxic stimulation. The athletes' psychophysiological characteristics were determined using the hardware and software complex "Sports psychophysiologist" [1] and the hypoxicator "Everest–1, v. 07m" (hypoxic test method).

The experiment was carried out according to the following program: 1. A preliminary psychophysiological study aimed to obtain the indices of thinking, motor responses, and functions under normal conditions. 2. Experimental exposure to normobaric hypoxia (10% oxygen gas mixture) for 30 minutes in standard laboratory conditions. 3. Re-testing of psychophysiological characteristics aimed to detect changes in the indices of thinking, motor responses, and functions under the influence of the hypoxic stimulus.

Results and discussion. Table 1 presents the response and central delay rates, which indicate a decrease in the response rate under the influence of the hypoxic stimulus.

In addition, there was a statistically significant decrease in the sensorimotor reaction rate in the dominant hand. This indicator in the non-dominant hand indicated a similar trend to that observed in dominant one. The sensorimotor reaction rate in the lower limbs was characterized by a mixed trend, which was not confirmed by the statistically significant differences, except for the light response time for the non-dominant leg.

Table 2 presents the thinking indices in the athletes (individual minute, errors made when learning the angular velocity of object motion, errors made when assessing the segments, errors made when assessing and learning the angles).

The "Individual Minute" test conducted using the hypoxic stimulus revealed no changes in the athletes' psychoemotional state. The reduction in the percentage of errors after the removal of the hypoxic stimulus was at the level of a strong tendency, and in the case of errors made while measuring the segments, this tendency was statistically significant ($p<0.05$).

Tables 3 and 4 present the dynamics of changes in the hand movement rate per 60 sec, however, these changes are not significant.

The dynamics of the dominant hand movement rate did not change statistically significantly, namely, there was an increase in the number of taps in the 1st and 6th 10sec intervals and a slight decrease in the number of taps from the 2nd to 5th 10sec intervals. The dynamics of changes in the non-dominant hand movement rate under the influence of the hypoxic stimulus was found to be similar to that of the dominant hand.

Table 4 presents the dynamics of changes in the leg movement rate in the combat athletes under the conditions of normoxia and hypoxia.

It was shown that the detected changes in the leg movement rate were similar to that of hand movements and were not statistically significant. This phenomenon, being associated with a decrease in the limb movement speed under the influence of the hypoxic stimulus, can subsequently be viewed as a factor that negatively affects the athletes' performance as they advance in the tournament bracket.

Table 5 present the indices of functional mobility (lability) of the visual sensory and central nervous systems during information perception and processing.

The findings showed the statistically significant changes in the critical frequency of light flashing and paired light pulses, which in our case reflected increased eye fatigue in the athletes.

Conclusions. The combat athletes were found to have a high degree of psychophysiological stability and a pronounced ergogenic effect of hypoxic stimulation. These phenomena were due to the specificity of the training and competitive activities within the sports disciplines in question and the presence of submission elements, which are mentioned in the list of technical actions permitted for use in the competitions.

The analysis of the tabular values revealed no pronounced negative changes in the psychophysiological

Table 1. *Response and central delay rates in combat athletes*

Indicator	Normoxia	After hypoxic stimulation	Mean difference	Normoxia	After hypoxic stimulation	Mean difference
	Dominant limb X±σ	Dominant limb X±σ				
LRT, sec	0.30±0.06	0.26±0.04	0.04*	0.25±0.04	0.25±0.06	0.00
SRT, sec	0.54±0.12	0.46±0.07	0.08*	0.53±0.10	0.47±0.10	0.06
CRT, sec	0.42±0.07	0.36±0.05	0.06*	0.39±0.07	0.35±0.04	0.04
LRT, leg, sec	0.39±0.05	0.41±0.14	−0.02	0.43±0.14	0.34±0.04	0.09*
SRT, leg, sec	0.35±0.04	0.36±0.09	−0.01	0.30±0.03	0.32±0.06	−0.02
CDR, sec	0.11±0.06	0.11±0.05	0.00	0.15±0.08	0.12±0.04	0.03

Note: * – the differences are significant at $p<0.05$; LRT – light response time; SRT – sound response time; CRT – choice reaction time; CDR – central delay response.

Table 2. *Thinking indices in combat athletes*

Thinking indices		Normoxia X±σ	After hypoxic stimulation X±σ	Mean difference
Individual minute, sec		59.14±13.07	59.14±19.98	0.00
% of mod errors	Errors made when learning the angular velocity of object motion	8.96±10.45	5.93±8.27	3.03
	Errors made when assessing the segments	18.98±15.79	21.98±15.49	−3.00
	Errors made when measuring the segments	20.65±11.66	15.83±7.95	4.82*
	Errors made when assessing the angles	24.65±21.45	10.37±7.36	14.28
	Errors made when learning the angles	2.20±2.80	1.00±1.92	1.20

Note: * – the differences are significant at $p<0.05$

Table 3. *Dynamics of changes in hand movement rate in combat athletes under conditions of normoxia and hypoxia (number of taps per 10 sec)*

Indicator	Normoxia X±σ	After hypoxic stimulation X±σ	Mean difference
Dominant limb			
1st 10sec interval	57.00±14.31	62.36±5.35	−5.36
2nd 10sec interval	62.91±7.69	59.64±5.24	3.27
3rd 10sec interval	59.36±6.04	56.91±6.11	2.45
4th 10sec interval	57.18±5.47	56.82±6.55	0.36
5th 10sec interval	56.64±5.20	56.36±6.70	0.28
6th 10sec interval	56.45±3.50	56.82±5.13	−0.37
Non-dominant limb			
1st 10sec interval	59.09±9.97	59.09±6.24	0.00
2nd 10sec interval	55.91±6.79	54.45±6.01	1.46
3rd 10sec interval	54.55±5.07	52.36±6.15	2.19
4th 10sec interval	53.27±4.41	52.00±4.58	1.27
5th 10sec interval	52.91±4.09	51.27±5.50	1.64
6th 10sec interval	51.55±4.37	52.09±5.24	−0.54

Table 4. *Dynamics of changes in leg movement rate in combat athletes under conditions of normoxia and hypoxia (number of taps per 10 sec)*

Indicator	Normoxia X±	After hypoxic stimulation X±	Mean difference
Dominant limb			
1st 10sec interval	65.90±19.84	62.60±21.36	3.3
2nd 10sec interval	63.10±19.60	64.40±16.78	−1.3
3rd 10sec interval	63.00±18.86	58.10±15.44	4.9
4th 10sec interval	63.70±23.17	53.50±14.92	10.2
5th 10sec interval	61.50±17.80	58.00±14.38	3.5
6th 10sec interval	50.10±22.58	53.50±9.13	−3.4
Non-dominant limb			
1st 10sec interval	58.40±16.97	52.30±14.44	6.1
2nd 10sec interval	56.90±15.92	60.60±21.55	−3.7
3rd 10sec interval	57.40±15.51	55.90±21.70	1.5
4th 10sec interval	55.70±13.70	56.80±23.19	−1.1
5th 10sec interval	53.50±17.21	56.50±23.16	−3.0
6th 10sec interval	55.50±15.76	53.00±20.53	2.5

Table 5. *Indices of critical frequency of light flashing and paired light pulses*

Indicator	Normoxia X±	After hypoxic stimulation X±	Mean difference	Normoxia X±	After hypoxic stimulation X±	Mean difference
	Dominant eye	Non-dominant eye				
CFLF, Hz	36.01±4.29	33.85±5.38	2.16*	34.27±5.02	35.71±5.10	−1.44
CFPLP, Hz	33.97±5.50	34.47±5.94	−0.5	35.82±5.67	33.94±5.89	1.88*

Note: * – the differences are significant at $p<0.05$; CFLF – critical frequency of light flashing; CFPLP – critical frequency of paired light pulses.

characteristics under study. Although the athletes were found to have increased eye fatigue, under the conditions of hypoxia their reaction time reduced, so did the number of errors made when performing the tasks related to thinking.

Apart from the benefits of the phenomenon under study, coaches and athletes must consider the negative changes associated with the decrease in the limb movement rates and the increase in the degree of eye fatigue, which may have a negative impact on the athletes' performance as they advance in the tournament bracket.

Given the provisions presented, it is reasonable to make preliminary use of hypoxic tests to predict changes in the psychophysiological characteristics of athletes. The data obtained may be potentially important for individual planning of athletic training.

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EFFECTS OF COMPOSITION OF UBIQUINONE-10 AND ROYAL JELLY ON PHYSIOLOGICAL AND BIOCHEMICAL CORRELATES OF IMPROVED PHYSICAL ACTIVITY RATES IN HIGHLY QUALIFIED ATHLETES

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Annotation

Objective of the study was to find a correlation between the physiological and biochemical indicators affected by the composition of royal jelly and Q10 and effectiveness of functional test execution by highly qualified athletes.
Methods and structure of the study. The study involved 40 highly qualified male swimmers aged 16 to 20 years. As a control exercise we used a series of segments 4x50 m covered using the main stroke with 45 sec of rest breaks in between. Based on the pretest results, we formed 2 groups of subjects with similar morphofunctional indicators. In the CG, the athletes were given honey (placebo) daily at a dose of 10 g/day for 10 days. In the EG, during the same period, the subjects were given the composition as follows: honey + royal jelly + Q10 at a dose of 10 g/day, including 400 mg/day of royal jelly and 60 mg/day of Q10.
Results of the study. We detected the regression relations showing that the composition of royal jelly and exogenous ubiquinone-10 (Q10), when administered for 10 days, statistically significantly affected the dynamics of changes in a number of physiological and biochemical indicators in the highly qualified swimmers during the control tests.
Conclusion. Using the principal component method and correlation analysis, it was shown that the co-use of royal jelly and Q10 improves the effectiveness of execution of the control exercise through the correction of the athletes' heart rate variability rates, inhibition of lipid peroxidation processes, and suppression of the development of hyperlactatemia under physical loads.

Keywords: *royal jelly, ubiquinone-10, heart rate variability, oxidative stress, metabolic acidosis, highly qualified athletes, athletic performance.*

Background. The analysis of heart rate variability and oxidative stress level makes it possible to determine the degree of bodily adaptation to different stimuli. The enhancement of adaptive processes in the body underlies the development of athletes' physical qualities and improvement of athletic performance. In this view, the possibility to timely correct the functional state of the body without violating the anti-doping regulations is gaining particular importance. Royal jelly and ubiquinone-10 (Q10) can be among those biomodulators, not included in the WADA (World Anti-Doping Agency) list of prohibited substances, that have minimal side effects and can quickly integrate into damaged systems and restore them [2,3]. Meanwhile, it was experimentally proved that, in case of combined use of these substances their impacts, the most important of which are trophic, antihypoxic, and antioxidant effects, may potentiate [1]. We believe that these effects can stimulate the development of adaptive changes in the body of athletes, which is reflected in the shifts in the physiological and biochemical indicators affecting their physical working capacity.

Objective of the study was to find a correlation between the physiological and biochemical indicators affected by the composition of royal jelly and Q10 and effectiveness of functional test execution by highly qualified athletes.

Methods and structure of the study. The study involved 40 highly qualified male swimmers aged 16 to 20 years. As a control exercise we used a series of segments 4x50 m covered using the main stroke with 45 sec of rest breaks in between. Based on the pretest results, we formed 2 groups of subjects with similar morphofunctional indicators. In the Control Group, the athletes were given honey (placebo) daily at a dose of 10 g/day for 10 days. In the Experimental Group, during the same period, the subjects were given the

composition as follows: honey + royal jelly + Q10 ata dose of 10 g/day,including 400 mg/day of royal jelly and 60 mg/day of Q10. The substances were taken sublingually. Q10 is a microbiological synthesis productsynthesized atOJSC "Kstovo Experimental Pilot Protein – Vitamin Concentrates Plant" according to the technology developed at the Research Institute "Sintezbelok" of the Russian Academy of Sciences and Research and Production Association "Vitaminy". Honey and royal jelly were extracted in the Federal Beekeeping Research Center.

The heart rate variability analysis was carried out using the hardware – software complex "Poly – spectrum – rhythm" (LLC "Neurosoft",Ivanovo). In the spectral analysis of heart rate variability,conducted based on the ECG signal recording data,three main frequency ranges in the heart rate fluctuations spectrum were highlighted: High Frequency, Low Frequency,Very Low Frequency [4],which characterized the contribution of the sympathetic and parasympathetic effects to the regulation of sinus node activity. We calculated the indicators characterizing the level of tension of the regulatory systems and stress reactivity of the body: index of tension of regulatory systems, vegetative balance index, vegetative rhythm index,vagosympathetic interaction index and index of centralization.

We measured the level of lipid peroxides in oral fluid and lactate in the blood of the athletes and took them as the clinical and laboratory criteria. The levels of dienoic conjugates (DC), trienoic conjugates (TC) and Schiff's bases (SB) were determined using the spectophotometer "SF – 2000" ("Specialist Design Office SPEKTR", Russia). The lactate levels in the blood were measured using StatStrip Lactate Xpress laboratory portable analyzer ("NOVA Biomedical",USA).

The athletes' physical fitness level was assessed based on the preliminary testing results with the time of execution of the control exercise and the corresponding number of points by the FINA assessment system.

Before the start of the experiment,each athlete was informed in detail on the ongoing research and gave their written consent to participate. The study was organized and conducted in accordance with the ethical principles of the WMA Declaration of Helsinki [5].

Statistical data processing was performed in Microsoft Excel 2013 and Statistica 12,R. The results are presented as the dynamic shifts for each of the studied indicators during the execution of the control exercise (the difference between the post – load and pre – load rates). The effects of the composition of royal jelly and Q10 on the dynamics of changes in the studied indicators during the execution of the control exercise by the swimmers were determined according to the following regression model:

$$Y = \beta_0 + \beta_1 Dummy + \varepsilon,$$

where Y – regressand; Dummy – dummy variable between 0 and 1 depending on the substance (0 = placebo,1 = composition of royal jelly and Q10); β_0 and β_1 – estimated regression parameters; ε – modeling error.

We applied the method of principal components, calculated the Pearson's correlation coefficient and determination coefficient to rate the statistical relations between the shifts in the physiological and biochemical indicators, which were statistically significantly affected by the composition of royal jelly and Q10 (RJ + Q10 – dependent variables),and the result of execution of the control exercise by the swimmers.

Results and discussion. The obtained models made it possible to compare the dynamics of shifts in each indicator in the group of swimmers taking the composition of royal jelly and Q10 and the group of swimmers taking placebo. These models showed that, under the influence of the functional test, the administration of the composition of royal jelly and Q10 statistically significantly affected the dynamics of changes in low frequency % – towards an increase, and in very low frequency %, vagosympathetic interaction index,index of centralization,vegetative balance index,vegetative rhythm index,tension index,SB/(DC + TC), dienoic conjugates, trienoic conjugates and Schiff's bases rates and lactate level – towards a decrease (Fig. 1).

The principal component method revealed that the PC1 value in the swimmers taking the composition of royal jelly and Q10 was lower than that in the swimmers taking placebo, which corresponds to the lower increase in very low frequency %, vagosympathetic interaction index, index of centralization, vegetative balance index, vegetative

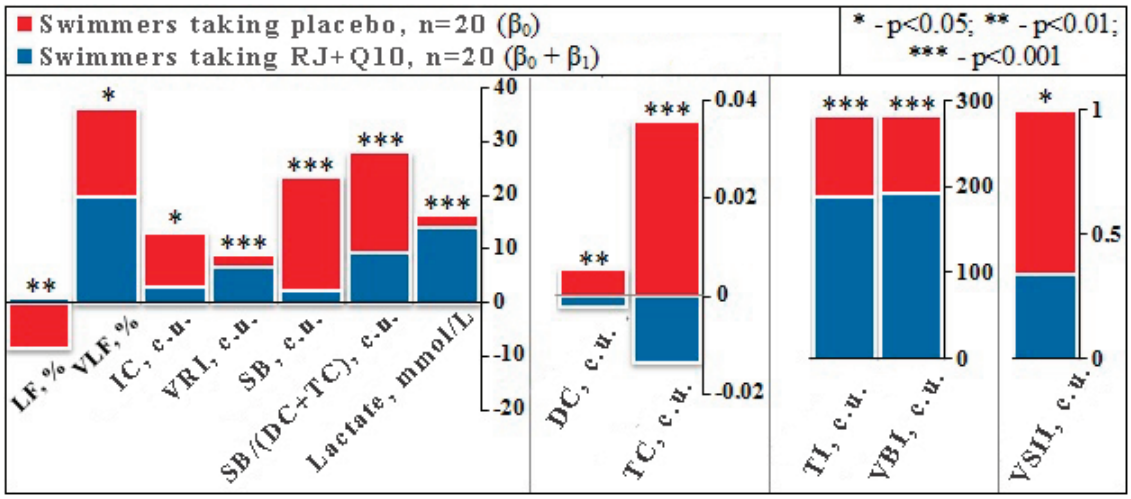

Fig. 1. *Results of modeling of effects of RJ+Q10 composition on dynamics of changes in physiological and biochemical indicators of swimmers in response to physical loads*

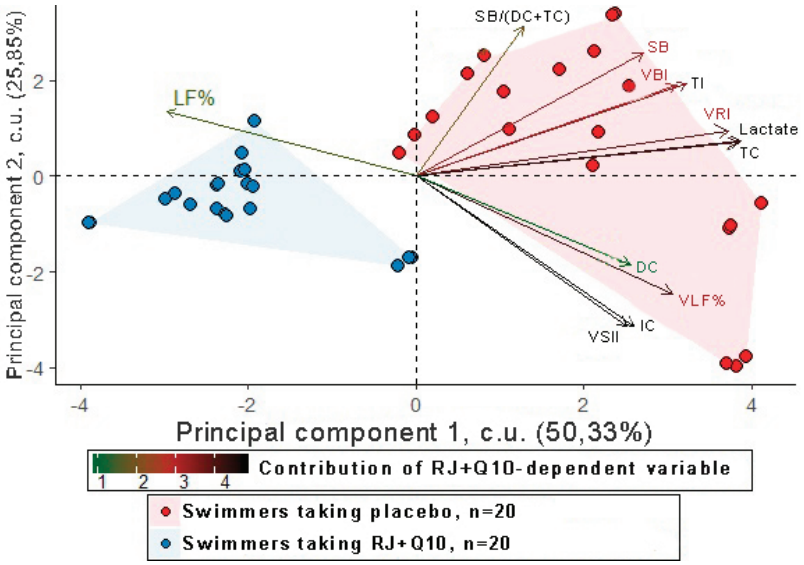

Fig. 2. *Principal component method in application to RJ+Q10-dependent variable collection in swimmers*

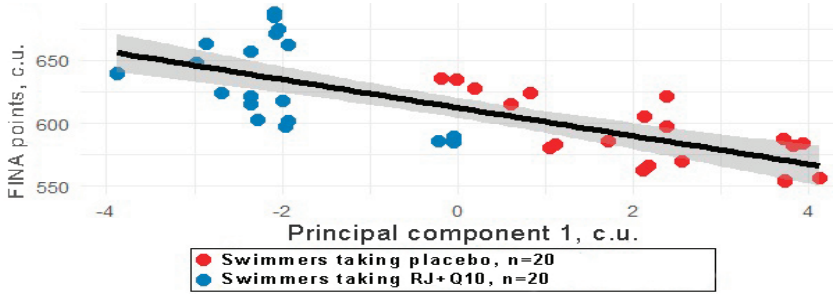

Fig. 3. *Scattergram of Principal component 1 and FINA points in swimmers*

rhythm index, tension index, SB/(DC+TC), dienoic conjugates, trienoic conjugates and Schiff's bases rates and lactate level in response to physical loads. (Fig. 2).

In the meantime,itshould be noted thatthere was a strong inverse correlation between CP1 and the number of FINA points after the functional test (R = −0.742) (Fig. 3).

The direction and strength of the statistical relation between PC1 and swimmers' athletic performance suggestthat the use of the composition of royal jelly and Q10 makes a significant contribution to the improvement of the control exercise execution technique by reducing the increment of very low frequency %, vagosympathetic interaction index, index of centralization,vegetative balance index,vegetative rhythm index, tension index, SB/(DC+TC), dienoic conjugates, trienoic conjugates and Schiff's bases rates and lactate level in response to physical loads.

Conclusions. The composition of royal jelly and Q10 leads to the decrease in tension of the regulatory systems, suppression of the intensity of lipid peroxidation processes, retardation of the development of hyperlactatemia in the swimmers during the control exercise. When administered for 10 days, the composition of royal jelly and Q10 improves the effectiveness of execution of the control exercise through the correction of the athletes' heartrate variability rates, inhibition of lipid peroxidation processes, and suppression of the development of hyperlactatemia under physical loads.

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AEROBIC POTENTIAL IN ADOLESCENTS WITH DIFFERENT PHYSICAL DEVELOPMENT RATES

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Annotation

Objective of the study was to conduct a comparative assessment of aerobic potential in adolescent boys with different physical development rates.
Methods and structure of the study. The study involved the 13-14 year-old adolescent boys (n=87). Based on the "body length" indicator, the subjects were divided into 3 groups: Group 1 - accelerants (n=26), Group 2 - normodants (n=40), Group 3 - retardants (n=21). The following parameters were measured: body weight and body length, vital capacity (VC), birth-death ratio (BDR) - the ratio of VC to body weight, oxygen utilization (UO2), absolute (O2C) and relative (RO2C) oxygen consumption, absolute (PhD) and relative (RPhD) physical development rates, absolute (MOC) and relative (RMOC) values of maximum oxygen consumption. The subjects' physical development was assessed in the step test according to V.L. Karpman, oxygen consumption - by means of a gas analysis.
Results of the study. The findings showed that the functional reserves of the oxygen supply system in adolescents depend on their physical development rates.
Conclusion. The greatest adaptation resources were detected in the normodants and retardants, which was confirmed by the higher RPhD and RMOC rates in the normodants and retardants as opposed to the accelerants. The study findings can be used in physiology of sports and sports medicine.

Keywords: *adolescents, aerobic potential, physical development, physical working capacity, oxygen consumption (O_2C).*

Background. The key provision of the sports science–based ontokinesiological approach [2,9] is that the training load parameters should correspond to the current state of the trainees and natural course of development of their motor functions [5]. Expansion in the number of sporting young people determines the relevance of investigation into the patterns of development of energy supply of motor functions during ontogenesis. The level of functioning of the body's oxygen supply system can be considered as the most important indicator reflecting the level of development of bodily adaptive reserves and largely determining the sports results. Neurohumoral restructuring of the regulatory mechanisms, heterochronous development of all physiological systems of the body, and high individual variation in the rates of ontogenesis result in significant differences in the aerobic working capacity rates within one age group. Adolescents have been found to have a decrease in the resources of the cardiovascular system, high level of energy consumption, higher oxygen debt under the influence of dosed physical loads, low level of maximum oxygen consumption, low aerobic potential [10]. Little attention has been given in the literature to the adaptive capabilities of adolescents with the high physical development rates – accelerants (A), average physical development rates – normodants (N), and low physical development rates – retardants (R). Several studies on this topic have made it possible to identify certain differences in the level of somatic health [7], the ways to ensure the stability of internal environment, physical working capacity in adolescents with different physical development rates [1, 4]. The analysis of the hemodynamic parameters showed that cardiac contractility was higher in adolescents with the average and low physical development rates [8]. In the available literature, there are no works devoted to the comparative analysis of the aerobic potential of accelerants, normodants and retardants. The comparative analysis of the aerobic capabilities of adolescent boys with different physical development rates can be used in sports physiology and sports medicine to optimize sports selection and prevent diseases.

Objective of the study was to conduct a comparative assessment of aerobic potential in adolescent boys with different physical development rates.

Methods and structure of the study. The study involved the 13–14 year-old adolescent boys (n=87). Based on the "body length" indicator, the subjects were divided into 3 groups: Group 1 – accelerants (n=26), Group 2 – normodants (n=40), Group 3 – retardants (n=21). The following parameters were measured: body weight and body length, vital capacity (VC), birth-death ratio (BDR) – the ratio of vital capacity to body weight, oxygen utilization (O_2U), absolute (O_2C) and relative (RO_2C) oxygen consumption, absolute and relative physical development rates, absolute (MOC) and relative (RMOC) values of maximum oxygen consumption. The subjects' physical development was assessed in the step test according to V.L. Karpman [6], oxygen consumption – by means of a gas analysis [11]. The maximal oxygen consumption (MOC) rate was calculated by the formula:

$$MOC = PWC_{170} \times 1.7 + 1240$$

The oxygen cost of work (the amount of oxygen needed to perform 1 W of work) was determined as a quotient of the amount of O_2 consumed per 1 minute of recovery and the power of the second step of load test according to V.L. Karpman. The data obtained were statistically processed using the STATISTICA for WINDOWS 6.0 software packages.

Results and discussion. It is shown that the aerobic energy supply and external respiration rates differed significantly between the accelerants, normodants and retardants. The results are presented in Table 1. VC was minimal in the retardants, average in the normodants, and maximum in the accelerants. The accelerants were found to have the highest level of physical development, the accelerants – the lowest one, the normodants – average. The retardants had a significantly higher level of overall physical fitness as opposed to the accelerants. The maximum MOC rates were registered in the accelerants, average – in the normodants, minimum – in the retardants. The latter were found to have the highest RMOC rates.

There were no significant changes in O_2U in all groups both at rest and after the dosed physical load. The maximum O_2C rates were recorded in the accelerants, average – in the normodants, minimum – in the retardants. RO_2C at rest did not differ significantly between the groups. It significantly increased in all the study groups under the influence of dosed physical loads. The largest increase (4.36 times) was observed in the retardants, the average (4.34 times) – in the accelerants, and the minimum (4.2 times) – in the normodants. The analysis of RO_2C at rest, in response to dosed physical loads (Karpman test) and physical loads at the level of MOC (see Figure) revealed some differences in the degree of increase of RO_2C in the study groups: the accelerants demonstrated the lowest degree of increase in response to physical loads at the level of MOC (8.9 times lower than at rest); while in the normodants and retardants, RO_2C increased 10.4 and 10.6 times, respectively. It was found that the muscular activity of the normodants was more "advantageous" in terms of energy consumption than in the 2 other groups: the oxygen cost of their work was statistically significantly ($p<0.05$) lower and amounted to 9.73±0.21 ml/W, whereas in the accelerants and retardants the oxygen cost amounted to 10.55±0.29 ml/W and 10.48±0.31 ml/W, respectively.

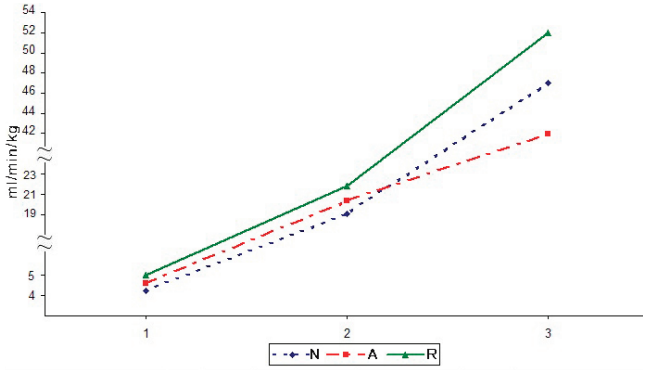
The study found some significant differences in the aerobic potential of adolescents – accelerants, normodants and retardants. The efficiency of the oxygen supply mechanisms to the working muscles characterizes the level of mobilization of the body adaptive resources of the adolescents and their somatic health level [3].

The group distribution of O_2C at rest and under physical loads, which revealed the high levels of O_2C in the accelerants, reflected their greater oxygen demand due to their larger muscle mass. The economical efficiency of work was the greatest in the normodants, as evidenced by the low oxygen cost of work in the adolescents with normal physical development rates as compared to their peers – accelerants and retardants. In the Karpman step test, which does not require the ultimate mobilization of oxygen supply resources, the accelerants and

Table 1. External respiration and aerobic energy supply rates (M±m) in the examined groups

Parameter	Group 1 (A) (n=26)	Group 2 (N) (n=40)	Group 3 (R) (n=21)	All (n=87)
Body length, cm	178.3±4.2 [1]	166.2±4.6	152.4±3.8 [1.2]	166.2±4.8
Body mass, kg	63.8±3.8 [1]	54.1±3.7	42.1±4.3 [1.2]	53.5 ±4.2
Vital capacity, ml	3528±272 [1]	2842±251	2159±249 [1.2]	2838±246
Birth-death ratio, ml/kg	58.1±3.2 [1]	52.8±3.0	51.2± 3.1 [2]	53.8±3.0
Absolute physical working capacity, W	140.6±7.2 [1]	125.2±7.1	96.7±7.9 [1.2]	122.5±7.3
Relative physical working capacity, W	2.28±0.08	2.37±0.07	2.47±0.06 [2]	2.36±0.3
Absolute MOC, ml	2702±174	2541±139	2245±143 [1.2]	2509±136
Relative MOC, ml/kg	42.2±2.3 [1]	47.1±2.2	53.2±2.3 [1.2]	46.7±2.2
O_2U at rest, %	7.0±0.3	7.46±0.4	6.89±0.4	7.29±0.4
O_2U in response to dosed load, %	6.85±0.7	7.03±0.7	6.77±0.8	6.96±0.5
Absolute O_2C at rest, ml	294±19 [1]	238±17	203±14 [1.2]	240±16
Absolute O_2C in response to dosed load, ml	1280±58 [1]	1007±57	850±52 [1.2]	1023±56
Relative O_2C at rest, ml/kg	4.7±0.3	4.5±0.4	5.0±0.4	4.6±0.4
Relative O_2C in response to dosed load, ml, ml/kg	20.4±0.9	19.1±0.7	21.8±0.8 [1]	19.5±0.8

Note. [1] – $p<0.05$ when compared to the normodants; [2] – $p<0.05$ when compared to the accelerants.



Relative O_2C (ml/min/kg) at rest (1), in response to dosed physical loads (2), in response to physical loads at the level of MOC (3).
Note: solid green line – retardants, dashed line with squares – accelerants, dashed line with rhombi – normodants .

retardants demonstrated the high level of tension of the oxygen transport system – the degree of increase relative to O_2C was significantly greater than in the normodants. Under physical loads at the level of MOC, the lowest rates of aerobic energy supply for muscular activity were registered in the accelerants, as confirmed by the minimum MOC rates and the smallest degree of increase in O_2C as opposed to the normodants and retardants.

Conclusion. The peculiarities of oxygen supply for muscular activity of adolescent boys are determined by their physical development rates. The highest levels of aerobic potential were observed in the normodants and retardants, as evidenced by the higher level of relative physical working capacity and RMOC, higher degree of increase in RO_2C in adolescent boys with the average and low physical development rates as opposed to the accelerants. The most economical type of energy supply for muscular activity (according to the oxygen cost of work) was typical of the normodants. The study findings can be used in the development of methods for sports selection, improvement of the training process, and prevention of somatic diseases among adolescent boys.

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COMPARISON OF PHYSICAL AND PHYSIOLOGICAL INDICATORS IN HANDBALL PLAYERS OF VARIOUS TRAINING GROUPS

UDC 796.01:612

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Annotation

Objective of the study was to conduct a comparative analysis of the physical and physiological indicators in handball players of the major and super leagues.
Methods and structure of the study. Sampled for the study were 36 handball players of the State Budget Professional Educational Institution "Moscow Secondary Special School of Olympic Reserve No. 2", Moscow Sport Committee, including 16 Major League athletes (aged 16-17 years) and 20 Super League ones (aged 17-21 years). The experiment ran in the competitive training period. The milestone complete physical examination involved a comprehensive assessment of the athletes' morphological state, level of aerobic working capacity, speed-strength abilities, level of dynamic and static stability on the Biodex Balance System simulator.
Results of the study. The handball players of various training groups did not differ much in terms of their anthropometric indicators. There were no pronounced differences in the maximum heart rate between the Major and Super League handball players at the significance level of $p<0.05$, while the dynamics of heart rate in the recovery period differed statistically significantly. There was a slight increase in the average blood lactate concentration for the group of Super League handball players.
Conclusion. The differences in the blood lactate concentration rates between the compared groups of athletes were statistically significant at $p\leq0.05$. With the increase of their anthropometric indicators, the handball players demonstrated better results in jumping exercises, which must be considered in the process of physical training.

Keywords: *handball, milestone complete physical examination, physical indicators, physiological indicators.*

Background. Nowadays, the issue of the athletic training system development is becoming more and more relevant. The achievement of high sports results depends on the relationship between the physical, tactical, technical, and psychological training. The intensity of a competitive struggle raised the quality standards for physical training, which reached such a level that further improvement of its effectiveness becomes a challenge. The primary importance of athletes' physical fitness is attributed to the use in the training process of large physical loads that require high functional potential [2].

Special functional training consists in the improvement of physiological mechanisms, which, in turn, ensure the efficiency of sports motor activity. The athletes' functional fitness is viewed as a complex, multi-component property of the body, with the perfect level of development of physiological mechanisms being the essence of the property, their readiness to secure, for the time being, the manifestation of all the qualities required for a specific sports activity, leading directly or indirectly to muscular activity, physical working capacity within the framework of a specific regulated motor act [3].

Objective of the study was to conduct a comparative analysis of the physical and physiological indicators in handball players of the Major and Super Leagues.

Methods and structure of the study. Sampled for the study were 36 handball players of the State Budget Professional Educational Institution "Moscow Secondary Special School of Olympic Reserve No. 2", Moscow Sport Committee, including 16 Major League athletes (aged 16–17 years) and 20 Super League ones (aged 17–21 years). The experiment was run in the competitive training period. The milestone complete physical examination involved the comprehensive assessment of the athletes' morphological state, aerobic working capacity level, speed-strength abilities, dynamic and static stability level on the Biodex Balance System simulator.

Results and discussion. The results of the complex morphological study of the athletes revealed some significant differences between the handball players of different leagues in terms of several anthropometric indicators. The differences between the body mass, fat body mass, and muscle body mass rates in the Major and Super League handball players were statistically significant at $p\leq0.05$. The

difference between the growth rates in the Major and Super League handball players were insignificant at $p \leq 0.05$.

The results of the morphological study are presented in Table 1 as the arithmetic mean (x) the standard deviation (σ).

The main indicator of the functional state of the body is the cardiovascular system functionality rate. Heart rate (hereinafter referred to as HR) is the most important cardiological criterion reflecting the degree of physiological stress. The competitive load rate can be determined by HR during the game and during the recovery period after the matchup.

The aerobic capacities (running speed on the aerobic threshold, threshold HR) of the handball players were determined in the HP/Cosmos treadmill test. The initial running speed was 7 km/h, followed by an increase of 0.1 km/h every 10 sec to the maximum. The average running speed of the handball players did not differ significantly, and the distance covered by the Super League handball players was lower (on average 3036.6±521.7 m) than that covered by the Top League handball players – 3143.3±428.7 m, indicating slight fatigue. Active recovery was taken into account against the background of a slow tempo (jam) on the treadmill for 7–8 minutes.

Throughout the experiment, the athletes' HR was recorded continuously. The data obtained showed that there were no pronounced differences in the maximum HR values between the handball players of the Major and Super League at $p \leq 0.05$. At an average speed of 16.2 km/h, HR ranged from 191.6±7.3 to 192.1±9 bpm, characterizing physical working capacity in the anaerobic energy supply mode. However, the HR dynamics in the recovery period differed statistically significantly. In the Major League handball players, HR during the first three minutes dropped to 119.5±6.4 bpm, while in the Super League athletes it reached 124.9±10.9 bpm only. These results can be explained by the fact that the age of the Major League handball players (16–17 years) affects the nature of the recovery processes. After the anaerobic exercises, their working capacity recovered faster than in the adult handball players of the Super League (17–21 years) (Fig. 1).

We also registered the maximum blood lactate concentration rates (prior to the testing, every 3 minutes during the test, immediately after the testing, and in the recovery during the 3rd and 8th min) in the handball players. There was a slight increase in the blood lactate concentration (group average for the Super League handball group – 8.9 mmol/l, for the Major League handball players – 8.2 mmol/l). During the recovery period, the blood lactate concentration rate was higher in the Super League athletes during the 3rd min – 9.5 mmol/l (during the 8th min – 7.6 mmol/l) than in the Major League ones – 8.4 mmol/l (during the 8th min – 6.2 mmol/l). It can be concluded that the differences in the blood lactate concentration rates between the groups were statistically significant at $p \leq 0.05$ (Fig. 2).

Anaerobic exchange threshold (AnT) – the HR level, at which the body changes from the aerobic to anaerobic mechanisms of energy supply – directly correlates with the physical fitness level and age. In the Major League handball players, the anaerobic threshold HR (HRat) amounted to 179.4±8.1 bpm and in the Super League ones – 176.4±8.8 bpm. This is due to the fact that junior handball players have a higher AnT rate as opposed to senior handball players. The differences in the HRat values between the Major and Super League groups were statistically significantly at $p \leq 0.05$ (Fig. 3).

It should be noted that the higher the AnT value, the more the load is performed through aerobic reactions. The improvement of aerobic capacity is primarily determined by the ability of various systems of the body (respiratory, cardiovascular, blood systems) to extract oxygen from the air and deliver it to the working muscles. To ensure the harmonious development of physical qualities, it is neces-

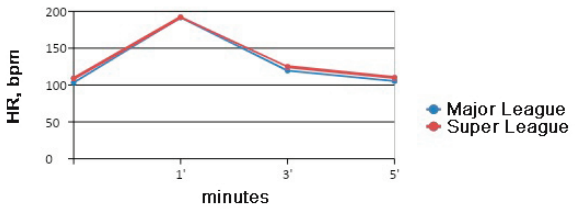

Fig. 1. *Dynamics of HR in recovery period in Major and Super League handball players*

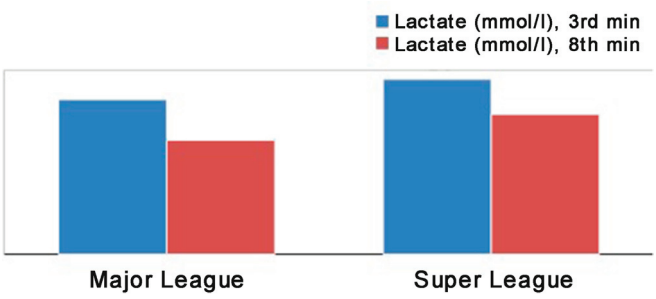

Fig. 2. *Blood lactate concentration rates (mmol/l) in handball players during the 3rd and 8th min*

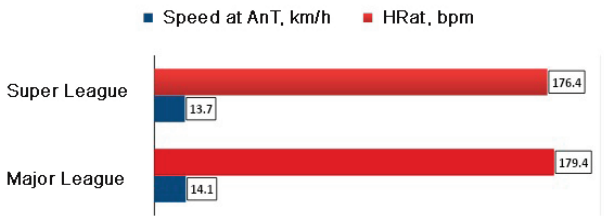

Fig. 3. *Anaerobic exchange threshold in handball players of various training groups.*

Table 1. *Results of morphological study of handball players*

Anthropometric indicators	Major League handball players $\bar{x}\pm\sigma$	Super League handball players $\bar{x}\pm\sigma$
Height, cm	187.2±6.51	188.3±10.0
Body mass, kg	80.5±10.4	83.8±11.7
Fat body mass, %	17.2±4.4	12.9±2.3
Muscle body mass, %	49.6±2.5	53.1±1.9

sary to perform physical loads of various intensity during independent exercises [1].

In the game activity of handball players, the manifestation of strength abilities is dynamic, and often it is necessary to use both speed strength (ball throwing, ball handling, holding the ball with a hand, etc.) and explosive force (jump, dash). In addition, it is necessary to demonstrate strength repeatedly. Therefore, strength endurance is not the least important quality in handball training.

The results demonstrated by the handball players in the "Standing long jump" and "Standing triple jump" tests characterize the level of development of speed–strength qualities of the leg muscles when performing complex coordination actions. The Super League handball players passed the tests better – 247.1±18 (standing long jump, cm) and 744.9±44.4 standing (triple jump, cm), respectively. This proves that the differences in the "Standing long jump" and "Standing triple jump" test results between the Major and Super League groups were statistically significant ($p \leq 0.05$) (Fig. 4). Moreover, the ratio between the triple and long jump results was 3.0.

In general, there was a clear pattern, which was that the handball players demonstrated better results in the jumping exercises with the improvement of anthropometric rates.

Overall vertical stability was assessed using the stability index (SI), which was lower in the Major League handball players (group average – 6.2±2.9) than in the Super League ones (group average – 7±3.6). The lower stability index, the higher the neuromuscular control level in the athletes, the better they hold the platform horizontally. The differences in the vertical stability rates between the Major and Super League athletes were statistically significant at $p \leq 0.05$ in favor of the Major League.

The percentage of time spent in zone "A", which was closest to the center of the target, was higher among the handball players of the Major League – 51.1±23.1% than among those of the Super League – 46.7±28%. These indicators characterize the effectiveness of the vertical posture control when performing a motor task, the maintenance of balance on a movable force plate.

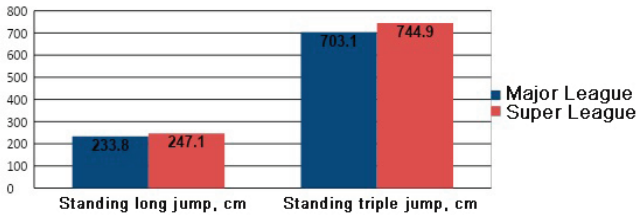

Fig. 4. *Speed-strength qualities of handball players of different training groups*

The athletes' ability to purposefully control the movement of the center of gravity of their body while performing a motor task was evaluated in the stability limit test. The stability limit is the maximum angle to which an athlete can deviate without losing balance. The stability limit rate was on average slightly higher in the Super League handball players – 12.6 (Super League – 11.7), indicating the group's ability to maintain balance.

The Major League handball players performed the test faster (on average 2:07 min:sec) than the Super League ones (2:34 min:sec). The quicker the test was performed, the fewer oscillations were recorded when the cursor moved.

Conclusions. The study found that the handball players of various training groups did not differ much in terms of their anthropometric indicators. There were no pronounced differences in the maximum HR values between the handball players of the Major and Super League at $p \leq 0.05$. At the same time, the dynamics of HR in the recovery period differed statistically significantly. These results can be explained by the fact that the age of the Major League handball players (16–17 years) affected the nature of the recovery processes. There was a slight increase in the average blood lactate concentration for the group of Super League handball players. The differences in the HRat values between the Major and Super League athletes were statistically significant at $p \leq 0.05$. HRat in the Major League handball players was higher than in the Super League ones. This was due to the fact that young handball players have a higher AnT rate as opposed to older handball players. To improve the aerobic capacity. it is necessary to increase the functional capacity of the circulatory, respiratory and blood systems of the body through regular targeted training. We identified a clear pattern, which was that, with the improvement of anthropometric rates, the handball players demonstrated better results in the jumping exercises. Therefore, particular attention should be paid to comprehensive physical training of handball players.

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PSYCHOLOGICAL BARRIERS FOR PROFESSIONAL SPORT CAREER

UDC 159.9.07

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Annotation

Objective of the study was to identify differences in the psychological barriers for a professional sport career, including: 1) student sports; 2) applied professional sports; 3) elite sports. Psychological barriers can be a serious obstacle to achieving high sports results.
Methods and structure of research. The authors applied the following research methods: 1) a questionnaire to identify the nature of respondents' relationships with sports and their athletic achievements; 2) the "Career Anchors" questionnaire by E. Schein (translated and adapted by V. A. Chiker, V. E. Vinokurova) for determining career-related value orientations; 3) an author's questionnaire to identify the athletes' psychological barriers. Sampled for the study were 106 students of FSBEI HE Sochi State University (aged from 18 to 44 years)..
Results of the study. The students of the elite sports group, as opposed to the athletes of other groups, demonstrated lower values of the following psychological barriers: unwillingness to make own lives more complicated or busier, to waste energy on a mythical result; understanding that success does not justify the efforts spent or means used; understanding that the desired sport goals have been reached, and now there are other values and priorities; understanding that the efforts spent were to no purpose due to a number of external factors (existing rules, traditions, laws, relationships, etc.); insufficient level of professional preparedness/ education; lack of the necessary conditions for success and professional growth in the organization (they work/ study at); unwillingness to hold back on interesting hobbies, various amusements; lack of necessary connections and patronage.
Conclusions. The study made it possible to determine the ways to remove psychological barriers for the professional sport career, carry out the necessary targeted psycho-correctional and psycho-development work.

Keywords: *physical education, mass sports, psychological barriers, professional career, sport career, priority values, elite sports, academic sports, professional applied sports.*

Background. Since the physical education and sports service and its health benefits are increasingly appreciated by the national policy makers, a special priority is given to the efforts to remove barriers for the physical education and sport service progress and competitive successes on the whole and psychological barriers for athletic progress in particular. The latter, as verified by the relevant studies, are manifested in harmful sentiments, lack of confidence, anxiety, fears, shame, low self-esteem etc. to result in physical inactivity and reluctance in some activity fields [3, 4]. As analyzed by S.I. Samygin and P.S. Samygin [2] in their study of athletic performance, such psychological barriers can seriously hamper competitive progresses. As provided by the national statistics, only 0.004% of the physically fit junior athletes make progress to qualify for WCMS; with 70% of those who quitted sports before qualifying for CMS reportedly did so for the loss of interest in sports and/ or dissatisfaction with the coaching service. Thus G.V. Bugaev, I.E. Popova and O.N. Savinkov[1] reported the following psychological barriers in the track and field sports: fatigue, fears of coach's negativism, fears of failure in the efforts to meet expectations, fears of non-compliance with the rules of competitions, pre-start fever, negative mindsets, poor sleep etc. It should be noted that the above and other studies demonstrate that the national science is still in need of psychological barriers studies for progress from mass sports to elite sports, and psychological barriers control models for the relevant retirement- and burnout-prevention, psychological support, corrective and mental progress facilitating purposes in sports.

Objective of the study was to identify group psychological barriers for physical education and sports on a sports-specific basis.

Methods and structure of the study. We run an empirical study using the following methods: (1) Questionnaire survey form with optional responses to find the sporting

cultures and competitive accomplishments in the sample; (2) E. Shein Career Anchors Test (adapted by V. A. Chiker and V. E. Vinokurov) to rate the priority values; and (3) Our own psychological barriers rating questionnaire survey form. Sampled for the tests were the 18–44 year old Sochi State University students (n = 106).

Results and discussion. Based on the prior survey, the sample was split up into (1) Academic sport group (n = 37) of the sporting and competing Socio–pedagogic Department students including future teachers, psychologists, speech therapists and other non–sporting specialties; (2) Professional applied sport group (n = 42) majoring in physical education, physical education and sports and adaptive physical education i.e. with the sports–specific future professional competences (in military or fire–fighting services, youth coaching at sports schools for children, etc.). The group was active in physical trainings and competitions – mostly in the specialty events; and (3) Elite sports group (n = 27) of the part–time actively sporting students majoring in physical education and physical education and sports (27 people), actively training and competing in the top–ranking events for the titles; having high sports qualifications, accomplishments and titles; with their future career expectations directly related to sports.

The group test data were processed to obtain the arithmetic mean psychological barriers test rates for a comparative analysis. On the whole, the psychological barriers test rates were the highest, moderate and lowest for Academic sport, Professional applied sport and Elite sports (Groups 1, 3 and 2, respectively). We highlighted the significant differences for Groups 2 and 3 since Group 1 test rates was even further from Group 3. The comparative analysis found some group psychological barriers being virtually the same, with the Elite sports Group 3 ranked the highest versus Group 2 in the following psychological barriers: unwillingness to take risks i.e. make the life too difficult, too stressful, waste energy for a mythical result; belief that the success may not be worth the costs; appreciation of own accomplishments with the feeling that now comes the time of different values and priorities; feeling limited by external factors (existing rules, traditions, laws, relations, etc.); insufficient professional fitness/ education; no progress opportunities at the work/ study site; unwillingness to restrict oneself in interesting hobbies, entertainments; and need for connections and patronage for progress.

The study data and analysis show these barriers being the most hampering for progress on the way from popular/ mass sports to elite sports. These psychological barriers may be due to external factors and typical individual traits that need to be addressed by prudent psychological support and correction service. We grouped the above wide range of psychological barriers so as to facilitate the service being provided on an integrated basis. We run a factorial analysis of the principal components with a Varimax rotation to find the following eight key factors that altogether account for 76.2% of the variance.

Factor 1 includes the following barriers: unwillingness to take further risks i.e. make the life too complicated, too stressful, waste energy for a mythical result; appreciation of own accomplishments with a feel that now comes a time for different values and priorities; feeling constrained by external factors (existing rules, traditions, laws, relations, etc.); unwillingness to restrict oneself in interesting hobbies, entertainments; desire to change the profession/ sport; loss of interest in the sport/ physical education and sports profession. On the whole, Factor 1 unites the psychological barriers dominated by the loss of physical education and sports motivations with unwillingness to take risks, complicate life and refuse its pleasures.

Factor 2 includes the following barriers: fear of failure; fear of new challenges; lack of confidence; fears of disappointment in the surrounding after failure; disappointment in own progress and sports–related professional achievements; poor mental controls; and low willpower. Thus Factor 2 refers to the emotional psychological barriers associated with fears, disappointments and poor emotional and volitional controls.

Factor 3 includes the following barriers: feel that success is not worth the costs; poor living standards and/or family problems; low prestige of the physical education–and–sports–related service; and laziness, unwillingness to leave the comfort zone. Thus this factor covers the psychological barriers associated with failed expectations from sports, low prestige of sports in society of frustrating effect on the athlete.

Factor 4 includes the following barriers: need for moral support/ appreciation from the surrounding; high competition, hard pressure from the rivals. This factor refers to the poor relationships with other people.

Factor 5 includes the following barriers: frustration with own resource and abilities; health issues with fears of health failures on the way to success. This factor refers to the health and own resource self–rating domain.

Factor 6 includes the following barriers: perceived shortage of material resource; life problems/ limitations; poor provisions for professional progress at work/ university; and need for connections and patronage. This factor is indicative of the athlete opting for victimized self–position under pressure from some external influences/ circumstances (which are never good enough) that are blamed for failures/ regresses.

Factor 7 includes the following barriers: emotional/ professional fatigue/ burnout; poor mental self–controls, low willpower. These barriers refer to the emotional/ professional burnouts that can hardly be corrected.

And Factor 8 includes the following barriers: perceived shortage of abilities; poor professional fitness/ education; and laziness, unwillingness to leave the comfort zone. Note that these barriers are partly covered by the above factors. Being consolidated herein they likely refer to self–criticism with a passively justifying rather than energizing reasoning.

We have also calculated the psychological barriers to career expectations correlation ratios to find the psychological barriers being in negative correlations with the following aspects: professional competence ($r = -0.214, p < 0.05$); and challenge ($r = -0.272, p < 0.01$). This finding shows that the higher is the athlete's determination to realize his/ her gifts and abilities, make progress, overcome obstacles, solve difficult problems, compete and suc–

ceed, the lower are the psychological barriers. Knowing that the career expectations are ranked with the deep-rooted personality psychological settings, as opposed to the psychological barriers, their analyses may provide a sound basis for the progress forecasts.

Conclusion. The study data and analyses offer a sound basis for the relevant rating scales development efforts, and make it possible to design the psychological barriers prevention systems to facilitate professional progresses in sports with the necessary targeted psychological, correctional and mental conditioning services. The perceived psychological barriers for professional progress are actually correlated with some individual typological features, which presumably include the external locus of control, failure avoidance behavioral models, some specifics of individual temperaments, career expectations and other personality traits that effectively shape up the individual psychological resource for professional progress. A broader survey may be recommended to profile the sports-specific psychological barriers on a more detailed basis.

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PRIORITY VALUES FOR PROFESSIONAL SPORT CAREER

UDC 159.9.07

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Annotation

Objective of the study was to compare value orientations that differ in the degree of their involvement in sports activity.
Methods and structure of research. During the empirical study the following research methods were applied: the "Career Anchors" questionnaire by E. Schein for determining career-related value orientations; technique of diagnostics of the need for achievements. Sampled for the study were the sporting students of Sochi State University.
Results of the study. It has been established that elite athletes are characterized by the higher levels of the following value orientations: "Expertise" (orientation towards sports perfection, achievement of high results) and "Challenge" (readiness to overcome obstacles, struggle and strive for victory). They also demonstrated higher indicators of the need for achievements (desire to exceed the results achieved, perseverance when overcoming obstacles and achieving the set goal). The athletes involved in applied professional physical training had higher indicators on the "Self-government" scale (desire to be free and independent in their professional field, not to be limited by strict rules, to make decisions independently). Being involved in sports by force of various circumstances and having achieved certain results at the initial training stages by utilizing natural potentials, such athletes find more attractive occupations and, thus, can retire from elite sports as they go forward. It is noteworthy that the highest indicators for both groups of athletes were registered on the "Serving" scale (desire to serve people, to make life better, protect other people's rights, help them in own professional activity).
Conclusion. The results obtained can be used during sport selection, since they help identify those who are truly focused on the highest achievements, ready to overcome difficulties, life obstacles and trials of their will power; as well as during trainings, as they stimulate the development and maintenance of relevant value orientations and personality traits.

Keywords: *elite sports, professional and applied sports, priority values, professional career, success motivations.*

Background. A professional career – interpreted as the vocational activity field and progress therein – may be successful when driven by high determinations, natural gifts and success motivations; with the modern professional sport careers known to require high mastery and competitive skills. As provided by N.B. Stambulova [4], sport careers nowadays start up relatively early and imply persistent self-perfection agenda and a good psychological support to attain high goals in one or a few sports disciplines. Professional sport careers and related issues have been subject to many theoretical studies [2, 3, 5]. Individual progress avenues in sports on the whole and their specific fields in particular are known to be largely determined by the personal value systems and priorities (referred to herein as the 'priority values'). As provided by V. Shein, they form internal success motivations and 'career anchors'. It could be beneficial in this context to rate the individual priority values systems on a sport-specific basis – in the way it was made, for example, by A.A. Bobrishcheva, K.V. Motovicheva [1] in their analysis of the priority values in martial arts on a training stage specific basis.

Objective of the study was to rate priority values in sports groups classified by the progress levels.

Methods and structure of the study. We used for the purposes of our empirical study the E. Schein Career Anchors questionnaire for the priority values rating; and the Y.M. Orlov Success Motivation Test. We sampled for the tests students of Sochi State University specialized in the physical education, physical education and sports and adaptive physical education disciplines. The sample was split up into Elite Sports group (n = 27); and Professional Applied Sports group (n = 42) showing significant differences in their group lifestyles, physical training styles and volitional efforts; with the Elite Sports group obviously trained much harder and exposed to higher mental stressors and, hence, developing the relevant values systems and priorities for progress.

Results and discussion. The sample priority values test data processed by the standard mathematical statistics toolkit are given in Table 1 hereunder.

A comparative analysis of the priority values arithmetic means found the Elite Sports group leading on the fol-

Table 1. *Priority values test rates of the Elite Sports and Professional Applied Sports groups*

	Priority values	Elite Sports	Professional Applied Sports	Mann-Whitney U test emp.	p
1	Professional competences	30,404	35,333	420,5	<0,05
2	Managerial progress	28,810	29,556	554,0	–
3	Independence/ autonomy	36,214	31,778	402,0	<0,05
4	Stable job	29,143	30,926	489,5	–
5	Stable household	18,512	23,000	430,0	<0,05
6	Service	37,119	37,889	561,0	
7	Challenge	28,143	35,556	354,0	<0,01
8	Lifestyle integration	35,976	36,630	560,5	–
9	Entrepreneurial progress	32,833	31,185	510,5	–

lowing priority values rating scales: professional competence ($p < 0.05$), challenge ($p < 0.01$); and stable household ($p < 0.05$); whilst the Professional Applied Sports group was rated higher than the Elite Sports one on the independence scale ($p < 0.05$). These test rates may be interpreted as follows. The Elite Sports group is more focused on the rivalry, competitive success, solutions of challenging problems, stress coping, fighting spirit and victory. The group also demonstrates high self-perfection agendas and achievement motivations. At the same time, the higher Elite Sports rates on the stable household scale may be interpreted as indicative of the desire to have a peaceful place to rest after the multiple trips and competitive stresses. Furthermore, the Elite Sports group was tested with the relatively higher rates on the success motivations scale that the Professional Applied Sports group (15.8 vs. 14.5 points, respectively; U-emp = 386, $p < 0.05$). That means that the Elite Sports group is determined to surpass the own and others' best results, shows great determination in the stress coping, goal achieving and problems solving domains.

The Professional Applied Sports group generally showed a higher need for freedom and independence in the professional field, decision-making independence and intolerance to the imposed rules, daily/ dietary regimens, and any interference in the habitual behavioral patterns. This means that the athletes, even when they have necessary psychophysical resource for progress in sports, may be reluctant to mobilize the resource for success if they internally resist to any limitations for their lifestyles imposed by sports. Once involved in sports, they may, due to different circumstances and upon making first successes in sports, still find more attractive fields that offer more perceived freedom and less restrict them by responsibilities and requirements, i.e. give more means to independently determine their own professional/ personality progress avenues. It is not unusual, however, that they opt for progress in the fields where their sports skills are highly valuable.

It is noteworthy that both groups were tested equally high on the service scale (35.98 vs. 36.63 points). Sports careers are known to claim high volitional efforts with the athletes often having to surpass their natural abilities and resources for success, overcome pain and multiple discomforts. That is why every sport develops its values and semantics system with contributions from the coaches, families, sports psychologists, peer athletes, mass media, etc., with the relevant indoctrination culture. As a result, every athlete strives to serve his/her motherland, bring spiritual and practical benefits for the compatriots, make the own life and others' lives better and thereby attain the personal life and self-assertion goals.

Conclusion. Based on the priority values rating tests, the Elite Sports group was tested higher than Professional Applied Sports group on the professional competence (career progress motivations) and challenge (stress coping, fighting spirit and desire to win) scales, plus the higher success motivations; whilst the Professional Applied Sports group was tested higher on the independence/ autonomy scale (desire to be free and independent in the professional field unlimited by rules, be unrestricted in the decision-making etc.). Both of the groups were tested equally high on the service scale – that may be interpreted as their moral fitness to meet serious sports-specific problems and challenges. The study data and findings are recommended for application in the career-driving priority values rating tests for the sports selection and training purposes.

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PHYSICAL EDUCATION AND SPORTS SERVICE IN NATIONAL EDUCATION SYSTEM: PROMISES OF ECO-PSYCHOLOGICAL RESEARCH

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Annotation

Objective of the study was to analyze psychologically acceptable indicators of representation of the physical education and sports environment of educational institutions.
Methods and structure of the study. The methods included study of the related literature, theoretical analysis of information, allocation of components of the investigated problem, systematization of selected facts, definition of general and various features of the phenomenon under study.
Results of the study. The authors analyzed the theoretical approaches to and methodological tools for the realization of the opportunity to conduct an eco-psychological study of the physical culture and sports environment of educational institutions. The methodological paradigm, within which it was suggested that the research should be conducted, rests on the eco-psychological approach – a separate direction that has developed in Russian psychology and is focused on the interpretation of the characteristics of subject-environment interactions as psychologically acceptable indicators.
Conclusions. The article outlines the main provisions of the eco-psychological approach to the physical education and sports environment of educational institutions, and presents the analysis of the methodological tools making it possible to perform the empirical validation of the considered theoretical provisions.
It is assumed that the data obtained during the study of the features of representation of the physical culture and sports environment of educational institutions conducted by the students and teachers will help determine the "resource"- and "deficit"-related directions of optimization of the sports and physical education environment.

Keywords: *eco-psychological approach, physical education and sport service, educational environment, psychological representation of physical education and sport service, formal aspects of physical education and sports psychological representation, content of physical education and sports psychological representation, mental representation.*

Background. The ongoing initiatives to find optimal education service models and tools include the national physical education and sport specialist training service improvement efforts. The physical education and sport cluster in the modern educational environment is reasonably versatile to ensure a good follow-up of the educational process actors in every point of the individual education trajectory. It may be pertinent to mention, as a case in point, that the modern bachelor training curricula includes a basic physical education and sport curriculum plus optional physical education and sport disciplines in the variable parts of the academic curriculum. An analysis of the formal and substantive aspects of the bachelor competence formation process, as provided by the valid third generation standards (FSHES), may be found in study reports by L.B. Andryushchenko, I.V. Manzheley and S.N. Chernyakova [6, 17, 18]. The bachelor training process, as provided by the education service policy-makers, must be designed to train specialists highly competent and skillful in the modern physical education and sport toolkits for success of their professional and social services and responsibilities. For these competences and abilities being 'inbuilt' into the individual system of interactions with the social environment, they need to be 'represented' in the cognitive, affective and behavioral domains of the individual mentality. Every aspect of such representation may be studied by the theoretical and practical tools provided by the modern eco-psychological approach.

Objective of the study was to analyze the psychologically relevant aspects of the physical education and sport service representation within the educational environment.

Methods and structure of the study. We used analyses of the reference literature on the subject, theoretical anal-

yses of the information flows, componential analysis and the factfinding methods to identify and discuss the general and specific aspects of the subject matter.

Results and discussion. Modern psychological community has long been developing eco-psychology as an independent research field which basics were laid by the foreign psychology [16], later on introduced in the national psychology by G.A. Kovalev [5], and then differentiated and methodologically classified by V.I. Panov [11]. Modern eco-psychological research is based on the fundamental assumption that an individual psyche grows and functions in a certain environment that largely determines its development pattern by the subject-environment interactions. A psychologically favorable interaction will be secured, on the one hand, by the subject's individual/ personal resources and, on the other hand, by the environmental resources mobilized ('subjectified'/ 'anthropomorphized') by the subject in its efforts to transform the surrounding space into a comfortable living environment.

Modern eco-psychology gives room for many studies to find the most promising educational environment optimizing models, including the educational environment vectoring theory by V.A. Yasvin [15], psycho-didactics model by V.I. Panov [10] and some others. Lately the eco-psychological and eco-didactical resources have been untapped and employed by the physical education and sport environment research community that defines the physical education and sport environment as the "wide range of the physical and spiritual personality progress encouragement inputs and aspects found in the natural and socio-cultural environments" [7, p. 132]. One of the theoretically substantiated and methodologically equipped options for the physical education and sport environment analysis in the context of eco-psychological approach is provided by the studies of psychological representation of the subject's living environment. This research option may be considered beneficial for the academic physical education and sport psychological representation studies for at least the following reasons.

First, the psychological representation phenomenon (in mental domain) provides a universal and classical toolkit for studies of the systemic/ structural elements of the living environment of special importance for the subject, with the subjective rankings of these "elements" by importance, and with the relevant "descriptive" logics i.e. qualification and classification of the environmental elements critical for the subject [9]. We can mention a few modern approaches to interpretation of the mental representation structures, including the mental representation interpretation in the cognitive psychology and intelligence psychology domains that consider it a "subjective vision of what is going on" (as provided by M. A. Kholodnaya); or a "mental model" (by E.A. Sergienko); or a "socio-psychological space" (by to A.L. Zhuravlev, I.A. Kupreichenko) etc.

Second, the science has developed and empirically validated a theoretical psychological representation model of a living environment with its levels, components and operational parameters to generate data on the types of representation [8]. This model has been successfully tested to identify the subjectively critical educational environment characteristics [3, 12]. As was found by the studies, the formal and substantial specifics of the educational environment representation – including the numbers of represented "elements" and "subjectification" (within the "reflected subjectivity" framework as provided by S.D. Deryabo) aspects of the environment [2] – may be ranked among the psychologically relevant subject-education-al-environment interaction factors that make it possible to spell out what in the educational environment is important for the students and relevant for their self-identification, and what is beyond their perceived lifestyle.

Third, eco-psychology and the related fields offer versatile practical toolkits to analyze the educational environment representation and profile every aspect of the subject-educational-environment interaction for the educational environment optimizing purposes [1, 4, 14, etc.]. The researchers offer the following key educational environment representation aspects/ criteria: subjective rating of the basic values and priorities being addressed by the educational environment [1]; subject-educational-environment interaction class/ type with its spatial, social and psycho-didactic components [4]; specifics of the socio-psychological activity space for the newcomer specialists [14] etc.

Every above aspect will be taken into account by the physical education and sport psychological representation facilitating educational environment research projects. It should be noted that, despite the fact that the theoretical basics for the physical education and sport service facilitating educational environment (dominated by the academic educational environment) have been well analyzed and developed, [13], no empirical studies have been run to address these issues as yet. Therefore, we would recommend running a wide range of empirical studies to analyze the psychologically relevant educational environment efficiency aspects for progress of the academic physical education and sport service. Of special promise may be the following research thrusts: analyses of the general/ universal specifics of the physical education and sport psychological representation facilitating educational environment and their classification; analysis of the environmental factors of influence on the physical education and sport psychological representation facilitating educational environment; and analysis of the individual psychological factors of influence on the physical education and sport psychological representation facilitating educational environment.

Conclusion. The article analyzes promises of the physical education and sport psychological representation facilitating educational environment studies driven by the modern eco-psychological approach. It is assumed that the physical education and sport psychological representation facilitating educational environment studies with contributions from students and teachers will make it possible to identify the resourceful and deficient avenues for the educational environment optimizing initiatives. Knowing the importance and relevance of the academic physical education and sport educational environment design and improvement goals both for the education service strategies and healthy lifestyle and psychological well-being

cultivation domains, we believe that the efforts to mobilize resource of the modern eco–psychology are well grounded in the theoretical terms and beneficial in practical terms.

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FEATURES OF PHYSICAL DEVELOPMENT AND PHYSICAL FITNESS OF JUNIOR FOOTBALLERS AND CYCLISTS (BMX) AGED 6 – 10 YEARS

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Annotation

Objective of the study was to analyze the peculiarities of physical development and physical fitness of the 6-10 year-old football players and cyclists (BMX).
Methods and structure of research. Proceeding from a comparative analysis of the morphological and functional indicators (body dimensions, muscle and fat mass, heart rate, blood pressure, VC) and the level of development of physical qualities (speed, coordination, strength, endurance, and flexibility) of the 6-10 year-old footballers with an experience of 8 months to 1.5 years (Moscow Football Academy, Sports School of Olympic Reserve, Lyubertsy) (n=113) and 6-10 year-old BMX cyclists with experience from 0.1 to 2 years (Sports School of Olympic Reserve, Saransk, Moscow) (n=100), it was shown that the peculiarities of physical development and physical fitness of young football players and cyclists (BMX) of 6-10 years of age are due to the age-related patterns of development under the targeted positive influence of sports activities on the growth and development rates and physical fitness level.
Results of the study. The authors detected the effects of the specific sport, which manifest themselves in the narrow-focused development of physical qualities, deviations in the mechanisms of regulation of the cardiovascular system, formation of body posture as a result of the lack of body conditioning and priority of technical training.
Conclusion. The findings indicate the advisability of sports activities at an early age with a focus on training impact aimed to harmoniously develop the functional systems of the body, musculoskeletal system and physical qualities.

Keywords: *footballers, cyclists (BMX), 6-10 year-old; physical development, physical fitness.*

Background. Global sports rejuvenation is an objective reality that cannot be ignored. It has been for many decades that discussions were conducted on the optimal or minimum age from which sports training can be started, as well as on the impact of early specialization on children's health and prospects for their success in sports [2, 6, 12]. The positive impact of early specialization on the morphofunctional indicators, physical fitness level, and psychological status is noted by many scientists [2, 12], which contrasts with the negative impact leading to various health disorders and early psychological burnout [6, 12]. Indeed, these contradictions are associated with the content of sports activities and their influence on the health and level of development of children of preschool and primary school ages. Nowadays, the time frame and content of the initial training program are regulated by the sport-specific federal standards for athletic training, which, for the most part, do not cover this age range, so the sports training programs for preschoolers and primary school students are regulated by the supplementary education institutions [11, 10].

Relevant approaches to this issue should be developed primarily through the study of a set of morphological, postural and functional indicators of physical development of junior athletes engaged in the most popular and progressive sports coupled with the development of their physical qualities.

Among the most popular sports is football, the most mass and popular one, requiring the comprehensive development of physical fitness with the priority formation of such physical qualities as speed, agility, and coordination of movements; the age of entry onto the initial training course – 9 years; the regimen of the first year of training: priority technical training (35–45%) including 9–11% of tactical, theoretical and psychological training and a small share of overall (13–17%) and special body conditioning (4–6%) [11].

BMX cycling, being a progressive and spectator sport, is a form of extreme cycling that requires comprehensive development of physical fitness with the priority formation of such physical qualities as strength, endurance, speed, agility, flexibility; the age of entry onto the training course – 6 years; the regimen of the first year of training: priority overall (28–30%) and special physical conditioning (9–11%), 20–22% – technical training, 12–15% – tactical, theoretical, and psychological training [8].

Objective of the study was to determine the features of physical development and physical fitness of junior footballers and cyclists (BMX) aged 6–10 years.

Methods and structure of the study. The research methods were chosen based on a complex test program developed following the physical development and physical fitness level rating standards in preschoolers and primary school students and the existing GTO standards for these children [4,5,7].

The methods applied were as follows: anthropometry, caliperometry, somatoscopy, physiometry, pulsometry, tonometry, pedagogical observations, descriptive statistics, Student t–criterion [1,3–5]. The following parameters were measured: total body sizes, circumferential dimensions of limb segments, skin–fat thickness; body posture, expiratory forced vital capacity (VC), HR, blood pressure (BP), wrist strength, 3x10m shuttle run time, standing long jump test rate, distance covered in 6–min run test, flexibility when bending forward standing on a gymnastics bench. We used an anthropometer, Lange caliper, scales, centimeter tape; tonometer, stopwatch, spirometer, and wrist dynamometer.

We tested the 6–10 year–old athletes: 113 junior footballers at the initial training stage, with 8 months to 1.5 years of experience (Moscow Football Academy; Municipal Institution Sports School of Olympic Reserve, Lyubertsy) and 100 junior BMX cyclists with 0.1 to 2 years of experience (Sports School of Olympic Reserve for cycling, Mordovia; Sports School of Olympic Reserve "Nagornaya", Moscow). The groups were made of the ethnic Russians (95.0% of the total sample) and children of other ethnic groups (Tatars, Belarusians, Ukrainians, Kirghiz, Tajiks, Armenians, Moldovans).

During the experiment, their parents (legal representatives) gave their informed consent in writing as required by the Federal Law "On personal data" (Article 9 No. 152–FZ).

Results and discussion. The comparison of the growth, development and fitness rates in the junior footballers and cyclists (BMX) with the normal age–specific characteristics revealed that the number of children with normal growth rates predominated: balanced body mass and chest sizes, high vital capacity rates, increased flexibility, speed, strength, and coordination rates (Tables 1–3) [4,5]. At the same time, both groups were characterized by the reduced muscle mass with the higher fat mass rates reached by the age of 9–10 years, which is in line with the data on the positive impact of sports activities on the growth and development of children of this age group and indirectly reflects the insufficiency of body conditioning practices – cyclic aerobic work and strength training using the loads adequate for the junior athletes' age, with the emphasis on technical training [2,12].

The comparative analysis of the even–aged groups of junior athletes of different specializations enabled to reveal the following features (Tables 1–3).

For the most part, the morphological indicators (total body sizes and labile body mass components) did not differ significantly between the junior footballers and cyclists in all age groups.

The cardiovascular system rates in the junior athletes differed between the footballers and cyclists, though: in the footballers, the increased blood pressure rates correlated with the reduced heart rate; in the cyclists, the normal blood pressure rates correlated with the increased heart rate. Increased blood pressure in the footballers could reflect the age–specific features of development of their cardiovascular system against the background of increased loading on the vascular system of the lower limbs in terms of high–priority technical training with the compensatory heart–rate fall. Increased heart rate in the cyclists was most likely due to the multiple repetitions of the rear wheel stunt, which causes a breath–hold – reduced heart rate compensated by its further increase. The features identified are relevant for the entire age period from 6 to 10 years, with a greater pronouncement at the age of 6–7, i.e. with the increase in the number of technical training tools and a decrease in the number of overall physical conditioning exercises aimed to develop the functional support systems.

Body posture of both footballers and cyclists, being a display of the harmonious formation of their neuromuscu–

Table 1. *Morphological indicators in junior cyclists (1) and footballers (2) aged 6-10 years*

Age, y.o.	Group	Body length, cm		Body mass, kg		Chest circumference, cm		Muscle mass, %		Fat mass, %	
		X	Σ	X	Σ	X	Σ	X	Σ	X	Σ
6	1	116.2	4.4	21.5	3.1	58.4	4.2	42.6	2.0	14.5	4.8
	2	118.6	5.4	21.4	2.7	58.3	2.3	43.3	1.57	13.0	2.84
7	1	124.7*	4.0	24.5*	2.7	59.9*	2.6	42.9	3.7	13.7	3.6
	2	121.8	3.1	22.1	1.0	58.2	1.40	43.2	1.89	12.8	2.32
8	1	130.7	5.3	28.1	5.7	62.9	6.0	43.5	3.6	15.6	4.6
	2	129.9	6.0	27.0	4.9	62.6	4.24	44.4	2.09	15.3	5.55
9	1	136.9	5.1	32.5	5.7	66.0	4.8	44.5	2.9	16.3	6.2
	2	135.0	7.0	30.6	6.9	66.1	6.31	43.5	2.16	18.2	6.82
10	1	139.4	5.6	32.6	5.7	66.4	5.2	45.0	2.9	16.2	6.3
	2	140.4	9.7	33.0	6.3	67.2	4.31	45.2	2.74	17.1	5.02

Note. Significant intergroup differences: * – p=0.05; ** – p=0.01.

Table 2. *Functional indicators in junior cyclists (1) and footballers (2) aged 6-10 years*

Age, y.o.	Group	HR, bpm		SBP, mmHg		DBP, mmHg		VC, l	
		X	Σ	X	Σ	X	Σ	X	Σ
6	1	95**	12.8	96*	8.7	61*	4.6	1.81*	0.15
	2	74	5.9	105	6.4	68	9.5	1.65	0.24
7	1	93**	13.7	98*	9.3	61*	6.2	1.63*	0.24
	2	72	6.5	106	8.9	69	7.7	1.86	0.25
8	1	85.3*	15.0	102*	10.5	64	4.9	2.41*	0.23
	2	77	8.5	110	5.6	67	6.3	2.08	0.23
9	1	85*	10.4	100**	10.5	63**	7.5	2.52**	0.24
	2	75	8.0	110	7.1	72	5.9	2.17	0.26
10	1	91**	9.4	102**	12.3	64*	4.3	2.59	0.28
	2	78	7.6	113	8.0	72	8.9	2.43	0.46

Table 3. *Physical fitness rates in junior cyclists (1) and footballers (2) of 6-10 years*

Age, y.o.	Group	Wrist strength,%		3x10m shuttle run, sec		Standing long jump, cm		Flexibility, cm		6-min run, m	
		X	Σ	X	Σ	X	Σ	X	Σ	X	Σ
6	1	41.0*	13.3	10.6	0.71	112*	11.3	4.6	4.41	902	126
	2	29.7	5.5	10.3	1.0	103	10.5	4.3	4.3	1007	88
7	1	39.6	5.6	10.1*	0.60	131*	10.5	5.4	4.42	1023	134
	2	36.7	4.9	9.4	0.54	121	11.4	3.8	3.4	1079	55
8	1	42.6*	5.1	9.4	0.44	139	15.0	8.4*	5.58	1017	123
	2	37.9	4.7	9.2	0.59	132	16.9	4.2	2.5	1082	77
9	1	41.7*	8.1	8.8	0.51	151	15.0	5.6	8.84	1111	144
	2	37.9	8.7	8.8	0.38	143	16.1	3.4	5.5	1139	98
10	1	43.5	7.4	9.0*	0.46	155	16.7	5.1	4.58	1015	110
	2	40.2	8.4	8.5	0.70	153	21.4	3.1	3.9	1091	236

lar and bone components, was mostly characterized by the abnormalities associated not only with the age-specific characteristics but with the lack of normal muscle tone in terms of the biomechanically targeted activity. Normal posture was less typical for the footballers than for the cyclists (24% versus 31%), additionally, they were found to have pelvic torsion against the torso (21.0%). The cyclists' body posture was characterized by the higher level of development of the muscle tone, good condition of the thoracic section of the spine (lower twist frequency, higher frequency of normal thoracic hyperkyphosis), less pronounced spinal curvatures, but with a more pronounced lumbar lordosis (57%), reflecting an imbalance in the development of the paired muscles and extensor and flexor muscles of the legs and torso.

Physical fitness manifests itself in the focused development of physical qualities at the ages of 6 and 7: in the cyclists – the priority development of the strength of the lower and upper limbs, as well as coordination and flexibility; in the footballers – the priority development of agility and coordination.

Conclusion. The features of the physical development and physical fitness of junior footballers and cyclists (BMX) aged 6–10 years are determined by the age-specific development patterns stipulated by the targeted and positive influence of sports activities aimed at the children's growth and development, physical fitness training. This is accompanied by the apparent effects of the specific sport, manifested in the focused development of physical qualities, irregularities in the regulatory mechanisms of the cardiovascular system, development of the postural system as a result of insufficient overall physical conditioning and priority specialized technical training. This proves that there are good reasons for sports activities at an early age, with an emphasis on the training effect aimed at the harmonious development of functional support and locomotor systems, as well as physical qualities.

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15-17-YEAR-OLD FOOTBAL PLAYERS' MENTAL CONDITIONIONG MODEL FOR TRAIING AND COMPETITIVE PROGRESS

UDC 796.41

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Annotation

Objective of the study was to experimentally substantiate the effectiveness of the methodology of psychological adaptation of qualified football players to training and competitive loads.
Methods and structure of research. When developing the methodology of psychological adaptation to training and competitive loads, we considered the psychological factors. The effectiveness of the developed methodology was assessed in an educational experiment, which involved 36 qualified (Class II and I) football players aged 15-17 years. They were divided into 2 groups: Control (CG) and Experimental (EG) Groups, 18 players of different positions each: forwards, defenders and midfielders, 6 players each, respectively. In the CG, the training sessions were conducted according to the generally accepted methodology. In the EG, the developed methodology of psychological adaptation to various training and competitive loads was used.
Results of the study. The analysis of the results of the educational experiment showed that under the influence of systematic training loads, the indicators improved in both groups with a pronounced advantage in the EG. A more significant improvement of the technical fitness level in the EG subjects was associated with the inclusion in the lesson plan of psychological training. This contributed to an increase in the athletes' self-confidence, formation in them of skills of self-control of motor actions; psychoemotional self-control skills; motivation for additional independent classes aimed to improve the individual technique of execution of the elements of motor actions that make up the content of football.
Conclusions. Psychological adaptation to changing training and competitive loads is a significant factor in increasing the level of sport mastery of qualified football players of 15-17 years of age, which ensures improved stress resistance under the influence of adverse environmental factors; focusing on the technique of execution of motor actions, etc.

Keywords: *football, mental conditioning model, model testing experiment, physical fitness, technical fitness.*

Background. Precompetitive mental conditioning methods and tools are known to be more efficient when the upcoming competitive performance is closely modeled to testthe actual physical,technical,tactical,theoretical and mental fitness for the event,with a special priority given to the potential competitors' fitness test data for comparisons and match planning purposes. When all the other competitive fitness elements are virtually equal,the highest priority will be given to the precompetitive mental conditioning tools.

Objective of the study was to test benefits of a new mental conditioning model for the 15–17 year–old skilled football players to facilitate their training and competitive progress.

Methods and structure of the study. We designed our new mental conditioning model customizable to the following psychological factors of influence:

– Player's interest in the sport, cognitive activity and competitive success motivations;

– Competitive determinations;

– Motivational aspects on the whole including the need for special systemic knowledge,leadership ambitions and resource etc;

– Responsibility including self–discipline and self–restrictions dictated by the competitive progress agenda;

– Progress facilitating climate including support from families and surrounding people.

The mental conditioning model was designed to:

– Cultivate good stress tolerance for the athlete to be able effectively cope with the external stresses by special concentrating, attention focusing, self–disciplining and mental/ emotional balancing skills;

– Help the athletes master modern ideomotor conditioning and competitive performance modeling methods;

– Advance and excel the individual mental control skills to effectively cope with fatigue and mental stressors by the timely and focused volitional resource mobilizing efforts;

– Improve the performance self–rating and self–analyzing skills to timely detect and correct errors;

– Improve the teamwork harmonizing skills; and

– Make the athlete fully fit for competitive encounters and versatile enough to employ the most efficient and unexpected techniques and tactics for success.

We sampled for the mental conditioning model testing experiment the 15–17 year–old Class I–II football players (n=36) split up into Experimental and Control Groups (EG,CG) of 18 people each with equal numbers of forwards, defenders and midfields (n=6 in each subgroup). The CG was trained using the traditional training method; and the EG training and precompetitive cycles were complemented by the new mental conditioning model.

The general and special physical fitness tests prior to the model testing experiment were as follows: 15/30m high–start/ interval sprint; standing long jump; standing high jump; triple jump; and stuffed ball throw tests. The pre–experimental physical fitness tests found insignificant intergroup differences ($p>0.05$). The pre–experimental technical fitness was tested by the ball control, passing and repossession; head shots; shots on goal; penalty shots; and long shots tests. The pre–experimental physical fitness tests found insignificant intergroup differences either ($p>0.05$): see Table 1.

Results and discussion. To rate benefits of new mental conditioning model for the physical and technical fitness aspects, we run post–experimental test – that showed progress in both of the groups with a significantly better progress in the EG.

The pre– versus post–experimental 15m high–start sprint test found the CG making progress from 2.50 ± 0.19 to 2.48 ± 0.21 s ($p> 0.05$); versus the EG progress from 2.49 ± 0.17 to 2.41 ± 0.18 s ($p> 0.05$). In the standing long jump test, the CG made progress from 2.12 ± 0.13 to 2.16 ± 0.17 cm ($p> 0.05$) versus the EG progress from 2.11 ± 0.18 cm to 2.23 ± 0.20 cm ($p <0.05$). The higher special physical fitness progress rates of the EG showed benefits of the mental conditioning model facilitated by the reasonably versatile training and competitive conditions including the multiple locations of the training/ competitive sites, widely variable workloads, reasonable changes in the climatic conditions etc.

The pre– versus post–experimental technical fitness tests found the following progresses. In the long pass test, the CG made progress from 4–6 to 5–8 passes ($p> 0.05$) versus the EG progress from 4–6 to 10–16 passes ($p<0.05$). In the penalty shots on goal test, the CG made progress from 3–4 to 5–6 shots ($p> 0.05$) versus the EG progress from 2–4 to 8–10 shots ($p <0.05$): see Table 2.

Meaningfully higher progresses of the EG versus CG in the technical fitness tests may be interpreted as indicative of the new mental conditioning model being beneficial for the training and precompetitive fitness systems. The EG players were also tested with progress in confidence, movement coordination and emotional balancing skills; plus the players showed more enthusiasm for self–reliant technical excellence trainings and improved motivations for competitive progress.

Conclusion. The new mental conditioning model testing experiment showed benefits of the special mental conditioning tools in the training and precompetitive settings as verified by the EG progress in sport mastery, stress tolerance, attention focusing on techniques, teamwork harmonizing and other aspects. The mental conditioning model benefits were rated with consideration for the model sensitivity to the actual competitive settings and challenges; training performance and accuracy; precompetitive fitness self–rating accuracy; practical performance efficiency; anxiety controls etc. Based on findings for the mental conditioning model testing experiment, the model may be recommended for application in the football excellence training systems.

Table 1. *Pre- versus post-experimental general/ special physical fitness test rates of the CG/ EG*

	Tests	Pre-experimental X±Sx	Post-experimental X±Sx
1	15m high–start sprint test, s	2,50±0,19 2,49±0,17	2,48±0,21 2,41±0,18
2	15m interval sprint test, s	2,14±0,19 2,15±0,20	2,11±0,15 2,09±0,16
3	30m high–start sprint test, s	4,57±0,33 4,58±0,39	4,53±0,29 4,47±0,34
4	30m interval sprint test, s	4,29±0,31 4,30±0,28	4,27±0,35 4,19±0,27
5	Standing long jump test, cm	2,12±0,13 2,11±0,18	2,16±0,17 2,23±0,20
6	Triple jump test, m	6,61±0,53 6,63±0,48	6,69±0,45 6,94±0,55
7	High jump fixed–hands test, cm	18,0±1,06 18.1±1,23	18,1±0,94 18,2±1,21
8	High jump hands–swing test, cm	28,2±1,48 28,0±1,35	29,5±1,56 30,8±2,16
9	Stuffed ball both–hands throw test, m	9,2±0,75 9,0±0,74	9,5±0,64 9,8±0,66

Note: CG in numerator and EG in denominator

Table 2. Pre- versus post-experimental technical fitness test rates of the CG/ EG

	Tests	Pre-experimental X±Sx	Post-experimental X±Sx
1	30m ball control test, s	7,08±0,54 7,07±0,52	6,55±0,49 6,39±0,61
2	30m dribbling test, s	6,52±0,56 6,53±0,48	6,50±0,52 6,41±0,51
3	Short pass test, count	26 – 28 27 – 30	34 – 37 38 – 46
	Middle pass test, count	16 – 18 15 – 19	19 – 22 27 – 35
	Long pass test, count	4 – 6 4 – 6	5 – 8 10 – 12
4	Repossession test, count	6 7	8 – 9 12 – 13
5	Head shot test, count	2 – 3 3 – 4	4 – 6 7 – 8
6	Far shots on goal, count	2 – 4 1 – 3	5 – 6 7 – 9
	Penalty shots on goal, count	3 – 4 2 – 4	5 – 6 8 – 10
7	Long shots, m	66,1±5,32 65,9±5,33	68,3±4,55 79,1±6,53

Note: RG in numerator and EG in denominator

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COMPARISON OF TRAINING PROCESS AND COMPETITIVE ACTIVITY CHARACTERISTICS IN ELITE BIATHLETES IN DIFFERENT SEASONS

UDC 796.012

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Annotation

Objective of the study was to compare separate indicators of training loads performed by the Russian national team during two adjacent training and competitive seasons characterized by different performance rates.
Methods and structure of research. The loads were registered on a daily basis by the same experienced staff using standard techniques. The training and competitive loads were compared based on the data obtained in the female biathletes.
Results of the study. The comparative analysis of the specifics of training loads performed by the women's biathlon national team for two consecutive years revealed that improvement of athletic performance in the key competitive exercise (biathlon sprint) can be accompanied by a decrease in the total volume of running and other types of training loads, but provided that their structure will change.
Conclusions. The findings obtained indicate that a "successful year" is characterized by the best results in terms of most components of competitive activity. At the same time, the main changes in the volumes and structure of training loads were as follows: a decrease in all volumes of load, especially power load, an increase in the share of intensive means used in the competitive period, while there were no significant changes in shooting training.

Keywords: *training loads, endurance, strength.*

Background. Modern biathlon may be ranked among the sport disciplines where competitive performance is highly sensitive to a wide range of factors of influence [1–3] including many psychomotor skills and physical qualities, with a special role played by endurance, strength and speed–strength abilities, high kinesthetic sensitivity [3] and others. This is the reason why the modern elite training systems need to be highly integrated and customizable to be effective and fully employ the natural gifts of every athlete [4–6]. It seems paradoxical that biathlon training systems are still understudied in many aspects – e.g. the relevant studies for the last 30 years have been about 10 times less extensive than studies of the cross–country skiing training systems [2]. The same applies, among other things, to the studies of the seasonal training system specifics versus competitive performance in the elite women's biathlon.

Objective of the study was to profile the training systems of the national women's biathlon team (NT) versus its seasonal competitive performance.

Methods and structure of the study. We sampled for the purposes of the study the women's NT members (n = 3) in 2017–18 season (aged 28.1 + 2.8 years old, maximum oxygen consumption = 66.7 ± 0.7); and 2018–19 season (29 ± 2.1 years old, maximum oxygen consumption = 67 ± 3.5) based on the following sampling criteria: (a) at least 2–year NT record and a high rank on the IBU ranking list; (b) no serious injuries/ health issues for the period with a formal medical clearance for trainings; (c) active competitors in the summer/ winter top–ranking national and international events; and (d) detailed training process test data for both seasons. Every sampled athlete gave a written informed consent for the personal data being used for scientific purposes on condition of anonymity.

Individual training workload was recorded on a daily basis in the training process as provided by the practical test method of the Moscow–based NT Sports Training Center (STC). The training workload were profiled by 39 test rates by certified specialists highly experienced in the training workload test procedures and classifications. The total cyclic training workload and intensity–zone–specific training workload were supported by the heart rate

variability data fixed by POLAR V800 (Finland – made) heart rate monitors.

Strength training process records fixed the numbers of attempts to obtain the strength endurance and hypertrophy and maximum strength test rates [6, 7]. The competitive performance rating method applied herein was described in our prior report [1]. Subject to a special analysis in the competitive period were the competitive rankings of the sample in the two sprint 8 – 10 stage events of the World Cup for the seasons. The test data were statistically processed and analyzed using the mean averages. We have not checked meanings of the differences in the data arrays to keep within the case study frame.

Results and discussion. Given on Figure 1 hereunder is the competitive performance of the sample in sprint events. Note that the sample made a 4 – 18% progress in the 2018 – 19 versus the prior season on every test scale save for the shooting time.

Given on Figures 2 and 3 are the monthly training workload profiles and averages for the precompetitive (PCP, May – October) and competitive (CP, November – May) periods.

In the highly successful 2018 – 19 season (hereinafter referred to as "successful"), the cyclic workloads were relatively lower (by 90 hours) mainly for account of the lower intensity zones 1 – 2 and intensity zone 3 – 5 trainings in the precompetitive period; whilst in the competitive period the intensity zone 3 – 5 trainings were increased. Ratios of the unspecific (running, cycling, rowing, simulator) and cyclic trainings were virtually unchanged in both of the periods although their annual volumes were slightly decreased. It may be pertinent to mention the unspecific trainings reduction trend in the successful season, particularly in the strength training domain. The aerobic – strength [6] and intensive indoor strength trainings (with weights of 70 – 90% of the individual maximums) were seriously cut down in the successful season whilst the low – intensity multi – repetition circular, static – dynamic [7] and static endurance trainings were kept at the same levels. There were no notable inter – seasonal changes in shooting trainings.

Having compared the training workload profiles for the two consecutive years were found that a competitive progress in the elite women's biathlon (sprint events) may be facilitated by reasonable reductions of the trainings workloads in the unspecific (running etc.) training domains and their prudent management. The relative reductions in the unspecific trainings could be

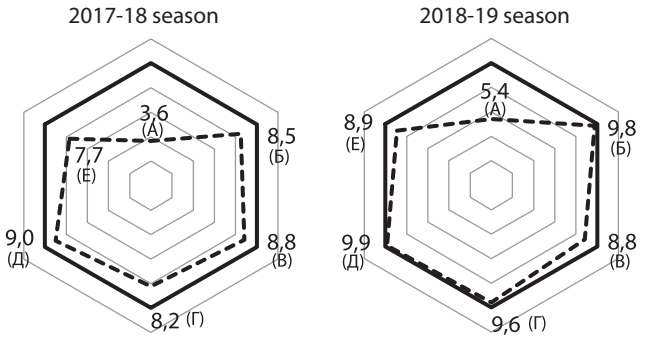

Figure 1. *Competitive performance of the Russia women's biathlon NT (-----) versus the reference performance model (——) of the 6 leading biathlon teams [1].*
A – speed on distance; B – last circle speed versus the starting speed; C – shooting time; D – shooting pace; E – prone shooting success rate; F – standing shooting success rate
2017 – 18 season 2018 – 19 season

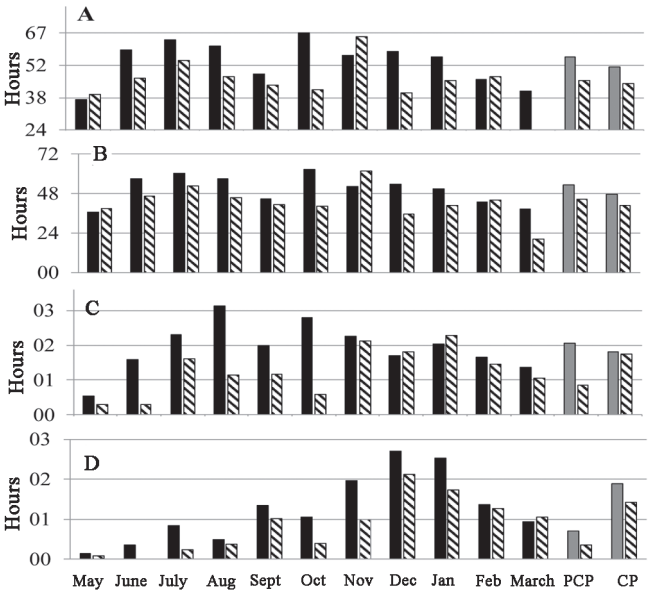

Figure 2. *2017-18 (black) and 2018-19 (hatched) training workload and precompetitive and competitive averages (grey) of the sample*
A: total cyclic workloads; B: Intensity zones 1-2; C Intensity zone 3; D Intensity zones 4-5
Hours Months PCP precompetitive period CP competitive period

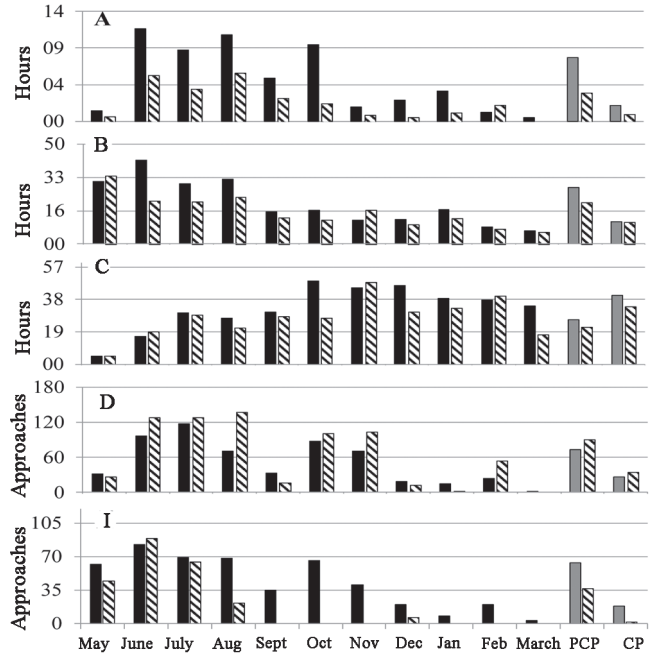

Figure 3. *2017-18 (black) and 2018-19 (hatched) training workload and precompetitive and competitive averages (grey) of the sample*
A: aerobic strength trainings; B: unspecific trainings; C: special trainings; D: strength training; E: hyper- and maximal-strength trainings
Hours Months PCP precompetitive period CP competitive period

of special benefits for the shooting accuracy – apparently due to the associating improvements in the psychophysical test rates.

Conclusion. The study data and analyses showed that a seasonal competitive progress in the elite women's biathlon may be secured in most of the competitive events and progress factors. It was demonstrated that the sample made progress in the successful season due to the following changes in the training system: reductions in every training element, particularly in the strength training and high-intensity training ones, with no significant variations in the shooting training components.

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RUNNING SPEED RATING CONDITIONS AND FACTORS: THEORETICAL GROUNDS AND PRACTICAL TESTS

UDC 796.012.412.5

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Annotation

Objective of the study was to increase the sprint running speed based on the factors that determine the effectiveness of training and competitive activities.
Methods and structure of research. The study was conducted on the basis of Ulyanovsk State Pedagogical University named after V.I. Ulyanov from 2017 to 2018. Two groups were formed: Control (CG) and Experimental (EG), 12 sprinters each.
The training sessions in the CG were conducted according to the traditional methodology in accordance with the athletic training program for qualified sprinters as recommended by the Russian Athletic Federation; in the EG, we applied a specially developed methodology that considers the pedagogical conditions and factors affecting the speed of running.
Results of the study. The educational experiment showed that the main pedagogical conditions and factors contributing to the improvement of effectiveness of the training and competitive activities of sprinters are as follows: ensuring gradual adaptation of athletes to muscle loads; conditions that exclude stresses of different nature; a system of special pedagogical influences that ensure the creation of a situation of success, increase of self-confidence, formation of a sense of satisfaction from trainings, realization of creative abilities and inclinations.
Conclusion. The effectiveness of training loads in sprint running is largely determined by the ability of the coach and athlete to rationally program the training system, taking into account the conditions and factors that contribute to the increase in the speed of running steps.

Keywords: *sprint, training provisions, factors, training workload, training and competitive performance.*

Background. Competitive success in modern sprint depends on the individual adaptability to the training workload; training system design and management; athlete's individual qualities and abilities, etc. The sport community gives a high priority to new training models to secure competitive progress. A special role is played by the coaching service and the training system management toolkit that need to prudently take into account every aspect and factor of influence on the sprint stride speed controls.

Objective of the study was to offer a sprint speed building model with account of the factors of influence on the individual training and competitive performance.

Methods and structure of the study. Competitive progress in the modern sprint events depends on multiple aspects and factors that may be listed as follows:

- Physical and technical fitness test rates;
- Functionality test rates;
- Individual stride control techniques;
- Ground contact control skills;
- Upper and lower limb movement coordination skills;
- Stride length and pace control skills;
- Startup and momentum gaining skills, etc.

Elite sprinter's training and competitive performance is known to depend, among other key factors, on provisions for the individual stride control technique excellence training tools and methods that should be reasonably versatile to keep up the progress facilitating mental/ emotional state, ease the tension in the key muscle groups, and establish good cooperative climate in the team. Coach should give a special priority to the athletes' satisfaction with the training system design and management service. Every individual training session should be reasonably customized to the individual motivations, interests, actual resources and progress needs.

Furthermore, training systems need to be customized to the individual functionality progress test data since the systematic and specific physical workloads are known to trigger complex transformations in biochemical parameters and functions. The efforts to build up the individual competitive sprint speed should take into account many factors of influence including the individual adaptability to the training workload variations versus the natural mor-

phological and functional progress profiles; and it should be borne in mind that the individual adaptation mechanisms can act differently depending on the physical training process volumes and intensities.

Many studies [2–4, 9, 6, 8, etc.] have shown that a new functioning level is attained when the training workload is close to the individual maximum. Training systems designed on this basis secure the athlete being highly fit for the competitive stressors to demonstrate the best performance. The muscle excitability and sensitivity excellence trainings facilitate performance of the nervous centers to effectively control the fast excitation and inhibition processes as required by the training workload, training process intensity and key motor skills.

Movement speed may be interpreted as one of manifestations for the individual functionality and fitness with a leading role played by the nervous system [7]. Modern sprint claims contributions from every physiological system to step up the musculoskeletal system performance and work intensity with the relevant inputs from every department of the central nervous system. Thus the sprint skills training tools need to be prudently selected to ensure progress in power of the working muscle groups to expand their effective movement range.

Individual excellence training systems in modern sprint may include cross-country racing practices to effectively develop the aerobic capacities as a basis for special endurance. Evenly-paced cross-country racing practices are known to improve the cardio-respiratory system performance, dynamic strength of the key muscle groups plus the inspiratory, expiratory muscles, vital capacity, MPV rates etc.

The trainings should be designed to facilitate the stride control and analysis for the sprinter being able to feel and control own performance in the context of the natural pheno-typological differences and develop the individual best sprinting style for competitive progress and success. Only a creative and analytical approach to the training process design and management may help prevent/ correct natural technical errors in the sprint techniques excellence process, mitigate the competitive stresses and secure the best and stable competitive performance.

We tested our new sprint speed building model designed with account of the factors of influence on the individual training and competitive performance at Ulyanovsk State Pedagogical University in 2017 through 2018. We sampled for the model testing experiment the 18–20 year old Class I/ II academic women sprinters (n = 24) specialized in the 100/ 200m sprint events, and evenly split up the sample into Experimental Group (EG) and Control Group (CG) of 12 people each.

Background sprint fitness of the sample was tested by the following pre-experimental tests: 60m high-start sprint; 150m high-start sprint; 3000m high-start race; standing triple jump; and 10 sequential standing long jumps tests. The tests found no meaningful intergroup (EG vs. CG) differences ($p > 0.05$). The CG was trained as required by the traditional sprint training system recommended by the Track and Field Sports Federation; and the EG trainings were dominated by the new sprint speed building model designed with account of the factors of influence on the individual training and competitive performance. The group progress was tested by the post-experimental tests.

Results and discussion. The pre- versus post-experimental test data and analysis showed progresses in both groups with a significantly better progress in the EG. Thus the 60m sprint test showed the CG and EG making progresses from 8.01 ± 0.07 to 7.90 ± 0.08 s ($p > 0.05$) and from 8.03 ± 0.11 to 7.70 ± 0.10 s ($p > 0.05$), respectively. In the 150m sprint tests, the CG and EG made progresses from 24.10 ± 0.12 to 23.0 ± 0.14 s ($p > 0.05$) and from 24.12 ± 0.13 to 21.20 ± 0.21 s ($p < 0.05$), respectively. The similar differences in the pre- versus post-experimental intergroup progress test data were found by the other tests.

The new model testing experiment showed that the training and competitive performance progress in the excellence sprint groups may be facilitated by the efforts to: secure gradual adaptation to physical workloads; prevent/ mitigate the process stressors; effectively apply the most efficient training tools to develop the success motivations, increase self-confidence and satisfaction with the training process climate and progress; and fully mobilize the individual creative resource and natural gifts/ predispositions for success. A special priority in the trainings will be given to the following leading factors: stride length/ pace controls and momentum gaining techniques; training workload management with an emphasis on the volume and intensity control aspects; and the ability to mobilize the individual resource for progress.

Conclusion. The new sprint speed building model with account of the factors of influence on the individual training and competitive performance was tested beneficial as verified by the EG versus CG pre- and post-experimental progress tests. It was found that the training system efficiency in modern sprint excellence groups highly depends on the coach's and athlete's ability to prudently design and manage the training process with account of every aspect and factor of influence on the performance to improve the stride speed control skills.

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CLAY COURT TENNIS: MEN'S ELITE COMPETITIVE PERFORMANCE ANALYSIS

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Annotation

Objective of the study was to determine factors affecting the tennis match scoring run as exemplified by two successive tennis plays on clay courts between the TOP-20 tennis players of the men's ATP rankings.
Methods and structure of research. Based on the analysis of the literature data and observation of the tennis plays on clay courts at the level of TOP-20 men's ATP rankings, 21 variables (indicators) of strategic actions were identified.
Proceeding from the correlation analysis, out of 21 indicators, 15 ones were singled out as suitable for a factor analysis. They were subjected to a canonical factor analysis without axis rotation. As a result, we got 8 factors explaining almost 100% of variance of the game results.
Results of the study. Almost 100% of the data changes are accounted for 8 factors, which include all the indicators of competitive performance in men's singles on clay courts at the level of TOP-20 ATP rankings. At this level, there are 7 indicators that are the most informative and convenient from the point of view of the competitive process management, as on other surfaces and in other categories.
Conclusion. A further study the factors of competitive activity that affect the outcome of games is required: in women's games, on different surfaces, at different levels; tactical and technical indicators.

Keywords: *clay court tennis, competitive performance test rate, action success rate, factor analysis, correlation analysis, efficiency ratio.*

Background. Modern tennis elite and sport research communities take persistent efforts to improve the long-term training systems for competitive progress on different surfaces including the traditional clay courts.

Objective of the study. Was to rate the factors of influence on the competitive accomplishments of the top-twenty ATP men players, with two successive games sampled for analysis.

Methods and structure of the study. We analyzed the match video replays to fix 21 key (strategic) competitive actions (variables) of the top-twenty ATP men singles (n=22) followed by a correlation analysis. We supported the study by analyses of the study reports on the subject [1–3]. Furthermore we selected 15 of the 21 competitive performance test rates for the canonical factor analysis without axial rotation to obtain 8 key factors of influence accounting for almost 100% of the competitive success variation range.

Results and discussion. To produce the 21 key competitive performance test rates, we analyzed 78 games of the top-twenty ATP players (n=22). The competitive performance test rates were classified in our registration cards as follows: total strategic actions grouped by classes (attacks, counterattacks, defenses, serves, equal rallies); wins thereof; and necessary attacks (serves; attacks on the short/ half-courtballs etc.). Generally, we fixed the obvious actions net of any interpretations of the players' goals/ intentions. We excluded the duplicating/ overlapping competitive performance test rates (such as the versatility of the individual toolkits, stability and accuracy of the strikes, etc.); and strived to expand as much as possible the range of significant competitive performance test rates computed using special formulas based on the competitive performance registration data. Having collected the key competitive performance data, we run comparative and factor analyses of the 21 variable competitive performance test rates and 39 action success rates in 78 games. Given in Table 1 hereunder is the competitive performance test rate versus success rate correlation analysis.

Given in Table 2 are the key success rates of the sampled men singles on the clay courts classified by attacks, defenses and counterattacks.

Given in Table 3 hereunder are the efficiency ratios of the attacks, defenses, counterattacks and equal games.

We would highlight the following two key criteria for selection of the integrated competitive performance rating factors: coverage and benefits for the competitive performance control purposes. We used these criteria to group the competitive performance test rates, with a special attention to their primary or secondary nature and their meanings. We gave a special priority to the group-specific competitive performance test rates combined to facilitate the individual excellence trainings. Then we analyzed the factors yielded by the factor analysis to find the following (1) prime reasons for wins and losses in every game and (2) factorial weights of the factors with account of their correlations with the game success rates. Thus we drafted mathematical formulas to compute the competitive performance test rates and make decisions on how they should be integrated/combined.

As a result, we arrived to 7 combined competitive performance test rates with the best coverage and benefits for the competitive performance control purposes since they were found: highly correlated with the game success rates i.e. every action success; covering every possible aspect of the strategic action efficiency; and maximally orthogonal with respect to one another. These combined competitive performance test rates include: 1 integral factor to rate success of whatever strategic action; 5 specific competitive performance test rates indicative of the specific action class success; and

Table 1. *Competitive performance to action success correlation ratios*

	Competitive performance test rate	r
1	Efficiency ratio	0,79
2	Attack efficiency ratio	0,53
3	Equal game efficiency ratio	0,52
4	Attack success	0,52
5	Defense success	0,46
6	Tactical success	0,46
7	Total defense actions	−0,46
8	Equal game efficiency ratio	0,43
9	Attack/ aggression opportunities usage rate	0,42
10	Defense efficiency ratio	0,37
11	Total attacks	0,33
12	Mid-court/ netgame efficiency	0,33
13	Counterattack efficiency ratio	0,22
14	Counterattack success	0,21
15	Game style	0,19
16	Aggression	0,19
17	Total counterattacks	0,16
18	Style efficiency	0,12
19	Style versatility	0
20	Equal game factor	0
21	Styles matching factor	0

Table 2. *Factor analysis of the key competitive performance factors*

Factors/ variables	Factor weights								
	1	2	3	4	5	6	7	8	9
Total attacks	0,87	−0,28	0,08	−0,28	−0,06	0,05	−0,18	0,06	−0,01
Total defenses	−0,61	0,33	−0,16	−0,13	0,08	−0,63	0,05	0,18	−0,03
Total counterattacks	−0,47	−0,47	0,26	−0,33	−0,10	0,10	0,59	−0,01	−0,12
Attack success	0,13	0,67	0,30	−0,33	0,51	−0,03	0,03	−0,22	−0,15
Defense success	−0,40	−0,03	−0,61	−0,58	0,03	0,11	−0,05	−0,18	−0,03
Counterattack success	0,02	0,72	0,52	−0,21	−0,03	0,16	0,14	0,19	0,27
Equal game success	0,73	0,33	−0,45	0,09	−0,11	−0,09	0,17	−0,05	−0,09

Table 3. *Key competitive performance test rates: integral factors*

Factors/ variables	Factor weights								
	1	2	3	4	5	6	7	8	9
Attack efficiency ratio	0,87	−0,05	0,20	−0,35	0,11	0,03	−0,17	−0,02	−0,05
Defense efficiency ratio	−0,48	0,04	−0,57	−0,52	0,12	0,18	−0,03	0,20	0,16
Counterattack efficiency ratio	0,23	−0,47	−0,13	0,33	0,74	0,01	0,15	0,03	0,12
Equal game efficiency ratio	0,73	0,29	−0,35	0,15	0,02	0,06	0,13	0,30	−0,19
Total efficiency ratio	0,87	0,29	−0,15	−0,04	−0,11	0,07	0,20	−0,16	0,01
Aggression	0,79	−0,28	0,12	−0,27	0,08	0,00	−0,01	0,28	−0,08
Tactics efficiency	0,84	0,05	−0,30	0,14	−0,08	−0,10	0,16	−0,13	0,28
Attack/ aggression opportunities usage rate	0,58	−0,42	0,19	−0,41	−0,09	−0,42	0,03	−0,07	0,11

1 supplementary competitive performance test rates that may be applied to analyze non–standard arrays of at–tacks and defenses in a game.

Conclusion. The study found that virtually 100% of the top–twenty ATP men singles' competitive performance elements on clay courts may be rated by 8 factors; with 7 factors offering the best coverage and benefits for the competitive performance rating purposes – that may be potentially used for the other surfaces and skill classes. We recommend further studies of the competitive performance factors in the modern elite tennis for the whole range of surfaces,for women groups and different technical/ tactical skill levels.

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STICK GRIP SPECIFICS IN MAS-WRESTLING

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Annotation

Objective of the study was to analyze the effects of the internal and external stick hold positions on the outcome of a bout.
Methods and structure of research. During the study, we analyzed 186 bouts, 123 of which - with a right-hand external grip, 63 - with a left-hand external one, 123 - with a left-hand internal grip and 63 - with a right-hand internal one. Having studied the peculiarities of the grip selection, and taking into account the contest rules, starting position (attack, waiting universal wagon, defense) and movements along the board during a bout, we decided to use the terms "right-hand position" (right hand is palm up) and "left-hand position" (left hand is palm up).
Results of the study. The data obtained during the analysis of competitive performance at the mas-wrestling championship of the Republic of Sakha (Yakutia) showed that 66% of bouts were conducted with the right-hand (external) stick hold position and 34% - with the left-hand (external) one. Out of 123 bouts with the right-hand position (external grip), 63% were won, 37% were lost. Out of 63 bouts with the left-hand position (external grip), 35% were won, 65% - lost.
Conclusion. At this stage of mas-wrestling development, it is the right-hand position that dominates. The study showed that when choosing a stick hold position, in case of an external grip, athletes are guided by the strength of their hands and thus take the stick with their strong hand, in our case - the right-hand grip. The choice of the grip type directly affects the starting left-hand or right-hand position and, in general, the algorithm of technical and tactical actions.

Keywords: *mas-wrestling, inside/ outside grip, left/ right hold, carpal strength, offense, defense, tug stick (mas), physical qualities.*

Background. Many analysts tend to consider competitive performance in modern mas-wrestling as an acyclic maximal-intensity work with some cyclic elements in long bouts of equally strong competitors. Modern long-term training systems in mas-wrestling give a special priority to the technical skill set excellence aspects based on versatile general physical conditioning and special age- and skills-specific physical training elements focused on certain physical qualities, technicalities and tactics. Generally, every training system is designed to secure the theoretical and practical training elements being perfectly harmonized with the individual progress in physical qualities, otherwise even a single deficient physical quality may undermine the individual progress on the whole. The physical qualities excellence components should be well combined with and supplemented by the technical and tactical excellence training elements.

Competitive rules in this traditional ethnic sport require the competitors sit opposite with their feet propped against the dividing board to tug on a wooden stick (mas); with the winner expected to pull his opponent over the board or wrest the mas out his hands. It is not unusual in the mas-wrestling bouts that a loss of an inside/ outside grip loses the match. This is the reason why the technical trainings in mas-wrestling make a special emphasis on the stick gripping technicalities and the carpal strength building elements [1, 2] plus special endurance trainings to prevent fatigues of the forearm/ carpal muscles in long bouts [6]. Generally a competitive success in the modern mas-wrestling is secured by versatile exercises to excel the tug stick holds and pulls, with original technical inventions in the stick controls, plus perfect well-trained pacing of every technical/ tactical action in the matches.

Objective of the study was to rate benefits of the right-/ left-hand-up inside/ outside gripping techniques for competitive progress in mas-wrestling.

Methods and structure of the study. We analyzed for the purposes of the study 186 competitive bouts including 123 bouts with a right-hand outside grip; 63 with a left-hand outside grip; 123 with a left-hand inside grip; and 63 with a right-hand inside grip. Having analyzed and classified the competitive techniques into the start-up grips (offensive, universal reactive and defensive) and board control actions, we categorized them for simplicity into the "right-up" and "left-up" positions – with the right and left palms up, respectively [4, 5].

Result and discussion. Having analyzed the latest records of the Republic of Sakha (Yakutia) Mas-wrestling Championships, we found the competitors' options dominated by the right-up outside grips followed by left-up outside ones (66% and 34%, respectively). The right-up outside grippers were reported to win 63% and lose 37% of 123 bouts; and the left-up outside grippers won 35% and lost65% of 63 bouts. A further analysis showed that the inside grip contact area averages 21.6±1.6 cm i.e. 43% of the half-stick, versus 57% for the outside grip. The stick was tested to move horizontally within the 45°±1.9 angle. We used hand dynamometers to meter the right/ left carpal strengths – that were found to average 54±6.8 and 48±7.4, respectively. The carpal strength tests of the right-up grippers showed their right hand being stronger than the left (54±6.6 versus 49±8.5, respectively); whilst the left-up grippers were tested with a stronger left hand (53±7.6 versus 48±8.0, respectively).

More detailed analysis showed that the strong hand drives and the weaker hand backs up in a bout; and this is the prime reason why the wrestlers opt for the strong-hand-up outside grip to facilitate the stick control versus the prop board. In the offense actions, when the tug stick moves towards the winner, the outside grip position is not that important – in contrast to the defense actions when the stick butt drifts off the parallel line and the wrestler has to rather hold the stick tight than pull. It may be pertinent to mention that 53% and 47% of the analyzed bouts were won with the outside and inside grips, respectively.

Conclusion. The study data and analyses showed that presently the right-up positions dominate in the elite competitive mas-wrestling; with wrestlers generally opting for the strong-hand-up outside positions – mostly the right-up outside grips in our sample. The choice of a starting left- or right-up position generally determines the range of the bout control techniques and tactics.

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