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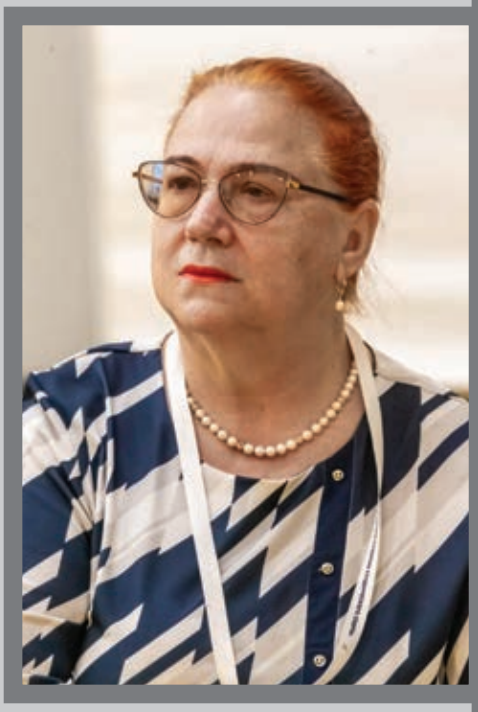
Theory & Practice of Physical Culture

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

Key issues of the modern sports science for discussion

Actualization of winter sports problems



The priority heading of our scientific publication is "Theory and methodology of sports", dedicated to innovative scientific solutions in the field of sports pedagogy, psychology, medicine, physiology, morphology, biomechanics and other areas related to sports training and competitive activities.

Today we present a study relevant to sports practice related to high science-intensive technologies in biathlon.

Biathlon is one of the winter sports that thousands of athletes are passionate about, not only in Russia, but also abroad. Many coaches solve a complex technical and tactical problem: how can the speed of movement of biathletes over a distance be increased in order to maximize the athlete's racing potential?

In the context of solving this problem, the authors from Omsk, Professor N.S. Zagursky and Ya.S. Romanov proved that an increase in the speed of movement of highly qualified biathletes at the finish circle in a sprint race is provided by an increase in speed in the second half of the final lap of the distance. At the same time, the length of the cycle of movements is shortened by increasing their frequency. The analysis of the technical and tactical actions of highly qualified biathletes in the sprint race showed that as the distance passes, the kinematic indicators are redistributed both in the cycle of movements and within it.

The results presented in the study can be used by coaches to improve the sports training of biathletes.

We invite scientists to publish articles that are aimed at finding and applying innovative methods and means of sports training in winter sports that ensure the achievement of high sports results.

Editor-in-chief of TPPC, Honored Worker of Physical Culture of the Russian Federation, PhD, Professor L.I. Lubysheva

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Contents

Influence of kinesiological means on the motor fitness of 15-16 years-old skiers-racers

UDC 796.92

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Abstract

Objective of the study was to determine the effect of kinesiological means on the motor fitness of 15-16-year-old ski racers.

Methods and structure of the study. The following methods were used in the scientific experiment: analysis of literary sources according to the methodology of organizing the training process of cross-country skiers, testing of motor fitness, pedagogical experiment, methods of mathematical statistics. Experimental work was carried out on the basis of the Children's and Youth Sports School No. 1 of the Tomsk region of the Tomsk region. The study involved 120 skiers aged 15-16, of which experimental and control groups were formed, 60 girls in each group.

Results and conclusions. In the course of the study, a block of tools was developed, which includes four kinesiology modules of various target orientations: preparatory and warm-up, basic (load), basic (shortened), warm-up and competitive. Each of these modules solved specific goals and objectives, depending on the period of preparation. As a result of the study, a significant increase in the results of motor fitness of female athletes of the experimental group was recorded, which indicates the effectiveness of the proposed means.

Keywords: *kinesiological means, motor readiness, skiers-racers, training process.*

Introduction. Modern cross-country skiing is characterized not only by an endurance sport, but also by a speed-strength and situational type of sports activity, which significantly increases the requirements for motor, technical and speed-strength training of female racers.

An integral part of cross-country skiing is training and competitive activity, which is a multicomponent integrative process of psychomotor development and motor fitness of female athletes [1, 2, 4].

In this regard, the problem of finding effective means aimed at improving the motor fitness of female athletes, on which the result of competitive activity largely depends, is actualized. In our opinion, effective means of developing motor qualities are kinesiological means that have an integrative effect on both motor fitness and psychomotor development of cross-country skiers.

Objective of the study was to determine the effect of kinesiological means on the motor fitness of 15-16-year-old ski racers.

Methods and structure of the study. Experimental work was carried out at the Children's and Youth Sports School No. 1 of the Tomsk region. The study involved 120 skiers aged 15-16, of which experimental and control groups were formed, 60 girls in each group. A pedagogical experiment to determine the effectiveness of the use of kinesiological means in the training process of cross-country skiers aged 15-16 years was carried out for one year.

Results of the study and their discussion. In the course of the experiment, we developed a block of tools that includes four kinesiology modules of various target orientations: preparatory and warm-up, basic (load), basic (shortened), warm-up and competitive. Each of these modules solved specific goals and objectives, depending on the period of preparation. The duration of the preparatory-warm-up module was 20 minutes (11.2% of the total time of the training session). This module includes five strictly regulated exercises: "Hand - Palm - Fist" (visual command); "Hand - Palm - Fist" (sound

command); "Splashes, lying on the stomach (sound commands)"; exercise "Splashes, lying on your back (visual command)". The preparatory-warm-up module was used in the recovery and preparatory periods of training, as well as in the preparatory and final parts of the lesson in the competitive period.

The basic (load) kinesiology module was used in the preparatory period in the main part of the sports training. The duration of this module was about 30 minutes (16.7% of the total time of the training session). In terms of content, the basic kinesiology module consists of seven strictly regulated exercises, such as: "On the toe" - On the heel - On the knee"; "Forward facing stand - lying emphasis (sound command)"; "Stand facing forward - emphasis lying (visual command)"; "Jumping to the side on the supporting leg (sound command)"; "Jumping to the side on the supporting leg (visual command)"; "Splashes in motion, facing forward (visual command)"; "Bursts in motion, turning backwards (sound command)".

In the competitive period, the basic (load) kinesiology module was used in a shortened version (basic shortened module) lasting up to 15 minutes (8.3% of the total time of the training session). In terms of content, the basic (shortened) module consists of four strictly regulated exercises, such as: "On the toe" - On the heel - On the knee"; "Stand facing forward - emphasis lying (visual command)"; "Jumping to the side on the supporting leg (sound command)"; "Splashes in motion, facing forward (visual command)".

During the competitive period from November to April, in the structure of the warm-up, immediately before the competitive activity, a warm-up-competitive kinesiology module was used, which in its structure consisted of three strictly regulated exercises: ("Forward facing stance – lying emphasis (sound and visual command)"; "Jumping to the side on the supporting leg (visual command)"; "Splashes in motion, turning his back forward (sound command)".

The maximum duration of the competitive warm-up module was 15 minutes (on average 37.5% of the total warm-up time before the competition).

It should be noted that in more detail the content of kinesiological modules of various target orientation was considered by us earlier [3]. Depending

Table 1. *Comparative characteristics of the training process of female skiers in the experimental and control groups (EG - 20 people; CG - 20 people)*

Part of the training	Duration of the training part	CG (n=20 people)	EG (n =20 people)
Preparatory (warm-up)	up to 35 min	A set of general developmental exercises - 20 min; stretching - 15 min	Stretching - 15 min; kinesiology exercises for the warm-up part of the lesson - 20 min
Main (load part of the workout)	from 45 to 120 min	Complex of general physical training, special physical training - 30 min; uniform or intense training work, depending on the goals and objectives of the training (cross-country, cross-imitation, skiing or roller skiing) - from 60 to 90 minutes	Kinesiology exercises for the main part of the lesson - 30 min; a complex of general physical training, special physical training - 15 min; uniform or intense training work, depending on the goals and objectives of the training (cross-country, cross-imitation, skiing or roller skiing) - from 60 to 90 minutes
Final (hitch)	from 15 to 30 min	Stretching - 15-30 min	Kinesiology exercises for the final part of the lesson - 15 min; stretching - 15 min
Warm-up (before the competition)	from 35 to 50 min	A set of general developmental exercises - 10 minutes, running at a low pace or skiing, roller skiing in the first pulse zone of intensity - 25-30 minutes; stretching - 10 min	Kinesiology exercises for the formation of a state of combat readiness - 15 min; running at a low pace or skiing, roller skiing in the first pulse intensity zone - 25 minutes; A set of general developmental exercises - 10 min
Charging	up to 35 min	A set of general developmental exercises - 10 min, running at a low pace for 15-20 minutes; stretching - 10 min	A set of kinesiology exercises for charging - 20 minutes; stretching - 10 min
Day off from training	up to 30 min	No training load	A set of kinesiology exercises for charging - 15-20 minutes; stretching - 10 min

Table 2. *Comparative analysis of changes in motor abilities indices of 15-16-year-old female cross-country skiers from the EG and CG before and after the pedagogical experiment*

Test	Experiment stage	Control group					Experimental group					p
		$\bar{x}$	±	σ	±	m	$\bar{x}$	±	σ	±	m	
Running at 60 m (s)	Before the xperiment	11,1	±	1,8	±	0,03	11,5	±	2,1	±	0,03	0,7
	After the experiment	11,0	±	2,1	±	0,03	10,3	±	1,7	±	0,03	0,04
	p	0,2					0,03					
Flexion and extension of the arms in the prone position (number of times)	Before the xperiment	32	±	8	±	1	33	±	9	±	1	0,8
	After the experiment	34	±	6	±	1	46	±	7	±	1	0,03
	p	0,4					0,02					
Lifting the body from a supine position in 30 s (number of times)	Before the xperiment	18	±	5	±	1	17	±	3	±	1	0,5
	After the experiment	20	±	4	±	1	26	±	4	±	1	0,03
	p	0,3					0,02					
Forward bend from a standing position with straightened legs (cm)	Before the xperiment	9	±	7	±	1	9	±	6	±	1	0,9
	After the experiment	10	±	4	±	1	16	±	5	±	1	0,04
	p	0,3					0,03					
Standing long jump (cm)	Before the xperiment	181	±	12	±	2	183	±	13	±	3	0,8
	After the experiment	189	±	5	±	1	191	±	6	±	1	0,7
	p	0,04					0,04					
Throwing a ball 0.3 kg for a distance (m)	Before the xperiment	27,7	±	7,4	±	0,8	28,1	±	8,1	±	0,9	0,6
	After the experiment	28,1	±	6,4	±	0,7	37,8	±	4,5	±	0,7	0,03
	p	0,4					0,03					
Cross-country skiing 3000 m Classic style (min, s)	Before the xperiment	13:25	±	1:27	±	2,4	13:11	±	1:23	±	3,3	0,5
	After the experiment	13:20	±	1:15	±	3,2	11:07	±	0:45	±	2,2	0,04
	p	0,7					0,02					
Cross-country skiing 5000 m Free style (min, s)	Before the xperiment	19:18	±	1:33	±	2,8	19:29	±	1:21	±	3,4	0,4
	After the experiment	18:10	±	0:55	±	2,9	17:13	±	0:42	±	3,1	0,03
	p	0,03					0,01					
Ski expander 3 min (number of movements)	Before the xperiment	38	±	5	±	1	37	±	6	±	1	0,5
	After the experiment	41	±	4	±	1	50	±	3	±	1	0,04
	p	0,4					0,02					

on the period of preparation, the goals and objectives of a particular training session, one or another kinesiology module was used. A pedagogical experiment to determine the effectiveness of the use of kinesiology modules in the training process of cross-country skiers aged 15-16 was carried out for one year (annual training cycle). Distinctive features of the training process of the participants in the experiment are presented in Table 1.

Conclusions. In conclusion, it can be noted that in the experimental group there is a significant improvement in motor fitness indicators in most of the tested physical qualities of female athletes (Table 2), which may indicate the effectiveness of the use of kinesiology modules in the training process of 15-16-year-old cross-country skiers.

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Improving the motor activity of highly qualified football players in china taking into account the variation of the intensity of training at small venues

UDC 796.012

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Abstract

Objective of the study was to evaluate the effectiveness of the methodology for improving the motor activity of highly qualified female football players in China, taking into account the variation in the intensity of training at small venues.

Methods and structure of the study. The experiment was conducted in 2020-2022, in which the girls of the Chinese women's national football team and professional clubs participating in the games of the Chinese Women's Super League took part. The age of the participants was 20-25 years. The study included approbation of the effectiveness of the use of small areas to increase the motor activity of female football players during the game, which was assessed by the dynamics of indicators of quantitative and qualitative characteristics of the game actions of female athletes in the process of competitive activity.

Results and conclusions. The methodology for increasing the motor activity of highly qualified female football players in China, taking into account the variation in the intensity of training on small venues, includes many components, factors and various forms of improvement in real game conditions that determine the effectiveness of the development of aerobic and anaerobic endurance, speed abilities, as well as technical and tactical actions and interactions .

To increase the motor activity of highly qualified female football players in the process of competitive activity through the mechanism of increasing speed and endurance, it is necessary to pay special attention to the issues of aerobic and anaerobic performance. This approach is a solid basis for improving athletic performance and serves as an important basis for improving physical fitness.

Keywords: *football, highly qualified sportswomen, physical activity, small football grounds.*

Introduction. Motor activity in football is considered as the volume and intensity of movements (running, starting accelerations, braking) that an athlete performs during the entire game [2, 4]. The intensity of movements largely depends on the speed that the athlete demonstrates in the process of running, and accelerations throughout the match or training [1, 3]. In this regard, the undertaken study allows us to state its high scientific and practical significance for the modern theory and methodology of training highly qualified female athletes in football.

Objective of the study was to evaluate the effectiveness of the methodology for improving the motor activity of highly qualified female football players in China, taking into account the variation in the intensity of training at small venues.

Methods and structure of the study. The experiment was conducted in 2020-2022, in which the girls of the Chinese women's national football team and professional clubs participating in the games of the Chinese Women's Super League took part. The age of the participants was 20-25 years. The study included approbation of the effectiveness of the use of small areas to increase the motor activity of female football players during the game, which was assessed by the dynamics of indicators of quantitative and qualitative

characteristics of the game actions of female athletes in the process of competitive activity.

Results of the study and their discussion. In modern men's and women's football, one of the most informative indicators of players' motor activity is the distance covered by the team during the game and the number of accelerations performed. Before the start of the formative pedagogical experiment, there were no significant differences in the indicators of the game overcome during the game and the number of accelerations ($p>0.05$) among the highly qualified female football players Kita from the CG and the EG, which indicates the homogeneity of the groups under consideration (Figure 1).

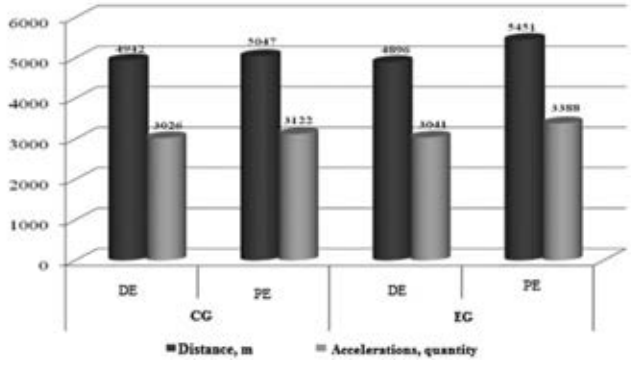

Figure 1. *Dynamics of physical activity of highly qualified female football players in China*

As a result of varying the intensity of training on small areas, highly qualified Chinese football players from the EG showed a significant increase in the indicators of the distance covered and the number of accelerations performed by 555.0 ± 4.6 m and 374.0 ± 3.8 times by the end of the formative pedagogical experiment compared to the players.

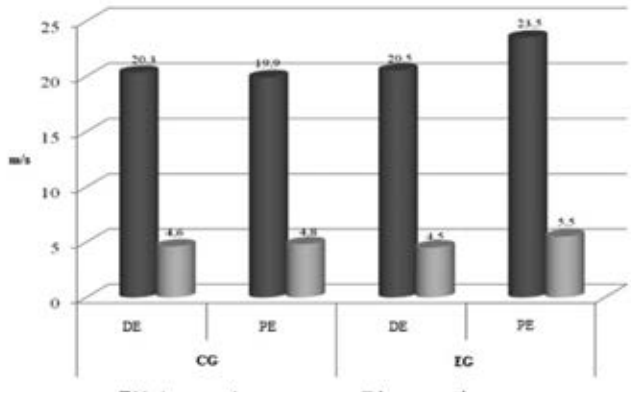

Figure 2. *Dynamics of maximum and average speed indicators among highly qualified female football players in China*

CG - 105.0±1.7 m and 96.0±0.8 times, respectively ($p<0.05$).

Studies have shown that before the start of the formative pedagogical experiment, highly qualified female football players in China were homogeneous, since the indicators of maximum and average movement speed did not have significant differences ($p>0.05$; Figure 2).

The use of game exercises on small areas allowed to significantly increase the maximum and average speed of movement of highly qualified Chinese football players in the EG by 3.0±0.02 and 1.0±0.005 m/s, respectively, compared with the CG ($p<0.05$).

Conclusions. The methodology for increasing the motor activity of highly qualified female football players in China, taking into account the variation in the intensity of training on small venues, includes many components, factors and various forms of improvement in real game conditions that determine the effectiveness of the development of aerobic and anaerobic endurance, speed abilities, as well as technical and tactical actions and interactions.

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Features of the use of rehabilitation and recovery measures in the training process of qualified gymnasts

UDC 796.01:612

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Abstract

Objective of the study was to evaluate the effect and effectiveness of the use of the non-steroidal anti-inflammatory drug Amelotex, the chondroprotector Chondrogard, the synovial fluid replacement drug Rusvisk in the complex rehabilitation treatment of qualified gymnasts with post-traumatic prearthrosis of the knee joints.

Methods and structure of the study. The scientific experiment involved eight qualified gymnasts who underwent a course of complex rehabilitation treatment from 2018 to 2020, including physiotherapy, exercise therapy, and massage. As part of this study, they were prescribed to take the non-steroidal anti-inflammatory drug Amelotex, the chondroprotector Chondrogard, and the hyaluronic acid preparation Rusvisk.

Results and conclusions. As the study showed, the use of Amelotex, Chondrogard and Rusvisk in complex therapy contributes to the regression of pain in athletes, improves the static-dynamic function of the joints, increases sports activity and improves the quality of life.

Keywords: *hyaluronic acid preparations, prearthrosis, sports injury, synovial joints, NSAIDs, Rusvisk, Amelotex, Chondrogard, gymnastics.*

Introduction. According to some scientific publications, the level of injuries in Russia is quite high. It is about 12% per year of the total population of our country [3]. The risk group includes most athletes, especially in contact sports.

Artistic gymnastics is not a contact sport, however, the complexity of the performed motor actions, extreme loads affecting gymnasts put this sport in the category of the most traumatic [8, 9].

Traumatic injuries of the knee joints and their consequences are an urgent problem for athletes and specialists. They have a negative impact on the training process as a whole, reduce exercise tolerance and the quality of life of athletes, and lead to a reduction in the period of a sports career [1, 4]. Trauma of the knee joint, as one of the most common, is one of the causes of the development of post-traumatic prearthrosis. In the etiology of this disease in gymnasts, high dynamic loads on the joints of the lower extremities and repeated microtraumatization of the knee joints play an important role [5, 10].

Medical support for athletes should be multicomponent and include both non-drug and medication. The selective non-steroidal anti-inflammatory drug Amelotex, the chondroprotector Chondrogard and the hyaluronic acid preparation Rusvisk were used as medications. These are effective drugs in the line of medical treatment of arthrosis, which are recommended for the treatment of knee, hip and other synovial joints of traumatic or degenerative-dystrophic origin.

Numerous clinical studies have confirmed the symptom-modifying property and structural-modifying effect of chondroprotectors [8, 11]. A positive result is more pronounced when used in the early stages

of the development of degenerative-dystrophic processes in the joint.

The advantage of Amelotex, Chondrogard and Rusvisk is that they are not included in the list of prohibited drugs (WADA) and their treatment is possible without prejudice to the training and competitive process.

Objective of the study was to evaluate the effect and effectiveness of the use of the non-steroidal anti-inflammatory drug Amelotex, the chondroprotector Chondrogard, the synovial fluid replacement drug Rusvisk in the complex rehabilitation treatment of qualified gymnasts with post-traumatic prearthrosis of the knee joints.

Methods and structure of the study. A comprehensive examination of athletes included: clinical examination, radiography of the knee joints in two standard projections, MRI of the knee joints, visual analog scale VAS, filling out the KOOS (Knee injury and osteoarthritis outcome score) questionnaire.

Athletes underwent a course of complex rehabilitation and rehabilitation treatment from 2018 to 2020, including physiotherapy, exercise therapy, and massage. Additionally, it was prescribed: Amelotex 1 tablet (dosage 15 mg) once a day for up to 7 days in the presence of pain 4 points on the VAS scale. In addition, athletes applied Amelotex gel topically twice a day for one to two weeks. If the pain syndrome did not exceed 3 points according to VAS, then local forms of NSAIDs were used without their systemic use. Chondrogard was administered intramuscularly at 100 mg every other day, starting from the fourth injection, with good tolerance, at 200 mg intramuscularly every other day. The course consisted of 25-35 injections according to the instructions, at least once every six months. The course of treatment with Rusvisk is three to five injections, with a week interval between each.

To study the subjective assessment of the functional state of damaged knee joints, we used the KOOS (Knee injury and osteoarthritis outcome score) scale for assessing the outcomes of injuries and diseases of the knee joint, developed by E. Roos (Department of Ortopedics, Lund University Hospital, Sweden) [7]. The scale consists of five subsections: "Pain", "Symptoms", "Difficulty in performing daily household activities", "Sports, leisure activities", "Quality of life". In accordance with the numerical value from 0 to 4, the number of points received was calculated. Then, using formulas, the indicators were normalized, taking into account the maximum values for each subscale separately, and the final index was calculated as a whole. Evaluation of the indicator: the best situation (no sign) value → (strive) to 100, the worst (maximum severity of the sign) - value → to 0.

Eight qualified gymnasts participated in the study. For an objective assessment of the level of pain in athletes, we used the VAS visual analog scale. During the whole period of the study, athletes filled out the COOS and VAS questionnaire four times: the first survey - before the start of the course of treatment, the second survey - one month after the start of complex treatment, the third - at the end of the course of rehabilitation measures, the fourth - three months after the completion of the course of rehabilitation measures . The training regimen was adjusted based on the subjective assessment of the athletes.

In our study, we used the classification of G.P. Kotelnikov, in which prearthrosis or zero stage of arthrosis (when there are no radiographic signs) is separately identified, this is necessary for the prevention of the disease and the appointment of adequate treatment at each stage of the disease [2]. As objective research methods, the patient underwent radiography of the knee joints in two standard projections and magnetic resonance imaging before the start of treatment and one year after the start of treatment.

Results of the study and their discussion. A survey of eight qualified gymnasts with a history of knee joint injuries of varying severity showed that there are symptoms of post-traumatic prearthrosis. In the study, we revealed a decrease in the functional mobility of the joints. According to the results of self-assessment of gymnasts using the KOOS questionnaire: in athletes with post-traumatic prearthrosis of the knee joints, the values of functional assessment both in general for the final index and for individual subscales were significantly lower.

Subjective assessment of pain intensity, using VAS, before treatment averaged 3 points, with an increase at the peak of training up to 4 points. Thus, the symptoms of post-traumatic prearthrosis identified by us and its impact on the functional state of athletes showed the need for early implementation of a complex of therapeutic and rehabilitation measures. One month after the start of treatment, the pain intensity decreased to 2 points, and after the completion of the course of treatment, the pain syndrome completely regressed. Three months after the completion of the course of treatment, the pain syndrome in the area of the joints also did not bother and was estimated at 0 points according to the VAS.

After the course of complex rehabilitation treatment, there was a regression of pain syndrome and other symptoms of prearthrosis (crunching in the knee joints during movement, clicks, limitation of mobility), as well as an increase in sports activity and quality of life. The results of x-ray studies showed that no signs of osteoarthritis were detected. The above activities contributed to the recovery of the gymnasts, which allowed them to continue the training process and participate in competitions at various levels in full.

Conclusions. The use of Amelotex, Chondrogard and Rusvisk in the complex therapy contributes to the regression of pain in athletes, improvement of the static-dynamic function of the joints, increase in sports activity and improvement of the quality of life, which is confirmed by significant differences in the indicators of the subscales "Pain", "Symptoms", "Sports activity" and " Quality of life", VAS indicators.

Based on the data obtained during the study, we believe that the complex rehabilitation treatment of an athlete with post-traumatic prearthrosis using Amelotex, Chondrogard and Rusvisk is an effective conservative method. Its use does not limit the ability of an athlete to train and participate in competitions, which is an important factor in his professional sports activities.

Therapy with Amelotex, Chondrogard and Rusvisk in the complex treatment of post-traumatic prearthrosis significantly reduces the risk of developing post-traumatic osteoarthritis, which allows athletes to continue their careers.

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Professional difficulties of coaches in working with qualified athletes of humanitarian and technical universities

UDC 796.071

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Abstract

Objective of the study was to study, generalize and offer coaches ways to overcome professional difficulties in working with qualified athletes of humanitarian and technical universities.

Methods and structure of the study. As part of the study, which was conducted during 2021-2022, a questionnaire was developed to study and justify the difficulties encountered in the professional activities of coaches when working with qualified athletes who are university students. The experiment was carried out at the North Ossetian State University after K.L. Khetagurov (Vladikavkaz) and Don State Technical University (Rostov-on-Don). In total, 25 highly qualified trainers took part in the survey.

Results and conclusions. Based on the study, general pedagogical and special requirements for a coach were drawn up, by fulfilling which he will be able to avoid many of the difficulties that arise when working with qualified student athletes in humanitarian and technical universities.

Keywords: *student, humanitarian and technical university, qualified athletes, coach, professional difficulties.*

Introduction. In the modern system of higher education, special attention is paid to the training of active qualified athletes who participate in the educational process without interrupting the main training and competitive activities [4]. Coaches working with active athletes are constantly faced with a large number of professional difficulties, as they have to find a balance between many years of training focused on achieving high sports results in their chosen sport and receiving the education that is in demand in modern society, providing humanitarian and technical universities of the Russian Federation [2, 3].

Thanks to the effective interaction of coaches and the faculty of humanitarian and technical universities, it is possible to correct the educational process, in particular, with the involvement of information technologies, and create favorable conditions for the training and competitive activities of athletes in their chosen sport [1, 5]. Thus, the analysis of the professional difficulties of coaches in working with qualified athletes who are university students determined the relevance of the research topic for modern practice.

Objective of the study was to study, generalize and offer coaches ways to overcome professional difficulties in working with qualified athletes of humanitarian and technical universities.

Methods and structure of the study. As part of the study, which was conducted during 2021-2022, a questionnaire was developed to study and justify the difficulties encountered in the professional activities of coaches when working with qualified athletes who are university students. The experiment was carried out at the North Ossetian State University after Kosta Levanovich Khetagurov (Vladikavkaz) and Don State Technical University (Rostov-on-Don). In total, 25 highly qualified trainers took part in the survey.

The results of the study were summed up by summing up the scores obtained in assessing the diffi-

culties caused by professional activities. Components that caused less difficulty received a lower sum of points (in this case, the absolute minimum is 25 points, if all 25 trainers give the same component 1 point, that is, they are considered to cause the least difficulty compared to other components). It is possible to judge the disagreements that have arisen in the assessment of specific issues by the degree of discrepancy between this assessment and the average statistical indicators.

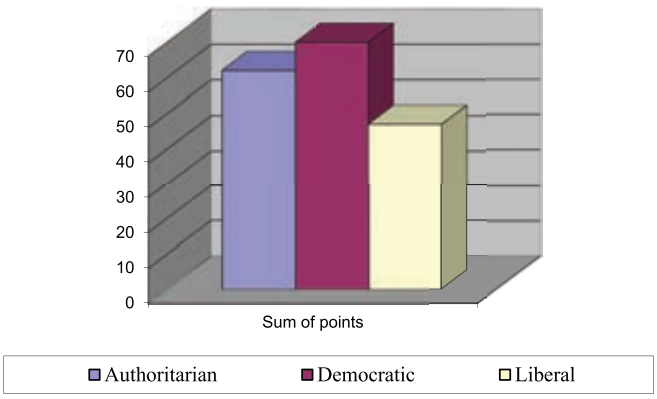
Based on the results of the study, recommendations were proposed for overcoming professional difficulties.

Results of the study and their discussion. The research allowed to establish that modern coaches experience the greatest difficulties with athletes involved in their chosen sport at the stage of improving sportsmanship and higher sportsmanship - 87 and 74 points (1st and 2nd place in the ranking) (Table 1).

It should be noted that athletes undergoing sports training in various sports at the stages of improving sportsmanship (16-18 years old) and higher sportsmanship (19-22 years old), as a rule, correspond in age to 1-2 and 3-4 th courses of study in a humanitarian and technical university.

In conversations with coaches, it was found that it is quite difficult for them to communicate with qualified athletes, especially those with leadership qualities, since it is difficult to find a common language with them, while maintaining their authority and normal working atmosphere in the team. All of the above reasons lead to the fact that most coaches consider working with groups of athletes studying at the university the most problematic.

The results of the analysis of the picture made it possible to establish that for the majority of modern coaches the most acceptable style of working with qualified athletes is the democratic style - 70 points (1st place in the rating).



Styles of work of modern coaches with qualified student athletes

In the process of professional activity, when a coach performs his functions and builds relationships with a large number of people, he relies on the relevant principles, takes into account his personal qualities, chooses certain forms and methods that he uses to solve the tasks assigned to each athlete. Such activity of a trainer is characterized as a style of activity ("handwriting" of his work). Watching the work of experienced mentors, you can see that in the style of any of them there is something from the "authoritarian", and from the "liberal", and from the "democrat", only some features are most pronounced.

Table 1. *Difficulties encountered when working with different groups of athletes*

Stages of preparation	Sum of points	Place
Stage of initial training	47	4
Stage of sports specialization	60	3
Stage of improvement of sportsmanship	87	1
Stage of higher sportsmanship	74	2

Table 2. *Areas of activity that cause difficulties in the work of a coach with qualified student athletes*

Activities	Sum of points	Place
Effective combination of educational and training activities by an athlete	74	1
Planning of educational and training activities	67	2
Participation of an athlete in competitions	53	3

A sociological survey showed that the most problematic area of activity for modern coaches is the effective combination of educational and training activities by athletes - 74 points (1st place in the ranking) (Table 2).

The planning of educational and training activities and the participation of an athlete in competitions also occupy a fairly high rating in the difficulties associated with the areas of activity of modern coaches - 67 and 53 points, respectively (2nd and 3rd places in the ranking).

A qualified coach has to solve a number of tasks related to health-improving, educational, hygienic, and social functions. The biggest difficulty for coaches is the role of a psychologist. This is due to the fact that during the training at the university, an active athlete goes through many psychological and physiological stages, which leaves its negative imprint on the role of a coach-teacher.

Conclusions. Based on the study, general pedagogical and special requirements for a coach were drawn up, by fulfilling which he will be able to avoid many of the difficulties that arise when working with qualified student athletes in a humanitarian and technical university. General pedagogical requirements are: a high level of moral self-awareness; Teacher Education; stable moral and volitional qualities; interest in modern achievements in sports theory, pedagogy, psychology and physiology; high general cultural level; the ability to manage oneself in any conditions; good organizational skills; the ability to lead a team and enjoy authority among their students.

Special requirements for coaching activities are: knowledge of the theoretical and methodological foundations of physical education, medical control; the ability to possess practical skills and knowledge of modern scientific and methodological achievements in the chosen sport; the ability to plan the future training of athletes, taking into account their individual training schedule at the university.

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Method of calculation of asymmetry of bar push from chest according to the results of high-speed 3d shooting

UDC 796.886

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Abstract

Objective of the study was to develop and test a methodology for analyzing the asymmetry of the push of the barbell from the chest.

Methods and structure of the study. High-speed 3D video filming was carried out with four cameras. The push-and-pull exercise was performed by the candidate master of sports S. Kh-vym, the weight of the barbell was 125 kg. Coach - Honored Coach of Russia S.A. Syrtsov. An analysis of the push of the barbell from the chest is presented. The method of performing a push of the barbell from the chest is "in scissors". Shooting was carried out synchronously at a speed of 250 fps.

Results and conclusions. The analysis of the video recording was carried out and the following indicators were calculated: the time dependence of the coordinates, velocities and accelerations of the ends of the bar during the push from the chest, the difference between the vertical and horizontal coordinates of the right and left ends of the bar, the vertical and horizontal components of the forces applied by the athlete to the right and left packages of pancakes. A comparative analysis of these indicators was carried out in two approaches. The moments of time are found at which the minimum and maximum differences of the vertical and horizontal coordinates of the neck ends are reached. Estimates of the asymmetry of the shock have been made. The proposed method can be recommended for use in the training process of athletes and the training of coaches and weightlifting specialists.

Keywords: *bar push from the chest, biomechanical characteristics, high-speed video filming, bar turns, asymmetry.*

Introduction. The relevance of this work is determined by the fact that this technique allows you to calculate the indicators necessary for the analysis of technique based on the results of high-speed shooting: vertical and horizontal movements, speeds and accelerations of the ends of the neck, vertical and horizontal forces applied by the athlete to the right and left packages of pancakes, etc., and allows performance-related visualization of the movement of the athlete and the barbell. The technique has no analogues in the world.

Objective of the study was to develop and test a methodology for analyzing the asymmetry of the push of the barbell from the chest.

Methods and structure of the study. To assess the asymmetry of the movement of the bar during the push of the bar from the chest, the necessary spatio-temporal, kinematic and dynamic indicators are calculated and the boundaries of the phases are determined. To calculate these indicators, a complex technique was used [2]. To register movements, high-speed 3D video recording was carried out with four cameras. Two cameras were located at the ends, one in front, one at an angle. The survey results in fig. 11-15. The presented arrangement of cameras allows shooting, according to which the necessary indicators can be calculated [1, 3].

Results of the study and their discussion. Let's analyze the asymmetry of the movement of the bar during the push from the chest. Graphs of vertical and horizontal displacements, speeds and accelerations of the left and right ends of the neck are shown in Figures 1-6. On all these graphs, the time is counted along the abscissa axis from the start of the

push. As can be seen from figures 1, 3, 5, the shapes of the curves of vertical displacements, velocities and accelerations are identical for the right and left ends. Differences in amplitude values are maximum for acceleration peaks – 18%. The differences in the curves of horizontal displacements of velocities and accelerations are more pronounced and reach 28% for acceleration peaks. There are differences in the forces acting on the right and left packets of pancakes. Thus, the maximum horizontal force at the left end is 290 N, and at the right end it is 200 N. The vertical forces are almost the same, the maximum difference at the peak of braking is 30 N. Using the obtained dependencies, it is possible to calculate the rotations of the barbell at any time and obtain the values kinematic and dynamic characteristics at that moment.

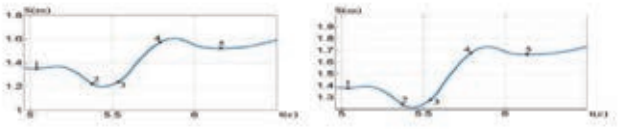

Figure 1. *Vertical movements of the left (left) and right (right) ends of the neck*

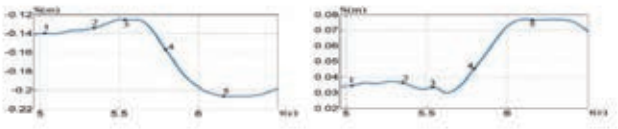

Figure 2. *Horizontal movements of the left (left) and right (right) ends of the neck*

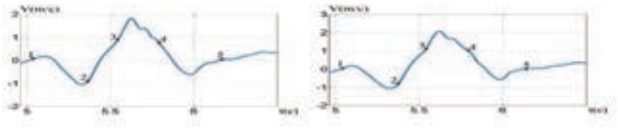

Figure 3. *Vertical speeds of the left (left) and right (right) ends of the neck*

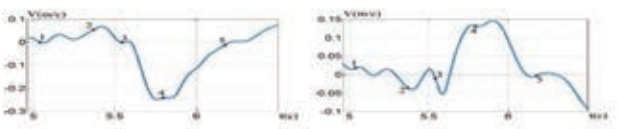

Figure 4. *Horizontal velocities of the left (left) and right (right) ends of the neck*

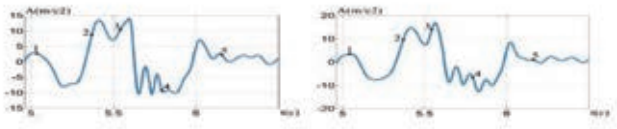

Figure 5. *Vertical accelerations of the left (left) and right (right) ends of the neck*

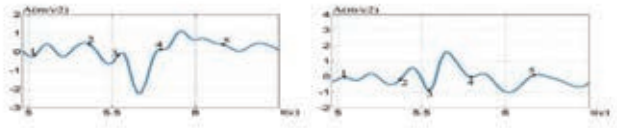

Figure 6. *Horizontal accelerations of the left (left) and right (right) ends of the neck*

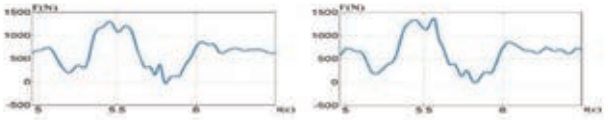

Figure 7. *Graph of the dependence of the vertical components of the forces applied to the packages*

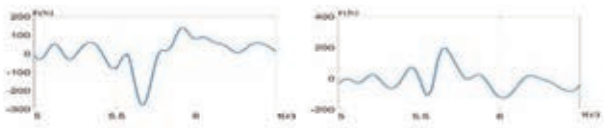

Figure 8. *Graph of the dependence of the horizontal components of the forces applied to the packages*

Positive values of the difference in vertical coordinates correspond to the rotation of the bar counterclockwise in the frontal plane (Figure 9). Negative values of the difference in horizontal coordinates correspond to the clockwise rotation of the neck (top view) (Figure 10).

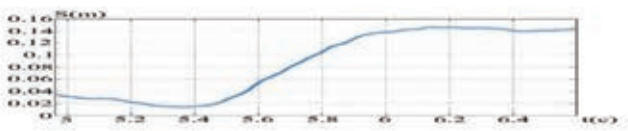

Figure 9. *Graph of the difference in the vertical coordinates of the ends of the neck*

The difference in vertical coordinates (Figure 9) at the beginning of the half-squat phase was 3 cm. On the graphs (Figures 1-6), the point of the beginning of the half-squat is marked with a marker “1”. The pos-

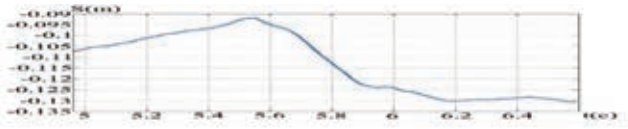

Figure 10. *Graph of the difference between the horizontal coordinates of the ends of the neck*

ture of the athlete at this moment is shown in Figure 11. Vertical and horizontal coordinates, speeds and accelerations of the ends of the neck at this point in time are shown in tables 1 and 2. During the half-squat, this value decreases to 1.4 cm, and then, up to fixation, increases and reaches a maximum value of 14.6 cm. The posture of the athlete at the moment of the minimum tilt is shown in Figure 12. On the graphs shown in (Figures 1-6), the point corresponding to the minimum value of the difference in coordinates is indicated by the marker "2". The inclination of the neck at the moment of fixing the barbell is clearly visible visually (see Figure 13). The moment of fixing the rod on the graphs shown in Figures 1-6 is indicated by the marker "5". The moment of change from a decrease in inclination to an increase occurs after the completion of acceleration down and with the onset of intensive braking.

Figure 11. *The posture of the athlete at the beginning of the semi-squat*

Consider the graphs shown in Figures 3 and 5. At the moment of the beginning of the increase in the inclination of the bar, the speeds of the ends of the bar passed a local minimum and begin to grow. At this moment, the speeds of the left and right ends of the neck are -0.87 m/s, the accelerations are 8.83 m/s2 and 9.43 m/s2, respectively. The right end is braked more intensively, which leads to a counterclockwise turn. The rotation continues to increase monotonously until the bar is fixed. So, at the moment indicated on the graphs (Figures 1-6) by the marker "4", the turn value is 10 cm. The values of the coordinates, velocities and accelerations of the neck ends at this moment are given in tables 1 and 2.

Let's move on to the consideration of the difference in horizontal coordinates (Figure 10). At the beginning of the semi-squat (Figure 11), the difference in horizontal coordinates was -10.5 cm. In the process of performing the semi-squat, this turn decreased to -9.1 cm, and then began to increase and reached -13 cm upon fixation (Figure 13).

Figure 12. *Athlete's posture at the moment of barbell rotation in the vertical plane*

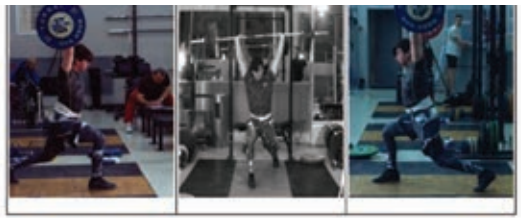

Figure 13. *The posture of the athlete at the moment of fixing the barbell*

Table 1. *Movement parameters at times 1-4 for the left end of the neck*

Coordinate value	1 (t=5,040)	2 (t=5,368)	3 (t=5,54)	4 (t=5,792)	5 (t=6,156)
Y	1,350	1,228	1,242	1,574	1,520
Y'	0,077	-0,878	0,863	0,757	0,020
Y''	2,612	8,834	5,540	-9,646	2,306
X	-0,140	-0,133	-0,125	-0,157	-0,206
X'	0,000	0,054	0,000	-0,241	-0,020
X''	-0,151	0,380	-0,140	0,136	0,410

Y – vertical coordinate, Y' – vertical speed, Y'' – vertical acceleration,
X – horizontal coordinate, X' – horizontal speed, X'' – horizontal acceleration.

Table 2. *Movement parameters at times 1-4 for the right end of the neck*

Coordinate value	1 (t=5,040)	2 (t=5,368)	3 (t=5,54)	4 (t=5,792)	5 (t=6,156)
Y	1,379	1,242	1,276	1,677	1,655
Y'	0,018	-0,870	1,083	1,025	0,020
Y''	3,461	9,427	13,390	-6,451	1,038
X	0,035	0,036	0,034	0,045	0,077
X'	0,018	-0,036	-0,011	0,132	0,006
X''	-0,019	-0,211	-0,864	-0,030	0,042

Y – vertical coordinate, Y' – vertical speed, Y'' – vertical acceleration,
X – horizontal coordinate, X' – horizontal speed, X' – horizontal acceleration.

The athlete's posture at the moment of reaching the minimum difference in coordinates is shown in Figure 14. On the graphs (Figures 1-6), the point corresponding to the minimum difference in horizontal coordinates is marked with a marker "3". Fluctuations in the difference of horizontal coordinates - less than 4 cm. The moment of change in the direction of the horizontal turn (Figure 14) is in the region of the final acceleration phase. At this moment, the values of vertical accelerations at the left and right ends of the neck are 10.45 m/s2 and 13.39 m/s2, respectively (see Figure 5), the horizontal velocity and acceleration are close to zero at both ends of the neck (see Figures 4, 6 and tables 1, 2). The horizontal turn continues in the unsupported phase (Figure 15).

Figure 14. *The posture of the athlete at the moment of changing the direction of the horizontal rotation of the bar of the bar*

Figure 15. *Athlete's posture corresponding to maximum flexion in the knee and hip joints in the unsupported phase*

The analysis of the second approach showed that the bar turns significantly decreased. The turn in the vertical plane increased monotonously until the bar was fixed and at the end it was 3 cm. The turn in the horizontal plane increased and at the end of the semi-squat it was 3.6 cm. Further, until fixation, it decreased to zero. You can consider the turns in the second approach as insignificant. They were no more than one degree.

Conclusions. An analysis of the two approaches showed that the asymmetry calculations are confirmed by motion visualization. In the second approach, the asymmetry of movement was much less, the angles of rotation were less than one degree. In the second approach, the grip changed, which may explain the decrease in bar rotation. The distances from the edge of the palms of the left and right hands to the bosses in the first approach are 33.5 cm and 34 cm, in the second - 34.3 cm and 33.1 cm, respectively. In the second approach, the grip shifted towards the right boss. To conduct a more accurate analysis, it is necessary to use a larger number of surveys.

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Organization of the training process of short distance runners at the stage of initial sports specialization

UDC 796.422.12

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Abstract

Objective of the study was to determine the main aspects of the organization of the training process of sprint runners in the People's Republic of China and the Republic of Belarus at the stage of initial sports specialization.

Methods and structure of the study. The data of a survey of coaches from Belarus and China who conduct training sessions with young sprinters are presented. Approaches were established for building year-round training of young sprinters, using different means in the structural units of the macrocycle and the main tests that coaches use to assess the preparedness of runners, the time spent on training effects of maximum intensity within the lesson and microcycle, etc.

The level of special preparedness of young sprinters aged 12-13 years of the two countries was assessed and the correlation between the experimental characteristics and the sports result in the 100m race was determined. Variants of individual planning of year-round training of young sprinters from the Republic of Belarus and China were subjected to statistical analysis.

Results and conclusions. Analysis of the results of the questionnaire survey made it possible to identify both general trends in the implementation of the approach to training young sprinters in the two countries, as well as certain differences. The difference in the level of special preparedness of young sprinters aged 12-13 and the parameters of the main training means in the annual cycle among young runners from Belarus and China is presented. The use by Belarusian coaches of the experience of training athletes in China can be a potential reserve for modernizing the existing system of training sprinters in the country.

Keywords: *young runners, sprint, analysis, questioning, annual cycle, load distribution, testing, organization.*

Introduction. The modern sprinter training system includes numerous means and methods of directed influence on the growth of his speed abilities, organized within the framework of individual structural units of the annual training cycle [1, 3, 4, 5, 7]. The literature concerning the training of young sprinters presents various aspects of increasing the level of development of motor qualities at the stages of long-term improvement of athletes, but at the same time there are very few works in which the construction of the educational and training process of young sprinters would be united by a common methodological line.

Recently in Belarus there has been a significant backlog of sports results in athletics from world achievements. This also applies to sprinting. For example, the record of the Republic of Belarus in the men's 100m run is 10.27 s and was set back in 1994 (for comparison, the record of the People's Republic of China (PRC) is 9.83 s, the world record is 9.58 s). Based on the foregoing, an urgent problem for Belarusian specialists is to improve the quality of training of young sprinters. Higher achievements of PRC runners are currently due not only to the level of results at the beginning of the sports path, but also, which is especially important, the influence of the sports training system that has developed in recent years.

There are objective prerequisites for using the Chinese experience of long-term training of sprinters to improve the system of organizing the training process with young Belarusian sprinters at the stage of initial sports specialization.

Objective of the study was to determine the main aspects of the organization of the training process of sprint runners in the People's Republic of China and

the Republic of Belarus at the stage of initial sports specialization.

Methods and structure of the study. The data of a survey of coaches from Belarus (n=25) and China (n=27) who conduct training sessions with young sprinters are presented. Respondents were asked to express their opinion on 16 questions contained in the developed questionnaire. The practical implementation of the approach was established for organizing year-round training of young sprinters, using means of various directions in the structural units of the macrocycle and the main tests that coaches use to assess the preparedness of runners, the time spent on training effects of maximum intensity within the lesson and microcycle, etc.

The level of special preparedness of young sprinters aged 12-13 years of the two countries (n=65) was assessed and the correlation between the experimental characteristics and the sports result in the 100-meter run was determined. Variants of individual planning of year-round training were subjected to statistical analysis for 27 young sprinters from Belarus and 25 sprinters from China.

Results of the study and their discussion. When comparing the data of questionnaire surveys, a certain commonality of approaches in the work of specialists from both countries in the organization of sports training for young sprinters was revealed. So, according to coaches, the priority focus of training sessions at the stage of initial sports specialization is the proportional development of motor abilities and the need to bring up the lagging qualities of the wards to the optimal level. At the same time, the implementation of the approach to building an educational and training process with young sprinters is implemented, in most cases, on their personal practical experience. Coaches believe that at the age of 12-13 it is still too early to use the two-cycle planning of the annual training cycle, and the macrocycle should consist of preparatory, competitive and transitional periods. Unfortunately, additional indicators that the specialists of the two countries overlook when organizing the training of young athletes are taking into account the individual characteristics and health status of the latter; the motivational component, study and living conditions are not taken into account much.

Despite the large number of similar opinions among specialists from the Republic of Belarus and China, significant differences were also revealed. Thus, a number of respondents in China (63%) suggest starting specialized training in sprint at the age of 14, while 48% of Belarusian coaches noted that specialized training for speed running should start at the age of 12-13. Regular pedagogical testing of young sprinters in the annual cycle of training is considered necessary by 74% of coaches in China, who evaluate the motor abilities of students three to four times a year, against 52% of Belarusian specialists who test their wards once or twice a year.

The greatest differences are observed in the organization of the annual training cycle of young runners and its structural components. Most Chinese coaches believe that in the preparatory period, attention should be paid to games and relay races, as well as general physical training, and in the competitive period, in their opinion, the amount of running aimed at increasing speed endurance should prevail, and then maximum speed. In the preparatory period, much attention in Belarus is paid to running with submaximal speed and games (including outdoor games) or running at different speeds is used in combination with general developmental exercises. At the same time, speed-strength and strength exercises alternate with running at submaximal speed, which is considered undesirable [3, 7], and in the competitive period in the Republic of Belarus they mainly practice running at maximum speed, sports games and jumping exercises.

In training with young sprinters, Chinese specialists use more speed-strength means. Some of them (52%) believe that such funds should be used throughout the entire annual training cycle, and a certain percentage (37%) prefers to use them only in the preparatory period. Most of the interviewed Belarusian coaches (74%) believe that it is necessary to practice means of speed-strength orientation throughout the year.

The importance of assessing the change in the condition of a young athlete under the influence of training influences of various directions was noted only by 16% of Belarusian and 11% of Chinese coaches. Taking into account the dynamics of physiological indicators in the process of training sessions is also underestimated by the coaches of both countries. There are opportunities to eliminate these shortcomings, as the coaches noted that insufficient attention is paid to individualization during the training process with young sprinters.

I would especially like to emphasize the fact that only 12% of the surveyed specialists of the Republic of Belarus and 11% of the China use various methodological recommendations and developments. At the same time, without increasing one's knowledge in the field of organizing the training of sprinters, solving the issues of developing their physical abilities and improving technical skills, it is difficult to hope for an increase in the sports results of their wards.

For a more specific diagnosis of the difference in the level of special preparedness of young sprinters 12-13 years old in Belarus and China, the statistical significance of the differences in the average indicators recorded in the athletes of the two countries

Table 1. *Difference of average values ($\overline{X}$), assessment of its statistical significance (p) and correlation relationship (r) of experimental indicators with sports results in young sprinters from China and Belarus*

Indicators	China		Belarus		Difference	p
	$\bar{x}$	r	$\bar{x}$	r		
100 m run, s	13,1	–	14,1	–	1,0	<0,05
Running 20 m on the move, s	2,5	0,42	2,9	0,73	0,4	>0,05
Running 30 meters from the start, s	4,5	0,47	4,9	0,83	0,4	>0,05
Running 60 meters from the start, s	8,1	0,56	8,8	0,89	0,7	<0,05
Standing long jump, m	2,29	0,77	1,98	0,68	0,31	>0,05
Triple jump from a place, m	6,64	0,76	6,13	0,52	0,51	>0,05
Shot throw with two hands from the bottom forward (3 kg), m	8,95	0,83	8,10	0,41	0,85	<0,05

Note: Running results are hand-timed.

was assessed and the correlation between the experimental characteristics and the sports result in the 100-meter run was determined (Table 1).

It can be seen that athletes of this age in China in all analyzed characteristics show better results than representatives of Belarus. At

At the same time, statistical significance ($p<0.05$) of differences between the results of youngathletes of the two countries is achieved only by the average running time for 60 and 100 meters from the start. If Chinese runners have the highest correlation of 100 m run results with speed-strength characteristics, then Belarusian young sprinters have the highest correlation with running tests.

An analysis of the practical experience of organizing training for sprinters aged 12-13 in China and Belarus made it possible to evaluate the parameters of training means and record differences in the volume of both running of one direction or another, and means of strength and general physical training between young sprinters of the two countries (Table 2).

Attention is drawn to the greater variability in relation to the analyzed means of training among the runners of the Republic of Belarus, compared with their peers from the PRC. Young athletes of Belarus at this age also outperform their peers from China in terms of the annual volume of running at maximum speed. At the same time, numerous studies to identify the effectiveness of methods for developing speed in children have shown that it is inappropriate to prematurely focus on highly specialized speed training [2, 5, 6].

It was revealed that young athletes in China perform a greater amount of running exercises at a speed of up to 80% (by 20.3%), prevail in cross-country running (by 50.0%), long jumping exercises (by 35.6%), games (by 26.3%),

strength (by 51.0%) and general developmental exercises (by 48.9%). All the above differences in the amount of load are statistically significant ($p<0.05$).

Thus, judging by the results obtained, coaches in China at the stage of initial sports specialization focus on speed-strength and general physical training. In Belarus, the emphasis is more directly on the use of speed running.

Conclusions. The results of the obtained material made it possible to determine the main aspects of building the training process of young sprinters of the two countries. A number of shortcomings were also identified, the elimination of which, in our opinion, would help their pupils achieve better results. Thus, coaches should pay more attention to testing, use

Table 2. *Annual volumes of basic training equipment for sprinters aged 12-13 in China and Belarus ($\bar{X} \pm \sigma$)*

Training tools	China	Belarus	Difference	%
Running up to 80 m (at a speed of 96-100%), km	6,9±1,4	8,8±2,6	**–1,9**	21,6
Running up to 80 m (at a speed of 91-96%), km	7,6±1,4	9,4±2,8	**–1,8**	19,1
Running 100-300 m (at a speed of 91-100%), km	19,9±1,6	24,1±4,1	–4,2	17,4
Running over 300 m (at a speed of less than 80%), km	46,7±8,1	34,5±9,9	**12,2**	26,1
Cross running, watch	28,0±5,9	19,0±6,1	**14,0**	50,0
Various strength exercises	33,7±7,6	19,5±6,7	**17,2**	51,0
Short jumps, number of rebounds	2650±590	2200±470	450	16,9
Long jump exercises, km	7,3±0,8	4,7±0,9	**2,6**	35,6
Games and game exercises, hours	95±9,6	70±11,9	**25**	26,3
General developmental exercises, hours	78,5±8,6	40,0±7,3	**38,5**	48,9

Note: Differences in bold face reach statistically significant differences for the 5% significance level.

the data obtained more widely in the individual planning of the loads of the wards, and strive to improve their level of pedagogical skills.

At the same time, the use of the scientific and practical experience available in the PRC in training sprinters will allow Belarusian coaches to transform it into an increase in the sports achievements of sprinters of the Republic of Belarus.

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Characteristics of competitive activity of football players of various playing roles in youth national teams

UDC

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Abstract

Objective of the study was to determine the characteristics of the competitive activity of players of different roles in national teams based on data received from GPS equipment.

Methods and structure of the study. In the course of the work, the motor activity of highly qualified players (267 players), who are members of the Russian national sports teams, who played 95 ± 3 minutes, was studied, which was measured by the RealTrack System GPS tracking system, Spain, and then classified according to speed ranges, accelerations and decelerations. Significance of differences was determined using one-way analysis of variance in the Statistica 10.0 software.

Results and conclusions. According to the results of the study, the characteristics of the motor activity of football players of various roles in the conditions of competitions, which are characterized by a certain structure of movements, were obtained. Accounting for positional requirements for competitive activity in the form of various movements is necessary when planning subsequent training sessions of various directions.

Keywords: *range, accelerations, decelerations, motor actions, football.*

Introduction. Understanding the requirements for physical fitness in football requires an accurate and objective quantitative assessment of the competitive activity of players. It is well known that football is characterized by low-intensity (for example, standing and walking) and high-intensity (for example, running at high speed and sprinting) motor actions [10]. Along with specific actions (e.g. martial arts, turning, heading and kicking, dribbling), motor activities make up the overall load that a player experiences during a match.

Previously, attempts were made to quantify this load, for example, by measuring the heart rate of players [2], determining the distance and intensity of running using video analysis [7,9]. Recently, computer analysis of actions has been increasingly used [8]. All this expanded the understanding of the requirements of individual game roles and football in general. But these analyzes miss such important indicators for football in terms of load assessment as accelerations and decelerations, which can be assessed using GPS-based equipment [5]. And the data used in the analysis are usually taken from football academies or clubs [1,3], which limits information about motor activity in national teams.

Objective of the study was to determine the characteristics of the competitive activity of players of different roles in national teams based on data received from GPS equipment.

Methods and structure of the study. To achieve this goal, the motor activity of players (267 players, age - 17.7±2.0 years; body length - 182.3±5.7 cm; body weight - 73.6±6.9 kg) was studied in the sports teams of Russia, who played 95 ± 3 minutes. Motor activity was measured with a tracking system from RealTrack System, Wimu PRO, Spain, consisting of a device fixed on the player with two built-in sensors: a navigation satellite system and a GNSS / GPS positioning system with a frequency of 10 Hz, compatible with the Galileo navigation system, as well as an accelerometer (1000 Hz), magnetometer (100 Hz), gyroscope (1000 Hz), barometer (100 Hz) [4]. All mo-

tor actions performed by the players were classified according to speed ranges [10] and acceleration and deceleration ranges [6], which we combined for their simple perception and presentation up to >2 m/s^2 and <–2 m/s^2. The significance of differences was determined using one-way analysis of variance in the Statistica 10.0 software.

Results of the study and their discussion. All players were divided into roles: central defender, flank defender, central midfielder, flank midfielder, forward (central). Based on the results of the study, a profile of motor activity was compiled, classified by speed and acceleration for each role (Tables 1, 2).

Central defenders are characterized by lower values: total distance volume ($p<0.05$, except for the attacker - $p>0.5$), maximum speed ($p<0.01$, except for the central midfielder and flank midfielder - $p>0.1$), high-intensity running ($p<0.001$), sprinting ($p<0.001$, except for the central midfielder – $p>0.5$), number ($p<0.001$ compared to the central midfielder) and volume of accelerations ($p<0.01$ compared to the flank defender and central midfielder), braking ($p<0.001$ compared to wingback and central midfielder), and intensity of braking ($p<0.05$, except for central midfielder).

Wing defenders are characterized by significantly higher values: maximum speed, “sprint” when compared with the central defender and central midfielder ($p<0.05$). At the same time, the number of accelerations of the flank defenders is lower than that of the central midfielder ($p<0.05$), and the volume does not differ ($p>0.05$). Also, flank defenders are characterized by a greater number and intensity of braking than a central defender ($p<0.001$).

Central midfielders are characterized by higher values: the volume of the total distance compared to players of other roles ($p<0.001$), high-intensity running compared to the central defender ($p<0.001$), the number of accelerations compared to the central defenders and flank defenders ($p<0.05$), acceleration volume compared to central defenders ($p<0.001$), braking volume ($p<0.05$) and highest braking volume ($p<0.001$ except H–$p>0.1$), lowest maximum speed and sprint volume , the differences are significant ($p<0.05$), except for the central defender.

Wing midfielders are characterized by identical values as wingbacks, since they perform movements on the flanks. Wing midfielders perform one of the largest volumes of acceleration, but at the same time a small-

Table 1. *Parameters of intense motor activity of football players of various roles, classified by speed*

Role*	Total distance, m	Running at 19.8-25.2 km/h (m)	> 25.2 km/h (m) «sprint»	Speed, max., km/h
	x±σ	x±σ	x±σ	x±σ
Central defender (n=92)	10070±695	358±120	74±55	29,5±1,7
Flank defender (n=66)	10690±598$	567±109$	163±84$♣	30,9±1,8$♣
Central midfielder (n=67)	11468±1043$#¶§	602±214$	84±54	29,2±1,6
Flank midfielder (n=24)	10840±737$	606±142$	153±84$♣	30,6±1,5♣
Forward (n=18)	10428±767	602±161$	204±81$♣	31,3±1,7$♣
All (n=267)	10667±948	510±187	115±81	30,0±1,9

Note:* Differences are significant at $p<0.05$: $ – more than the central defender; # - more than a flank defender ♣ - more than a central midfielder; ¶ – more than a flank midfielder; § - more than a forward.

Table 2. *Parameters of intense motor activity of football players of different roles, classified by accelerations*

Role*	Accelerations >2 м/с^2, x±σ			Braking >2 м/с^2, x±σ		
	Times	Meters	Max.	Times	Meters	Max.
Central defender (n=92)	203±37	1395±260	5,27	193±33	951±225	–6,37
Flank defender (n=66)	207±30	1568±252$	5,23	219±31$	1169±185$	–6,79$
Central midfielder (n=67)	225±42$#	1618±325$	5,11	236±39$#¶§	1316±263$#¶	–6,60
Flank midfielder (n=24)	207±28	1621±214	5,12	204±27	1047±136	–7,39$♣
Forward (n=18)	198±38	1539±252	5,33	199±37	1128±259	–7,17$
All (n=267)	210±37	1522±286	5,21	212±38	1115±263	–6,68

Note:* The differences are significant at $p<0.05$: $ – more than the central defender; # - more than a flank defender; ♣ - more than a central midfielder; ¶ - more than a flank midfielder; § - more than a forward.

er amount of braking (significant differences, $p<0.05$, between central midfielders), and are characterized by the highest braking intensity (significant differences, $p<0.05$, when compared with a central defender and central midfielder).

Forwards are characterized by significantly higher values: maximum speed, sprint volume ($p<0.05$, except for flank defenders and flank midfielders), intensity of braking ($p<0.05$ when compared with a central defender) and the lowest values of acceleration and braking ($p<0 .05$ when compared to the central midfielder).

Conclusions. According to the results of the study and comparative analysis of the players of the Russian national teams of different roles, it was found that the players of different positions perform motional actions peculiar only to them during the game. The greatest amount of movement in a sprint is performed by flank players and attackers, who are characterized by the highest maximum speed that the playing space allows them to achieve and high maximum braking values. Central midfielders have the highest amount of total distance, acceleration and braking, and the lowest top speed due to limited free space in the center of the field. Central defenders demonstrate the least amount of motor activity both in terms of acceleration and braking, and in terms of speed.

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Parameters of vibration imaging and psychophysiological reactions in highly qualified athletes specializing in bullet and bench shooting

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Abstract

Objective of the study was to determine the information content of the innovative vibraimage technology (VibraMed10, 2020), taking into account the psychophysiological indicators of the state of athletes.

Methods and structure of the study. In the course of scientific work, methods of vibraimaging and psychophysiological testing were used to analyze the current state of 58 highly qualified athletes specializing in bullet and clay shooting. A statistical analysis of the parameters of the vibraimage and psychophysiological reactions was carried out. The informative significance of the indicators determined when using the technology of vibraimage to assess the psychophysiological state of highly qualified athletes specializing in bullet and bench shooting has been determined.

Results and conclusions. The conducted pilot study indicates the possibility of using the technology VibraMed10 to monitor the psychophysiological state of athletes in the process of training and competitive activities. This is confirmed by the identification of common characteristics, such as "self-regulation", "energy", "charisma", "aggressiveness", "stress", "anxiety", "depression" and "danger", which are typical for shooting sports athletes in general. Along with this, differences were found in the severity of the parameters: "poise", "neuroticism" and "inhibition", which can be attributed to the priority signs of belonging to a narrow specialization.

Keywords: *highly qualified athletes, bullet shooting, bench shooting, vibraimage, psychophysiological testing.*

Introduction. In recent decades, modern methods of psychophysiological diagnostics have been actively developed in elite sports to assess the preparedness of athletes. Vibraimage technology is one of the innovative methods for improving psychophysiological diagnostics. As an indicator of the body's response to internal and external factors, the characteristics of the functioning of the vestibular system are used, which has multiple afferent and efferent morphofunctional connections with cortical-subcortical formations of the central and autonomic nervous systems of the brain and spinal cord, as well as with neuroendocrine processes [4]. The parameters of the vibraimage reflect the systemic reaction of the body, which already now allows you to quickly identify individuals with deviations or disorders of psychophysiological adaptation. Pilot studies on the use of vibraimaging technologies based on the VibraMed10 and MI-Sins programs (Elsis company, St. Petersburg) in elite sports in the first approximation showed the informativeness of this diagnostics and monitoring of the condition of highly qualified athletes [1, 6, 7]. However, the correlation of vibraimage data with the results of standardized psychophysiological methods used in sports practice has not been studied, which limits the application of the method.

Shooting, as a technical sport with complex coordination, differing in specific requirements for the psychophysical abilities of an athlete, is an adequate model for studying the activity of the central nervous system using vibraimage technologies.

Objective of the study was to determine the information content of the innovative vibraimage technology (VibraMed10, 2020), taking into account the psychophysiological indicators of the state of athletes.

Methods and structure of the study. The research was carried out on the basis of the Federal Scientific Center for Physical Culture and Sports. A comprehensive examination of 58 highly qualified sportsmen-shooters was carried out: 24 sportsmen - trap shooting, 34 - bullet shooting, with an equal number of men and women; age 18-36 years (mean age 22.8±4.4 years); sports qualification: 8 people - Honored Master of Sports, 24 people - International Master of Sports of Russia, 18 people - Master of Sports, 8 people - Candidate Master of Sports.

Testing included the use of vibraimage technology (VibraMed10, 2020) and psychophysiological methods "NS-PsychoTest" [3, 5].

The method of vibraimaging technology determines the psycho-emotional portrait of a person based on the results of frequency and amplitude analysis of the spatial and temporal movement of the head. The obtained movement parameters are converted using mathematical formulas into psychophysiological parameters with the allocation of emotional and psychophysiological states in percentages from 0 to 100%, which can be divided into four groups:

- the first group of conditionally negative emotional parameters includes: aggressiveness, stress, anxiety and the level of danger of this person to others;
- the second group includes conditionally positive emotional parameters: balance, charisma, vigor and self-regulation level;
- the third group of emotional parameters includes physiological parameters: inhibition, neuroticism, depression and the level of happiness;
- the fourth group consists of psychophysiological parameters: extraversion, stability, satisfaction, period of brain activity.

Among the standardized methods, a simple visual-motor reaction (VMR), complex reactions - a choice reaction (ChR) and a reaction to a moving object (RMO) were used. In the VMR test, the mean response time assessed the level of CNS functionality, and the standard deviation assessed cerebral homeostasis [2]. The ChR test evaluates the mobility of nervous processes: the average value of the reaction time reflects the general mobility of nervous processes with the diagnosis of inertness or mobility of nervous processes, the standard deviation evaluates stability [3].

Characteristics of psychophysiological state parameters (VibraMed10 method, APK NS-Psychotest) and type of specialization among high-skilled shooters, U Mann-Whitney

Index	Bullet shooting					Bench shooting					Bullet / bench shooting
	Men		Women		p	Men		Women		p	
Vibraimage	X	σ	X	σ		X	σ	X	σ		p
Aggression	42,6	2,4	43,4	3,9		44,0	8,6	40,5	6,4		
Stress	34,3	4,6	31,6	4,0		32,2	4,5	30,9	3,8		
Anxiety	31,5	3,4	30,1	4,0		30,8	3,3	28,9	6,3		
Danger	36,8	2,9	34,3	3,1	0,0005	35,5	2,2	34,7	2,5		
Equilibrium	69,5	10,0	71,7	11,1		78,1	6,0	80,1	4,2		0,00001
Charisma	59,5	12,1	67,8	8,0		54,2	10,3	58,0	11,4		0,024
Energy	22,3	7,2	21,9	5,9		21,2	2,9	23,4	5,2		
Self-regulation	64,1	8,9	69,2	7,6		65,8	4,1	68,8	5,7		
Braking	20,0	2,9	20,1	3,6		15,3	2,0	16,9	2,3	0,002	0,00001
neuroticism	26,4	4,8	28,8	5,4		34,1	7,3	37,7	8,9		0,0001
Depression	26,6	5,5	26,4	8,0		29,5	2,8	27,8	3,3		
Positive	53,9	7,9	57,6	7,1		54,8	3,6	57,6	5,4		
Negative	36,6	2,9	34,1	3,2	0,007	35,3	2,2	34,5	2,6		
Physiological	27,9	4,2	29,1	4,6		27,4	2,0	28,3	1,5		
Simple visual-motor reaction											
Average reaction time (ms)	204	14,9	213	34,9		188	15,7	187	21,4		0,0002
Standard deviation (ms)	45,7	15,3	42,3	13,7		34,2	11,4	34,8	11,2		0,001
Total number of errors	0,8	1,2	0,9	1,3		1,0	2,3	1,0	1,1		
Choice reaction											
Average reaction time (ms)	334	42,8	355	53,0		322	23,2	324	53,7		
Standard deviation (ms)	84,0	19,4	79,5	18,7		74,5	17,1	79,0	25,8		
Total number of errors	7,3	3,1	5,0	3,4	0,003	5,3	3,6	4,9	4,9		
Reaction to a moving object											
Average reaction time (ms)	0,9	17,0	-4,6	32,2		-2,1	14,1	-3,3	11,6		0,0002
Standard deviation (ms)	44,5	9,9	60,8	42,5		30,5	8,3	30,1	15,5		0,0005
Percentage of accurate reactions (%)	62,4	12,3	57,8	17,0		78,7	12,7	79,7	19,4		0,00001
Latency Percentage (%)	18,0	9,9	19,3	13,3		9,2	6,0	8,3	11,6		0,0001
Lead Percentage (%)	19,0	14,0	22,5	17,1		12,0	11,9	12,1	11,8		0,003

In the RMO test, to assess the balance of excitation and inhibition processes, the following were used: the average response time, standard deviation, the number of accurate reactions, delay and lead reactions (% of the total number of reactions) [8].

Results of the study and their discussion. A preliminary analysis of the test results showed that men and women of the same shooting specialization do not have significant differences in terms of psychophysiological state indicators, which made it possible to consider them as single groups representing athletes of both sexes in the "trap shooting" and "bullet shooting" groups (see table).

Comparative analysis of the results of the study of vibraimage and standardized psychophysiological methods between groups of shooters of different specializations showed that there are indicators that mark belonging to a specialization at the level of statistically significant differences. Thus, the "Skeet Shooting" group demonstrates a higher level of the "poise", "neuroticism" indicators and a lower level of the "inhibition" indicator, which also correlates with higher strength and stability of the central nervous system (VMR), greater reaction stability (ChR). It should be noted that the meaning of the term "neuroticism" in this method is interpreted as a measure of the stability of the "inhibition" indicator.

The results of the RMO test deserve special attention, indicating that athletes of both bullet and clay specializations are characterized by a balance of inhibition-excitation processes, however, the stability and frequency of reaction accuracy are fundamentally higher in the clay shooting group.

Conclusions. The conducted pilot study already at this stage indicates the possibility of using VibraMed10 technology to monitor the psychophysiological state of athletes in the process of training and competitive activities. This is confirmed by the identification of common characteristics, such as "self-regulation", "energy", "charisma", "aggressiveness", "stress", "anxiety", "depression" and "danger", which are typical for shooting sports athletes in general. Along with this, differences were found in the severity of the parameters "poise", "neuroticism" and "inhibition", which can be attributed to priority signs of belonging to a narrow specialization.

In trap shooting, the parameters "poise" and "neuroticism" reflect the general mobility of nervous processes, stability, balance of nervous processes and correlate with the results in the ChR and RMO tests. The "inhibition" parameter is manifested in the assessment of the level of functional capabilities of the central nervous system, the balance of excitation and inhibition processes in the VMR and RMO tests.

Further research of highly qualified athletes of various sports will allow forming the information field of the method, supplementing and verifying individual concepts in order to use them in the scientific and methodological support for the training of athletes of the national teams of the country.

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Variability of ankle movements as a fatigue factor in runners

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Abstract

Objective of the study was to assess the stability of the ankle trajectory in runners of various qualifications under conditions of fatigue.

Methods and structure of the study. During the study, two groups were formed: a group of highly qualified runners - 8 people (4 men and 4 women) with more than 5 years of trail running experience, age 30±3 years, average preferred running speed 13±1.33 km/h; without injuries for the past and current calendar year. Control group - novice runners - 10 people (7 men and 3 women) with half a year experience of smooth running on asphalt/hard ground, age 18±2 years, speed in the mixed pulse zone 7±2.2 km/h.

The movement registration method was used to study the instability of the ankle trajectory in runners of various qualifications under conditions of fatigue.

Results and conclusions. It is shown that fatigue that develops during long-term running loads (45 minutes) is accompanied by an increase in the variability of ankle movements, and if this increase is not so significant for experienced athletes, then for beginner runners it is very significant and can serve as a risk factor for sports injuries. This aspect must be taken into account when planning the training process, when choosing sports shoes and when assessing the risk of injury.

Keywords: *running, kinematics, ankle, sports injury.*

Introduction. Running is the standard and most common type of training activity. Along with the significant health benefits of running in various age groups, running comes with a high risk of injury. The risk of injury increases gradually - without special exercises, which often happens with independent runners, running acts as a delayed (accumulated) damaging factor. The frequency of sports injuries during excessive exercise is quite high [5, 6]. Violations of the biomechanics and kinematics of the athlete's movements during fatigue are considered important risk factors.

In most cases, runners choose a running pace (frequency of steps) that provides the minimum energy expenditure [1, 4]. Also, an important factor in running is maintaining a constant phase structure of movements - each cycle should repeat the previous one. Due to the peculiarities of the functioning of the neuromuscular apparatus, it is prone to repeated repetition of stable cyclic movements [2].

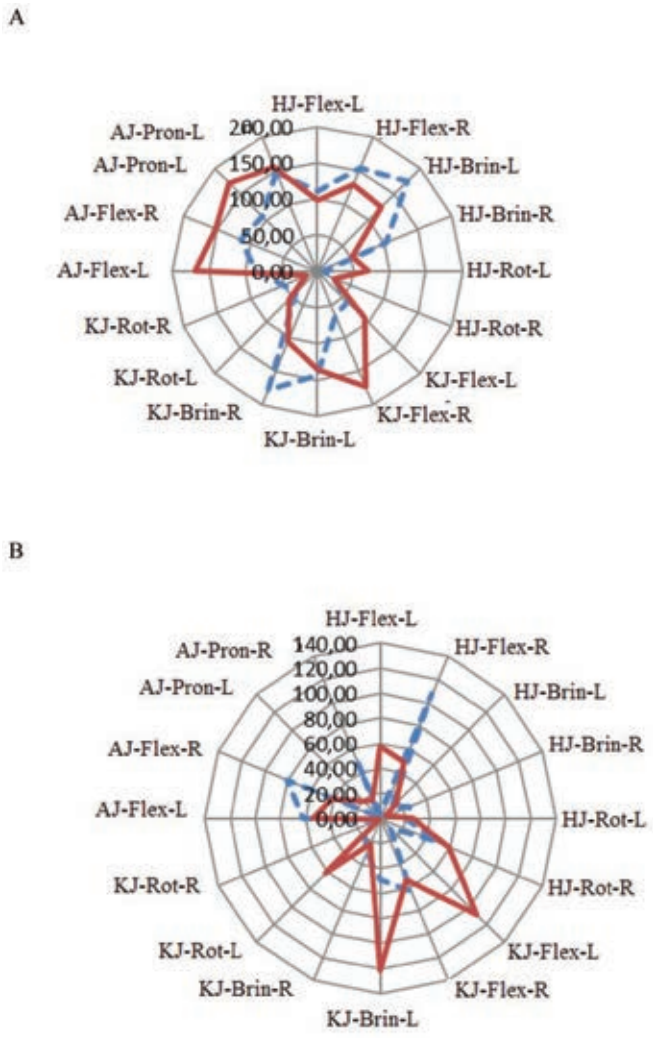
In case of violation of the structure of the cycle for any reason (external - uneven structure of the supporting surface or shoe defects; internal - desynchronization of the leg muscles), it is necessary to apply additional muscle efforts to maintain a constant trajectory of the foot and its interaction with the surface [3, 6]. But the ability to adequately respond to such changes is formed only in experienced athletes.

Objective of the study was to assess the stability of the ankle trajectory in runners of various qualifications under conditions of fatigue.

Methods and structure of the study. During the study, two groups were formed: a group of highly

qualified runners - 8 people (4 men and 4 women) with more than 5 years of trail running experience, age 30±3 years, average preferred running speed 13±1.33 km/h; without injuries for the past and current calendar year. Control group - novice runners - 10 people (7 men and 3 women) with half a year experience of smooth running on asphalt/hard ground, age 18±2 years, speed in the mixed pulse zone 7±2.2 km/h.

Fixation of the position of the hip, knee, ankle joints was carried out using the hardware-software complex "Trust - M") (Russia), version 2.12.x. The device, using sensors connected via wi-fi, including channels for recording Euler angles relative to the zero position, allows you to register the position of the body in space and measure the angular and temporal characteristics of joint movements during physical activity, as well as average data on the time of a running step. For visual control of the running technique, frame-by-frame shooting was carried out in the sagittal plane.



Picture 1. *Indicators of maximum range of motion in the joints of experienced (A) and beginners (B) runners (mm).*

The solid line is before the running load.

The dotted line is after 45 minutes of running.

Designations: HJ – hip joint; KJ – knee-joint; AJ – ankle joint; Flex – flexion; Brin – bringing; Rot– rotation; Pron – pronation; L – left; R – right

The design of the study implied the fixation of three-dimensional kinematics at regular time intervals for a three-minute run on a treadmill at a speed corresponding to the mixed anaerobic pulse zone (in the range from 145 to 155 depending on the age of the athlete) before and after a 45-minute running session in that same pulse zone. The pulse zone was recorded using a Polar watch with the function of fixing the required heart rate and a chest strap, which ensures accuracy in measuring heart rate. The average, peak angles of the joints in the hip, knee and ankle joints, the time of the phases of the maximum amplitude of the joints during the control three-minute running session before and after the 45-minute training load in the mixed pulse range were recorded.

Results of the study and their discussion. The results obtained are shown in Figure 1. It is noteworthy that highly qualified runners' movements are characterized by symmetry, which is preserved after a running load. Changes after loading are present but not significant (Figure 1A). A fundamentally different picture in novice runners (Figure 1B) - the asymmetry of movements, expressed at the beginning of the run, significantly increases at the 45th minute. In general, after the load, pronounced violations of the structure of the motor cycle are noted.

Advanced runners showed significant increases in right knee and both ankle flexion, while control runners increased left knee adduction and left hip flexion. In relation to other indicators, beginners are characterized by a decrease in the maximum amplitude of angles after a running session, in addition, the trend of being in the phase of maximum joint flexion and pronation amplitudes for 1 cycle after a running session by 20% increased among beginner runners, which indicates a decrease in the efficiency of running equipment , an increase in the time for performing flexion locomotions, an increase in the ankle joints in a pronated state, and a knee joint in an extended state, which can cause some injuries of the lower limb (excessive rotation can have a particularly significant effect on the talocalcaneal joint), resulting from the accumulation of stress with a subsequent decrease in the function of adductors and extensors

of the thigh, pronators of the foot. Advanced runners also showed an increase in the trend of being in the phase of maximum amplitudes by an average of 10% for all indicators, which indicates the overall effect of fatigue on the decrease in the speed of the muscles of the lower limb. The absence of pronounced differences in the stability of maximum amplitude indicators, a more even distribution of joint performance indicators in the maximum amplitude phase of advanced runners after a running session (with the exception of flexion and rotation indicators of the left knee joint) in comparison with beginner runners indicates the importance of the stability factor of ankle kinematic parameters in qualified runners athletes.

Conclusions. The results obtained indicate that fatigue that develops during long-term running loads (45 minutes) is accompanied by an increase in the variability of ankle movements, and if this increase is not so significant for experienced athletes, then for beginner runners it is very significant and can serve as a risk factor for sports injuries. This aspect must be taken into account when planning the training process, when choosing sports shoes and assessing the risk of injury. To prevent injuries, exercises aimed at strengthening the inverters of the ankle joint and the hip abductors can be recommended.

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Influence of differently directed motor activity on indicators of external respiratory functions in the process of special physical training in boxing

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Abstract

Objective of the study was to analyze the influence of multidirectional muscle activity on the functional parameters of the external respiration apparatus during the performance of special physical training exercises in boxing.

Methods and structure of the study. Two equivalent groups were formed from boxers of the 1st category from 18 to 19 years old, 10 people in each group: the experimental group (EG) and the control group (CG). All athletes were represented by the weight category up to 71 kg. Within six months, the athletes were tasked with improving special physical training based on the tactical features of the fight. Boxers who use a playful style of fighting and achieve sports results by winning by beating an opponent on points (boxers-players) used means aimed at a more significant development of the muscles of the lower extremities when performing punches (EG). Athletes who use a strong blow to achieve the result (boxers-knockouts) performed exercises with a more significant involvement of the muscles of the upper limb girdle (CG) in the activity.

Results and conclusions. It has been noted that the use of agents that involve the muscles of the lower extremities in the activity contributes to the development of optimal functional training in boxing, which qualitatively affects the spirographic parameters after the performed motor work of athletes.

Keywords: *indicators of external respiration functions, multidirectional physical activity, special physical training in boxing.*

Introduction. Applying a direct blow in boxing, depending on the athletes using different tactics of the fight, is possible with a ballistic or non-ballistic type of muscle tension [3, 4, 6]. At the same time, to perform strikes of various types, different means of improving their motor and speed-strength qualities should be used [6, 9]. At present, a number of authors scientifically substantiate the influence of the type of muscle tension during the improvement of the impact movement on various systems of the vegetative support of the body, which implies a different time interval for the restoration of the body of athletes after muscle activity and its adaptation to the work done [2, 3, 5, 10].

Thus, the means used to improve strikes in athletes of different tactical manner of conducting a duel should correspond to an increase in their functional and motor-coordination capabilities [1, 3, 8, 9].

Objective of the study was to analyze the influence of multidirectional muscle activity on the functional parameters of the external respiration apparatus during the performance of special physical training exercises in boxing.

Methods and structure of the study. Two equal groups were formed from boxers of the 1st category from 18 to 19 years old, 10 people in each group: the experimental group (EG) and the control group (CG). All athletes were represented by the weight category up to 71 kg.

Within six months, the athletes were tasked with improving special physical training based on the tactical features of the fight. Boxers who use a playful style of fighting and achieve sports results by winning by beating an opponent on points (boxers-players) used means aimed at a more significant development of the muscles of the lower extremities when performing punches (EG). Athletes who use a strong blow to achieve the result (boxers-knockouts) performed exercises with a more significant involvement of the

muscles of the upper limb girdle (CG) in the activity.

At the end of the study, one-stage testing was carried out to assess the functions of external respiration during the performance of work, due to the different activity of the muscle groups used when involved in the impact movement. Boxers from the EG performed squats at the maximum pace for 30 seconds. With a similar time interval, the athletes from the CG performed push-ups from the floor from the floor support at the maximum pace.

The following research methods were used:

Spirography [3]. Determination of respiratory system parameters was carried out at the complex of functional diagnostics "Valenta-FVD", St. Petersburg. The study was conducted at rest and after the testing task. The indicators of the vital capacity of the lungs on inspiration (VCins), the forced vital capacity of the lungs (FVC), the volume of forced exhalation at 1 second (VFE1), the Tiffno index (TI), the peak volume exhalation rate (PVR), the maximum volume expiratory rate at 25, 50 and 75% of the FVC (MVR25, MVR50, MVR75), the average volume exhalation rate by 25-75% of the FVC (AVR25-75) [7].

The obtained data were processed using the Statistica 10.0 statistical analysis program. The nonparametric Mann-Whitney criterion was used to assess the reliability.

Results of the study and their discussion. Analyzing the results of lung volume for a multidirectional load in solving coordination and motor problems in senior athletes, we noted the following values. The VCins values recorded after testing with compared with the results at rest decreased in the EG by 24.4%, and in the CG by 31.5% (Table 1; $p<0.05$). This fact allows us to testify to the adequate reaction of the organism of athletes of various tactical manners of conducting a duel to the load performed for the needs of motor activity during the development of muscle groups involved in the work during the improvement of striking actions.

When evaluating the FVC indicator, which reflects bronchial conduction and involvement in the activity of expiratory muscles, we did not notice any significant differences after testing between groups that focus on the development of various muscle groups to increase the speed-strength characteristics of impact actions (table 1; p>0, 05).

When comparing the data recorded before and after the test load, we noted their decrease after the load in the EG by 24.3%, and in the CG - by 22.9% ($p<0.05$). This fact indicates a good elasticity of the lung tissue in athletes of various studied groups and indicates their sufficient functional training to perform specific exercises of a speed-strength nature.

When analyzing the VFE1 values, we noted the predominance of the values recorded after testing in the EG over the level observed in the control by 43.3% (Table 1; $p<0.05$). When comparing these values with the results at rest, we did not note their statistical difference in the EG, while in the CG they decreased by

Table 1. *Spirographic indicators in athletes-athletes with multidirectional load to assess the improvement of speed-strength and motor capabilities of shock movements,* X±m

Boxers of the 1st category				
Indicators	Control group		Experimental group	
	Rest	Load	Rest	Load
VCins (l)	6±0,3	4,11±0,4#	6,1±0,2	4,61±0,3#
FVC (l)	5,2±0,3	4,01±0,2#	5,8±0,2	4,39±0,3#
VFE_1 (l)	4,8±0,2	3±0,1#	5±0,2	4,3±0,2*
TI (%)	79,9±5,1	73,4±4,4	78,5±3,6	94±5,3*
PVR (l/s)	9,7±1,2	6±0,5#	11,1±1,1	10,6±1,01*
MVR_{25} (l/s)	7,8±0,8	5,2±0,3#	9±1,1	9,1±0,9*
MVR_{50} (l/s)	5,4±0,4	4,1±0,1#	5,9±0,4	6,1±0,5*
MVR_{75} (l/s)	3,2±0,3	2,9±0,09	3,7±0,2	4,5±0,3*#
AVR_{25-75} (l/s)	5,4±0,3	3,8±0,2#	6,2±0,3	5,6±0,4*

* – reliability of differences between EG and CG data, P<0.05;
# – reliability of load data relative to rest level, P<0,05.

37.5% ($p<0.05$). This allows us to make an assumption about a more significant efficiency of the work performed with the involvement of the muscles of the lower extremities in the activity of the athletes from the EG.

In the study of the Tiffno index after exercise, we noted its predominance by 28.1% in athletes from the EG over the values of the CG (table 1; $p<0.05$). The EG values observed after testing increased significantly, but were not marked by significant differences relative to the data recorded at rest. In the CG, the results after exercise were not noted by us as statistically significant differences relative to background values and remained at the same level. This fact does not allow us to testify to obvious respiratory disorders, but it characterizes the lower efficiency of activity with a significant involvement of the arm muscles in the CG.

When analyzing a number of indicators characterizing bronchial conduction on expiration after a multidirectional load, we noted a 76.7% predominance of the values of the peak volumetric velocity and expiration of the EG boxers over the control level (Table 1; $p<0.05$). When comparing these values with the values observed at rest, we did not record their significant differences in the EG, while in the CG they decreased by 38.1% ($p<0.05$). When considering the values of the air velocity in the large bronchi after testing, we noted the predominance of 75% of the MVR25 values of athletes from the EG over the CG (see table; $p<0.05$). These results practically did not change relative to the background values in the EG, while in the CG they became 33.3% lower ($p<0.05$).

When analyzing the air flow rate in the middle bronchi during expiration, we noted the predominance of MVR50 values by 48.8% in boxers from the EG recorded after testing over the control data (see table; $p<0.05$). When comparing these results with the values recorded at rest, we did not notice their statistical difference in the EG, while in the CG they decreased by 24.1% ($p<0.05$).

MVR75 values after exercise in the EG were 55.2% ($p<0.05$) higher than the results in the CG (see table). In the EG, the results, after testing, became higher than the initial values by 21.6%, while in the CG they were not marked by significant differences ($p<0.05$).

The values of AVR25-75 observed after exercise in the EG were 47.4% higher than the control values, remaining almost at the level observed at rest (see table; p 0.05). In the CG, these results were 29.6% lower than the background values ($p<0.05$).

Thus, the results obtained allow us to assume that a specific physical activity performed with a more significant involvement of the leg muscles in the activity is more economical, which contributes to a more adequate functioning of the respiratory system during the recovery of athletes after muscle activity.

Conclusions. The results of the study allow us to state the fact that the performance of special physical training exercises with a more significant involvement in the activity of the leg muscles contributes to a more adequate functioning of the external respiration system, which ensures the rapid recovery of the body of athletes and the improvement of its speed-strength characteristics while simultaneously developing the muscle groups necessary for improvement of motor-coordination training.

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Physiological effects of the introducing of the program of personalized support for adolescent chess players

UDC 796.323.2

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Abstract

Objective of the study was to evaluate the physiological effects of introducing a program of personalized support into the educational and training process of 15-16 year old chess players.

Methods and structure of the study. The experiment involved 15 teenage chess players (15-16 years old) with 1-2 sports categories. The functional assessment of the respiratory and cardiovascular systems was carried out using the Stange and Genchi tests, the calculation of the endurance coefficient, and the fatigue state index. The quantitative assessment of the health of chess players was studied according to the method developed by N.N. Mityukov on the basis of changes in the level of adaptive potential. A comparative five-segment analysis of body composition indicators was carried out using professional Tanita BC-418MA analyzer scales (Japan).

Research results and conclusions. A personalized program of physical training of a chess player is proposed. A feature of the personalized support program for a chess player is that it includes the creation of a training system taking into account individual indicators of physical endurance with entry into the database and the implementation of professional consultations in the pre-competitive and post-competitive period. After the application of the personalized physical training program, the reserve capacity, the efficiency of the functioning of the respiratory and cardiovascular systems of chess players increased.

Keywords: *chess, training process, physical training, personalized program, body composition, cardiovascular system, respiratory system.*

Introduction. The popularity of the game of chess is steadily increasing. The reasons for the increased interest in chess are varied, they are determined by the intellectualization of modern society and the importance of the problems of human creative development [1, 4, 5]. Educational, training and competitive loads of chess players are accompanied by increased emotional stress against the background of low motor activity, leading to dysfunction of many body systems. In this regard, it is relevant to introduce a personalized physical training program into the educational and training process of chess players, which will reduce psycho-emotional stress and prevent destabilization of the physiological functions of the body.

Objective of the study was to evaluate the physiological effects of introducing a program of personalized support into the educational and training process of 15-16 year old chess players.

Methods and structure of the study. Scientific work was carried out at the municipal educational institution of additional education for children, specialized children's and youth sports school of the Olympic reserve in chess and checkers in Chelyabinsk, it was attended by 15 teenage chess athletes (15-16 years old), with 1 -2nd sports categories. The functional assessment of the respiratory and cardiovascular systems was carried out using the Stange and Genchi tests, as well as by calculating the endurance coefficient. With the help of a test

with physical activity (15 squats in 30 s), the index of the state of fatigue was calculated (according to the method of L.L. Varnas, I.I. Yashchaninas). The quantitative assessment of the health of chess players was studied according to the method developed by N.N. Mityukov (1993).

Comparative analysis of indicators of the component composition of the body was carried out using professional scales-analyzers Tanita BC-418MA (Japan). Changes in the ratio of labile components of body weight - adipose tissue and lean mass were analyzed. Bioimpedance analysis of body composition in a sample of chess players was carried out in the morning on an empty stomach in a five-segment mode. The assessment of the general physical fitness of chess players was carried out using standard tests.

The organization of the survey was regulated by compliance with the requirements of the Council of Europe Convention on Human Rights and Biomedicine. To compare the indicators measured in two different periods on the same sample of moderate athletes, statistical analysis of the results was carried out using MS Excel 2016 programs with the calculation of the Wilcoxon T-test, changes in indicators were considered statistically significant at $p<0.05$.

Due to the fact that the duration of a chess game can last from 1.5 to 6 hours, with the development of a state of fatigue, far from specific chess factors come to the fore, but such as physical endurance, the state of the cardiovascular and respiratory systems. We have proposed a personalized program of physical training for a chess player, which includes a set of exercises and a plan for their use during a six-month training cycle.

A feature of the program of personalized support for chess players is that it includes the creation of a training system taking into account individual indicators of physical endurance with entry into the database and the implementation of professional consultations in the pre-competitive and post-competitive period. The program includes both exercises of general impact and for strengthening various muscle groups of the body (back, abdominals, cervical spine, shoulder girdle and limbs), relieving fatigue; as well as individually selected exercises for playing the game in conditions of lack of time for the development of physical and mental endurance.

Results of the study and their discussion. In order to more objectively assess the effectiveness of introducing a personalized physical training program to the activities of the main energy supply systems of the chess players' body, we studied the reaction of the respiratory and cardiovascular systems to a dosed physical load. In the dynamics of the study, the duration of breath holding on inspiration (Stange's test) increased from 72.5±4.9 (s) to 85.5±5.1 (s) ($p<0.05$); on exhalation (Genci test) – from 43.5±3.9 (s) to 51.4±4.2 (s) ($p<0.05$); VC increased from 2.8±0.4 (l) to 3.2±0.5 (l) ($p<0.05$); vital index from 60.2±4.8 (ml/kg) to 63.7±4.9 (ml/kg) ($p<0.05$); endurance coefficient and fatigue state index decreased from 16.8±1.1 and 1.30±0.30 to 16.3±0.9 and 0.90±0.02, respectively ($p<0.05$), which indicates on improving the efficiency of the functioning of the cardiovascular and respiratory systems in chess players aged 15-16.

In the dynamics of the training process, there was a significant decrease in heart rate and systolic blood pressure at rest, after exercise, after 1 minute of recovery. In addition, after systematic physical training sessions in athletes, recovery of heart rate after a dosed load was observed at 2–3 minutes; the values of the double product after the load, compared with the beginning of the training process, decreased from 17013.21±657.89 to 14945.76±567.43 ($p<0.05$), after a minute of recovery - by 20.7% against the background of a decrease in efficiency ratio from 279.92±25.31 to 236.86±21.45 ($p<0.05$).

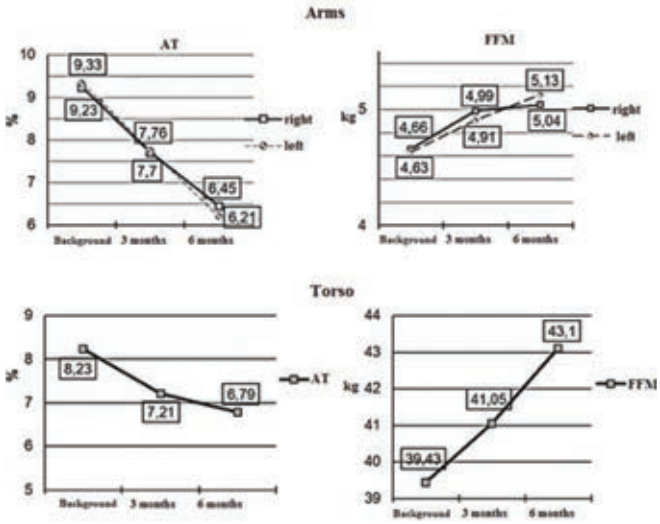
An indicator reflecting the effectiveness of physiological adaptation is the recovery rate after a load within one minute [7], which in chess players increased from 72.05±5.11 to 81.31±6.35 ($p<0.05$) under the influence of personalized physical training. The values of the health index among chess players at the beginning of the training process indicate a decrease in adaptation; after six months of training, this indicator decreased, corresponding to a satisfactory level of adaptation (from 3.89±0.22 to 2.91±0.14 at $p<0.05$).

Under the influence of the program of personalized support in the dynamics of the training process, there was an improvement in all indicators of the general physical fitness of chess players: the effectiveness of 30m and 2000m runs decreased from 5.7±0.5 (s) and 600.6±34.4 (s) to 4.4±0.4 and 513.4±31.5 (s); the number of flexion-extension of the arms while hanging on the crossbar and in support increased from 7.5±0.4 and 25.1±3.9 to 9.6±0.5

and 31.3±4.8; the number of body lifts in 1 minute from the "lying on the back" position increased from 41.9±4.1 to 47.1±4.9; stuffed ball throws – from 8.3±1.5 to 9.2±2.1.

Focusing on the results of bioimpedance analysis of the body composition of chess players, it can be revealed that after three months of using the personalized support program, chess players have a statistically significant decrease in the content of adipose tissue in all parts of the body. This trend was also observed after six months - a decrease in adipose tissue in the extremities by an average of 31.4%, and in the trunk - by 17.5%. Fat-free mass in the studied regions of the body in chess players increased (in relation to the background values, at $p<0.05$): after three and six months of using the program in the upper shoulder girdle - by 5.9% and 9.5%; in the bottom - by 7.4% and 7.9%; in the trunk - by 4.1% and 9.3%, respectively.

Asymmetry was revealed in the content of adipose tissue in the hands of chess players after six months of the physical training program ($p<0.05$). The figure shows a decrease in adipose tissue and an increase in lean mass in the studied regions of the body in chess players in the dynamics of using a personalized program. When calculating the Wilcoxon T-test, which is equal to the sum of the ranks corresponding to an atypical shift of the indicator,



Dynamics of regional changes in the parameters of the component body composition of chess players during the application of the physical training program.

Note: Note: AT - adipose tissue; FFM - fat-free mass; difference of paired indicators |d| within [0.1:0.5]

with the revealed difference in paired indicators |d| within [0.1:0.5], T=4.5 was obtained. Comparing Temp. with Tcr., which at a significance level of $p=0.05$ and $n=15$ is equal to 14, we can consider changes in bioimpedance study parameters to be statistically significant.

A systematic increase in lean mass and a decrease in adipose tissue in the regions of the body corresponds to an increase in working capacity in the conditions of a decrease in energy costs per unit of work [1], and also confirms the adequacy of the applied training effects to the functional capabilities of the athletes' body and the formation of long-term adaptation of the phosphate, oxygen and lactate energy systems [6].

The program of personalized support for chess players should be developed in compliance with the principle of ensuring a sufficient volume of compensatory work against the background of a decrease in the total volume of motor work when an individual limit is reached in terms of lean mass and low levels of adipose tissue.

Indirectly, the issues of personalized training of chess players were considered by A.G. Korovyansky, who argues that a good level of chess form can be achieved only with attention to physical exercises, adherence to a sports regime, and control over one's health [5]. E.V. Kondratieva points out the need to include general physical training classes in the training process of chess players in order to reduce the negative impact of emotional stress on the body, minimize the negative consequences of high tournament loads, which is consistent with our findings [4]. E.V. Bykov notes that a sedentary lifestyle negatively affects the health of chess players, it is necessary to develop technologies that ensure the preservation of the health of athletes [2]. V.S. Grinchenko proposed a daily routine aimed at building an effective process of training chess players, mobilizing body systems without negative health consequences [3].

Conclusions. The introduction of a personalized training program into the educational and training process of teenage chess players contributed to functional changes, which manifested themselves in the following physiological effects: an increase in the reserve capacity of the cardiovascular and respiratory systems; reduction in the degree of fatigue after exercise; increasing the endurance and working capacity of the organism of chess players aged

15-16 under conditions of competitive loads against the background of improving their sportsmanship.

In addition, the optimal combination of mental and physical loads in the system of personalized training of teenage chess players contributes to the activation of thought processes, concentration of attention, increase in noise immunity, improvement of technical and tactical training and increase in the effectiveness of game actions.

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Functional features of the heart of swimmers

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Abstract

Objective of the study was to evaluate the cardiac activity of young swimmers.

Methods and structure of the study. The scientific work was carried out on 19 young swimmers with at least three years of swimming experience. The control group included 22 young volunteers who had not been involved in sports throughout their lives. In both groups, an ultrasound examination of the heart was performed using the SSD-80 Aloka device (Japan). Statistical processing was carried out by calculating Student's t-test.

Results and conclusions. In trained swimmers, hypertrophy of the left ventricle was noted with an increase in the mass and thickness of its posterior wall, with an optimum of its external size and cavity volume. In swimmers, a physiologically beneficial increase in the mass of the left ventricle was noted with its normal contractility and the optimal size of its cavity. Well-trained swimmers had a higher rate of myocardial relaxation than physically untrained young men.

Keywords: *swimming, ultrasound, myocardium, heart, left ventricle, physical training.*

Introduction. Regular muscle training has a stimulating effect on the entire body [6, 9]. Systematic physical training has a positive effect on its morphological, biochemical and physiological characteristics [4, 11]. In the case of their rational dosing, stimulation of vital processes in all internal organs is achieved [1, 7].

It is very important to study the impact of regular physical activity on the morphology and contractility of the myocardium. Registration of these indicators allows assessing the state of functional capabilities of the heart [3, 8]. For the physiology of sports, the study of the characteristics of the heart in swimmers is of particular importance, since this information contributes to understanding the mechanisms of adaptation of the heart to regular loads in the aquatic environment [2]. Achieving high effectiveness of swimming training is possible only when taking into account the dynamics of cardiac indicators in trainees [12].

Objective of the study was to evaluate the cardiac activity of young swimmers.

Methods and structure of the study. The study was conducted on 19 young swimmers aged 18 to 21 years. All of them regularly for at least three years went in for swimming in the pool for at least 40 minutes per session four times a week. The control group included 22 clinically healthy young men aged 18 to 21, leading a physically inactive lifestyle. All patients underwent an ultrasound examination of the heart using an SSD-80 ultrasound echocardiograph manufactured by Aloka (Japan).

Mathematical processing of the results was carried out by computer by calculating the value of Student's t-test. Differences between the parameters of the compared groups were considered significant at $p<0.05$.

Results of the study and their discussion. Systematic swimming in the pool contributes to positive functional changes in the heart (see table). The most obvious differences between both groups of observation were noted in the parameters of the left parts of the heart. The diameter of the left atrium in swimmers tended to exceed the control level (by 6.1%). In physically exercising, the anterior-posterior size of the left ventricle during diastole was 5.7% higher than the control. The decrease in this indicator tended to prevail among those who went in for swimming (by 6.9%). The thickness of the posterior wall of the left ventricle during diastole was 15.7% higher in swimmers. At the

Recorded indicators in male swimmers taken in the study

Indicator	Swimmers, M±m, n=19	Control, M±m, n=22
Myocardial mass, cm^3/kg	2,57±0,17	2,18±0,12 p<0,05
Ejection fraction, %	61,65±1,34	60,21±0,80
Left atrial diameter, cm/m^2	1,92±0,06	1,81±0,05
Antero-posterior size of the left ventricle in diastole, cm	5,39±0,16	5,10±0,11
Reduction of the anterior-posterior value of the left ventricle,%	35,19±0,78	32,92±0,65
Diastolic thickness of the left ventricle in the posterior wall, cm	1,18±0,10	1,02±0,07 p<0,05
End diastolic volume of the heart, cm^3/kg	1,79±0,11	1,95±0,07
Stroke volume, cm^3/kg	1,11±0,12	1,09±0,08
The highest rate of relaxation of the left ventricle in the posterior wall, cm/s	13,5±1,18	10,0±0,45 p<0,05
Ratio of end-diastolic volume to myocardial mass, cm^3/kg	0,72±0,08	0,92±0,07 p<0,01

Note: p - statistical significance of differences between groups.

same time, the value of the end diastolic volume of the heart in them showed a tendency to yield to the value in the control (8.9%).

Myocardial mass in swimmers was significantly higher (by 17.9%) than in the control group. This indicated the development of some physiological myocardial hypertrophy during swimming loads. Its severity was small, which did not change the magnitude of their stroke volume, which remained comparable in both observation groups. The ratio of diastolic final volume to the mass of the myocardium in swimmers was higher than in the control.

In the posterior wall of the left ventricle, the rate of relaxation prevailed in experienced swimmers over this indicator in physically untrained by 35.0%.

It can be assumed that swimming contributes to the development of left ventricular hypertrophy, as indicated by an increase in the thickness of its posterior wall and an increase in its mass even with the stability of the volume of its cavity, which in the examined athletes corresponded to the values in the control group.

A high rate of onset of myocardial relaxation is typical for people who exercise regularly [11]. The highest rate of development of relaxation of the walls of the left ventricle reflects the time of implementation of this phenomenon during diastole [12]. In our observation, this parameter was increased in swimmers. However, the value of this indicator is very unstable and experiences dynamics even during one ultrasound observation. In this regard, this indicator cannot be considered completely reliable for making final judgments.

Conclusions. Regular swimming has a beneficial effect on the physiological capabilities of the heart. Systematic swimming training contributes to an increase in the mass of the left ventricular myocardium and the preservation of its functionality without the development of signs of dilation in it. Regular swimming exercises lead to a functionally beneficial increase in the rate of left ventricular relaxation.

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Evaluation of changes in the motives of physical culture and sports among students during the period of self-isolation

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Abstract

Objective of the study was to assess the change in the motives for physical culture and sports among students during the pandemic.

Methods and structure of the study. In February 2020, an online survey was conducted, which was based on the methodology of A.V. Shaboltas, adapted for physical education at the university. The study involved 1385 students of Belgorod universities (n=755 girls and n=630 boys). A second survey was conducted in late April - early May 2020. It was found that the distribution of motives of boys and girls before self-isolation was identical.

Results and conclusions. During self-isolation, an increase in the indicators of the motive of emotional pleasure and social self-affirmation was noted. Moreover, in girls, the indicators of this motive significantly increased from 2.8±2.4 points to 3.6±2.3 points and moved from the last line of the rating of motives to the penultimate one. Thus, it was found that the self-isolation associated with Covid-19 and the limitations in self-expression that arose among students contributed to an increase in the significance of the motive of social self-assertion. Consequently, students have formed a desire to prove themselves, which is expressed in the fact that physical education classes and the successes achieved at the same time are considered and experienced from the point of view of personal prestige and respect from friends/acquaintances.

Keywords: *students, motives, physical culture, self-isolation, Covid-19.*

Introduction. The student period often occurs at the age of 17-22 years, when young people become independent. What value systems they were able to form in the family [6] and school largely determines how they will study at the university, how they will organize their day and their leisure. Nevertheless, it is common for a person to reconsider values and outlooks on life [4]. This can be facilitated by various events that have occurred with a person or people close to him [5]. The surrounding society has a great influence on these processes.

For example, studies by Falk E. and Scholz C. [3] indicate that consistently structured information can change a person's perception of a phenomenon or event, form certain value attitudes and motives. However, a more significant factor for the transformation of motives is a change in the habitual way of life of a person associated with some kind of disease or limitation. In this connection, the question arises: how could the two-month lockdown associated with Covid-19 affect the needs and aspirations of student youth?

Objective of the study was to assess the change in the motives for physical culture and sports among students during the pandemic.

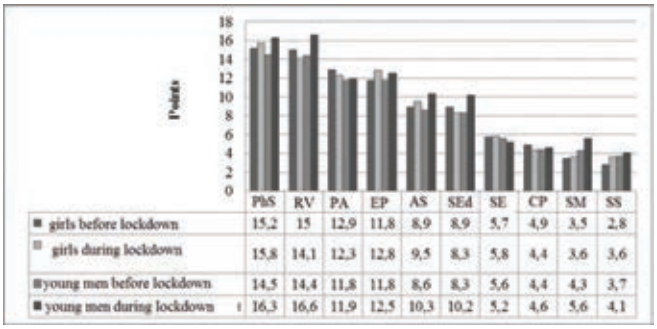
Methods and structure of the study. To assess the motives for physical culture and sports among students, a survey was conducted, which was based on the method modified and adapted for students by A.V. Shaboltas [2]. Judgments concerning competitive activity were rephrased taking into account the realities

of educational and physical culture and sports activities at the university. However, the semantic load and correspondence to motives-categories remained unchanged.

The survey was conducted in two stages: the first - in February 2020, the second - in late April and early May 2020. The survey involved 1385 students (n=755 girls and n=630 boys).

Results of the study and their discussion. A comparative analysis of the dynamics of changes in girls' motives for physical culture and sports activities during the period of self-isolation is shown in the figure. The most pronounced motive, both in women and men before self-isolation, was the motive of physical self-affirmation. Consequently, most of the students are engaged in physical culture or sports in order to have a good physique and be physically developed. In second place in importance among students was a rational-volitional motive, which allows us to say that physical culture or sports are considered as an opportunity to compensate for the lack of motor activity associated with intellectual load and a sedentary lifestyle during study. The results of the survey during self-isolation showed that in boys the rational-volitional motive came out on top, while in girls there were no such changes. In general, the ranking of motives is similar to the results obtained in our earlier studies [1].

In girls and boys during the period of self-isolation, indicators of the motive of emotional pleasure increased. This is due to the fact that during the lockdown period, the forms of obtaining new emotions and impressions, such as live communication with friends, visiting cinemas, cafes, restaurants, various events, and much more, have significantly decreased. There was a need to compensate for the lack of emotions with other available activities. One of these forms for girls was physical education and sports, which contribute to the production of "happiness hormones": serotonin and dopamine. Moreover, in girls, the motive of emotional pleasure began to prevail over the motive of preparation for professional activity.



Dynamics of changes in the motives of physical culture and sports among students during the period of self-isolation

PhS - the motive of physical self-affirmation
RV - rational-volitional motive
PA - the motive for preparing for professional activity
EP- motive of emotional pleasure
AS - the motive for achieving success in sports
SEd - sports and educational motive
SE - socio-emotional motive
CP - civil-patriotic motive
SM - social and moral motive
SS - the motive of social self-assertion

The least significant, both for girls and boys, are the socio-moral motive, which manifests itself in the desire to train for the victory of their team, and the motive of social self-affirmation, which is based on the mechanism of self-expression and obtaining social recognition through sports achievements. The validity of finding these two motives at the bottom of the rating obtained is understandable. Both motives are focused on sports activities and the achievement of sports success. Given that the majority of respondents do not connect their lives with sports, these motives are less significant for them.

To assess the dynamics of indicators of motives before and during self-isolation, a comparative analysis was carried out. Initially, using the Kolmogorov-Smirnov method, it was found that the indicators of all motives have a normal distribution (Z statistic varies from 3.12 to 5.09; p=0.000). Accordingly, this made it possible to apply the Student's t-test for paired samples. As a result, significant changes from 2.8±2.4 points to 3.6±2.3 points were found only in girls in the index of social self-affirmation motive (t=2.864; p=0.004). We assume that such changes may be related to the lack or limitation of live (offline) interaction between people during self-isolation. In this connection, physical culture or sports, both at home with video recording and subsequent placement in a social network (challenges, stories, etc.), and on the street, were perceived by girls as a way of self-expression and attracting attention to themselves. There were no significant changes in the indicators of motives among young men.

Conclusions. Comparing the results of boys and girls, it is necessary to note the identity of the distribution of motives before self-isolation. During self-isolation, the girls experienced a redistribution of priorities, and the motive of emotional pleasure became more significant than the motive of preparing for professional activities. The indicators of the motive of social self-affirmation significantly increased among the girls. As a result, this motif moved from the last line of the rating

to the penultimate one. No significant changes were found in boys.

Regardless of gender characteristics, the most significant for both boys and girls are the motive of physical self-affirmation and the rational-volitional motive. This is due to the fact that in this age category, students, on the one hand, still tend to strive for physical development and health promotion, and on the other hand, there is an understanding of the lack of physical activity due to workload. Nevertheless, awareness of the need to regularly engage in physical culture or sports does not always develop into real physical culture and sports activities.

Thus, the conducted research showed that the motives for going in for physical culture and sports can, albeit slightly, change depending on the created external conditions. Therefore, the search for forms and methods that can activate the necessary motives for physical culture or sports in students will be the basis for our further research in this direction.

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Social representations of health among students-athletes and students not involved in sports

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Abstract

Objective of the study is the content and structure of social ideas about health among students who have linked their future with professional sports, and among students who do not go in for sports.

Methods and structure of the study. The research methodology was based on the main provisions of French social psychology on the phenomenon of social representations and their functions in the life of people and society (S. Moskovisi), as well as provisions on the structure of social representations (J.K. Abrik). The research methods were the SF-36 Health Status Survey Questionnaire and the methodology for studying the structure and content of social representations by P. Vergès. The study involved 56 students aged 20 to 24 years, of which 29 people are professionally involved in sports and 27 people are not involved in sports.

Results and conclusions. The results of the survey showed that student-athletes have complete, evidence-based and systemic knowledge about health, about the requirements of health-saving conditions and the principles of a healthy lifestyle. However, the study of the prototype analysis data showed that for athletes, health is considered as a condition for the success of sports activities, providing a high level of physical capabilities. Such an "instrumental" approach leads to the fact that professional athletes consider health not as the most important value, but as a basic condition for sports achievements and career success. Students, participants of the study who are not involved in professional sports, have poorly structured knowledge about the essence of a healthy lifestyle, tend to give stereotypical answers. However, their social representations consider health as a necessary condition for a happy life, associated with activity and general well-being.

Keywords: *social representations, health, athletes, sports, activity, healthy lifestyle, association.*

Introduction. Professional sport, designed to create a social model of health, unfortunately, in recent years has shown a complete disregard for the issues of maintaining the health of professional athletes. Athletes are aimed at achieving high sports results and do not always pay attention to actions that can potentially cause irreparable harm to their health. Between the content of ideas about health and professional sports, the semantic distance is expanding, the image of sports ceases to fulfill its social function.

Social representations reflect the context in which the information mass is constructed, reflecting what is considered as common sense, acting as certain regulators of human behavior, as well as the functioning of society as a whole [2]. The theoretical basis of this study was: a meaningful definition of the phenomenon of social representations in people's lives by S. Moskovisi [6]; the factors necessary for the construction of social representations, identified in the studies of T.P. Emelyanova [3]; the structure of social representations highlighted by Zh.K. Abrik [5]; characteristics of the study of social ideas about health I.B. Bovina [1].

Objective of the study was to identify the social representations of athletes and people who do not go in for sports about health; revealing the structure, content and qualitative characteristics of the ideas about the health of these groups of respondents.

Methods and structure of the study. 56 people, male students, took part in the scientific experiment. 29 people are professionally involved in sports (cyclic

and acyclic), they study at faculties that train specialists in the field of physical culture and sports and plan their professional career in sports. The students of the second group (27 people) do not go in for professional sports, they plan their professional career in different areas far from sports. The age of the participants ranged from 20 to 24 years.

The study used the Questionnaire SF-36 Health Status Survey) [8], adapted at the Institute of Clinical and Pharmacological Research in St. Petersburg [4], and the method of studying the structure and content of social representations by P. Verg s [7].

Results of the study and their discussion. The results of the SF-36 Health Status Survey were processed using the method of variation statistics, which allows you to fully calculate the necessary parameters to determine the significant significance of the study results. In each of the groups for all signs were calculated: arithmetic mean (M); average error of the arithmetic mean (m); significant difference confidence factor (t); error probability (p).

The results of the SF-36-S test allow us to talk about a significant difference between the perception of sports, assessment of their own health and quality of life among athletes and students who are not involved in sports.

Statistical analysis performed using the Mann-Whitney U-test (at p = 0.05) showed:

- athletes at the level of a significant statistical difference demonstrate systematic, evidence-based knowledge about health, evaluate the positive impact of playing sports not only on the physical, but also on the emotional state; athletes, more than people who do not play sports, tend to believe that playing sports forms a stable positive assessment of their own capabilities;

- students who do not go in for sports showed a statistically lower level of knowledge about health and a healthy lifestyle;

- athletes believe that sport makes them more resistant to physical and psycho-emotional stress.

All study participants believe that sports have a positive effect on quality of life indicators, there is no significant statistical difference.

A method of studying the structure and content of social representations of P. Verg s was carried out. An analysis of the data of a prototypical analysis of associations given by student-athletes to the word "health" showed that the core elements of the idea of health included the following associations: "happiness" (23; 4.5), "achievement" (23; 2.3), "body" (20; 2.87), "goal" (16; 2.69), "immunity" (10; 3.06), "life" (22; 2.80), "youth" (16; 2.57).

Actually, the peripheral system of ideas about health is formed by such concepts as "well-being" (12; 4.67), "rehabilitation" (8; 4.75), "doctors" (13; 3.92). The potential zone of changes included "training" (17; 2.29), "aspiration" (8; 3.25), "medal" (16; 3.19), "sports" (15; 3.07), "strong "(9; 3.56).

Table 1 presents the associations that form the core and periphery of student-athletes' ideas about health, indicating their average rank and frequency of occurrence.

An analysis of the data of a prototypical analysis of associations given by students who are not involved in professional sports to the word "health" showed that the following associations were included in the core elements of the idea of health: "beauty" (20; 3.07), "training" (5; 2.47), "diet" (2; 2.59), "organism" (12; 1.93), "well-being" (9; 3.61), "treatment" (21; 2.17), "aspiration" (3; 3.64), "discipline" (6; 2.98). Actually, the peripheral system of social ideas about health in people who do not go in for professional sports is represented by such concepts as "activity" (24; 4.08), "rest" (19; 4.16), "nature" (26; 3. 85), "fitness" (21; 3.90). The potential zone of changes included the words: "movement" (24; 3.63), "food" (20; 3.09).

Table 1. *Structural status of the elements of student-athletes' social representation of health*

Association frequency	Average rank of the association	
	Less than 3.65	Greater than or equal to 3.65
Greater than or equal to 18	«happiness» (23; 4.5) «achievement» (23; 2.3) «body» (20; 2.87) «goal» (16; 2.69) «immunity» (10; 3.06) «life» (22; 2.80) «youth» (16; 2.57) «training» (17; 2.29) «aspiration» (8; 3.25) «medal» (16; 3.19) «sporty» (15; 3.07) «strong» (9; 3.56)	«activity» (3; 3.67) «organism» (8; 3.88) «competition» (12; 4.67) «people» (13; 3.92)
Less than 18		«well-being» (12; 4.67) «rehabilitation» (8; 4.75) «doctors» (13; 3.92)

Table 2. *Structural status of the elements of the social idea of health among students who do not go in for sports*

Association frequency	Average rank of the association	
	Less than 3.66	Greater than or equal to 3,66
Greater than or equal to 27	«beauty» (20; 3.07) «training» (5; 2.47) «diet» (2; 2.59) «organism» (12; 1.93) «well-being» (9; 3.61) «treatment» (21; 2.17) «aspiration» (3; 3.64) «discipline» (6; 2.98) «movement» (24; 3.63) «food» (20; 3.09)	«active» (23; 3.78) «purposeful» (27; 3.96) «man» (29; 3.97) «image» (12; 4.03) «organism» (68; 3.99) «immunity» (30; 3.87) «body» (10; 3.74)
Less than 27		«activity» (24; 4.08) «rest» (19; 4.16) «nature» (26; 3.85) «fitness» (21; 3.90)

Table 2 presents the associations that form the core and periphery of the ideas about health among students who are not involved in professional sports, indicating their average rank and frequency of occurrence.

For athletes, health is closely related to sports activities, is associated with a high level of physical capabilities, with achievements. Social ideas about the health of people who do not go in for sports are associated with activity and a healthy lifestyle.

Conclusions. The conducted research suggests that student-athletes are well aware of the positive impact of sports on the quality of life, highly appreciate the role of health in their own lives. However, at the semantic level, athletes treat health as a means to achieve their life goals. Such an "instrumental" approach significantly reduces the value content of the concept of "health", which can lead to situational, potentially erroneous forms of behavior.

Students who are not involved in professional sports consider health as an independent value, a necessary attribute of a happy and fulfilling life.

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Motor activity of children during stay in a preschool educational institution

UDC 373.24

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Abstract

Objective of the study was to identify the volume of motor activity of preschool children during their stay in a preschool educational institution.

Methods and structure of the study. To collect information on the number of motor acts of preschool children during the study, the method of shagometry was used. The number of locomotions was counted using a Yamax DW-200 Sh 25 pedometer manufactured by Yamasa Corp., Tokyo, Japan. The scientific research was carried out during the cold period of the year from November to March. A total of 234 children were tested.

Results and conclusions. With the help of shagometry, differences in motor activity were revealed between boys and girls 3-4 years old and 5-6 years old uring their free motor activity. It has been determined that the organization of motor activity during a walk is an important form of a child's physical activity, since it includes the largest number of locomotions performed by the child during he day. Therefore, it is necessary to develop programs for the physical education of preschool children, which will be aimed at the effective implementation of their motor activity during a walk, as well as the creation of a developing object-spatial environment for the territory of a walk for preschoolers using sports simulators nd equipment.

Keywords: *child, physical activity, development, motor skills, motor activity, pedometry.*

Introduction. The education, upbringing and development of preschool children involves complex processes of biological, physiological, psycho-emotional and socio-humanitarian changes in the child. Systematic classes in physical culture and sports are of great importance for the physical development, motor and functional readiness of preschoolers, and also influence the formation of a conscious attitude to motor activity [4].

The works of J. Milenko et al. (2021) noted that children aged 4–5 years spend 85% of their time daily in a sitting position and only 15% are engaged in moderate or intense physical activity [10].

The World Health Organization (2020) guidelines state that children aged 5 to 17 should engage in moderate to vigorous physical activity for at least 60 minutes per day. Such physical activity is optimal for the development of the functional systems of the child's body, as well as for the prevention of obesity [5].

According to studies by C. Tudor-Locke et al. (2004), to maintain the optimal state of health of the child's body, boys aged 5-7 years should perform about 15,000 steps, and girls of this age - about 12,000 steps [11]. In the works of J.S. Duncan, G. Schofield, E.K Duncan (2007) noted that in order to avoid overweight, preschool children need to perform 16 and 13 thousand steps per day for boys and girls, respectively [8].

It should be noted that in the works of L.A. Kurtz (2006) revealed deviations in motor functions that are demonstrated by preschool children who do not have intellectual disabilities. Such concepts as "clumsy child syndrome", developmental dyspraxia, implying problems in the implementation of coordination ac-

tions, are becoming relevant, provided that children do not have pronounced disorders of the intellectual sphere and muscle tone [9].

Active muscular activity, according to many researchers (N.A. Bernstein, R. Aston, etc.), is one of the main elements in the development of the functional systems of the child's body, in the formation of vital motor skills and abilities, and in the formation of a conscious need to perform physical exercises [1, 6].

In the works of N.A. Bernstein (1966), motor activity is considered as a factor in the development of the human nervous system, in particular, his psychomotor abilities, which include simple and complex sensorimotor reactions of the body. Thus, the relationship between motor activity and the development of the human nervous system is determined. In this regard, the process of physical development must be considered in close connection with cognitive and mental development, starting from preschool age. It should be noted that in the process of physical development of preschoolers it is necessary to pay attention not only to the development of physical qualities, but also to the development of psychomotor abilities [1].

In the studies of A.S. Denisova, Yu.M. Saveliev (2022) notes that the central nervous system in the process of human motor activity is stimulated by impulses from working muscles, which has a beneficial effect on its development. The level of development of the central nervous system depends on the complexity of performing a motor action, in particular, complex coordination exercises and exercises aimed at developing fine motor skills [2].

In the work of V.P. Dudeva (2020) established the relationship between the level of a child's motor fitness and the development of his speech apparatus, including the volume of vocabulary [3].

In the studies of P. Bonifacci, S. Contento (2008), the relationship between the components of general and fine motor skills of a preschool child was noted. Primary is the mastery of motor actions of large motor skills, and the mastery of elements of fine motor skills occurs secondarily. It should be noted that the motor actions of general motor skills have a positive effect on the formation of not only fine motor skills, but also on psychomotor development, in particular, on simple and complex sensorimotor reactions in children [7].

In this regard, the motor training of a preschooler is the most important element that considers the development of the child both from the side of physical development and invests in it the process of preparing for cognitive activity. This process draws parallels between the movements and cognitive abilities of the child.

Objective of the study was to identify the volume of motor activity of preschool children during their stay in a preschool educational institution.

Methods and structure of the study. To collect information on the number of motor acts of preschool children during the study, the method of shagometry was used. The number of locomotions was counted using a Yamax DW-200 Sh 25 pedometer manufactured by Yamasa Corp., Tokyo, Japan.

In the process of studying the motor activity of children during their stay in a preschool educational institution (PEI), pedometer indicators were analyzed when organizing free motor activity of preschoolers (on days when children do not have classes in physical education, art and aesthetic education, robotics, etc. .). The study was conducted from November to March with a four-hour interval in the morning and evening in

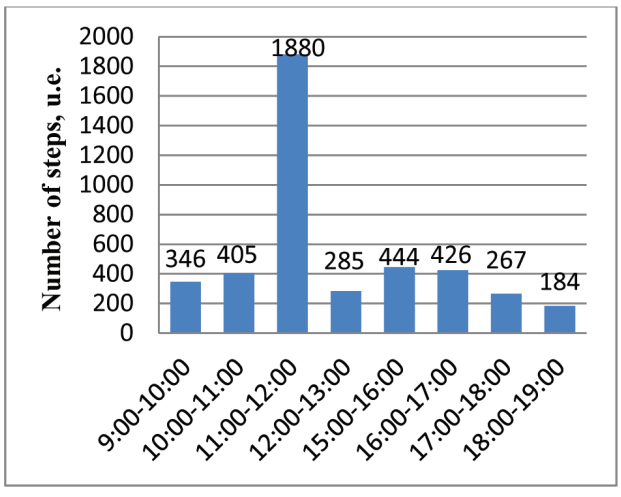

Figure 1. *The number of motor acts of girls aged 5-6 during their stay in kindergarten*

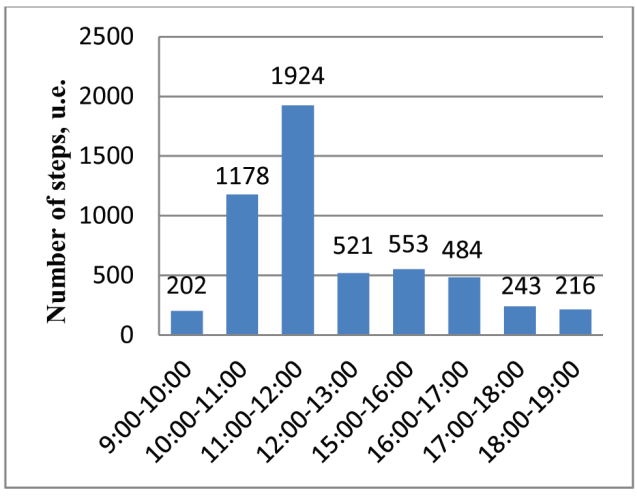

Figure 2. *The number of motor acts of 5-6 year old boys during their stay in kindergarten*

Table 1. *Motor activity of preschool children during their stay in preschool educational institution*

Indicators	Girls 5-6 years old	Boys 5-6 years old	Girls 3-4 years old	Boys 3-4 years old
	$\bar{X} \pm \sigma$	$\bar{X} \pm \sigma$	$\bar{X} \pm \sigma$	$\bar{X} \pm \sigma$
Number of locomotions, c.u.	4482±1036	6090±978	3960±963	4264±952
Distance traveled, km	2,22±0,54	3,18±0,87	2,08±0,57	2,14±0,61

accordance with the regime moments of certain age categories of children (from 9:00 to 13:00, from 15:00 to 19:00). The study analyzed data from a pedometer of 234 children (132 children 5-6 years old (70 girls, 62 boys), 102 children 3-4 years old (46 girls, 56 boys).

Results of the study and their discussion. As a result of the study, it was found that the number of steps performed by girls aged 5-6 years in the process of free motor activity during their stay in the kindergarten averaged 4482 steps, this figure is less than the average value of boys 5-6 years old - 6090 steps. Analyzing the average indicators of the number of locomotions in children aged 3-4, it can also be concluded that boys (4264 steps) are more active than girls (3960 steps) of this age (Table 1).

According to the results of the distance traveled by preschool children, it can be concluded that during their stay in the preschool educational institution with free motor activity, girls 5-6 years old covered an average of 2.22 km, while boys 5-6 years old overcame more than 3 km. Girls and boys of 3-4 years old walked a little more than 2 km (2.08 km and 2.14 km, respectively) (Figure 1, 2).

Conclusions. As a result of the study, it was determined that the organization of motor activity during a walk is an important form of a child's physical activity, since it includes the largest number of locomotions performed by a child during the day. Therefore, it is necessary to develop programs for the physical education of preschool children, which will be aimed at the effective implementation of their motor activity during a walk, as well as the creation of a developing object-spatial environment for the territory of a walk for preschoolers using sports simulators and equipment.

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Comparative analysis of motor activity and physical fitness of age people before and after the pandemic

UDC 796.034

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Abstract

Objective of the study was to assess the level of physical activity and its impact on the indicators of physical fitness of older people before and after the end of the pandemic.

Methods and structure of the study. Since 2018, a pedagogical experiment has been conducted at the Faculty of Physical Education of the National Research Tomsk State University to study the effect of physical activity of older people on the duration and quality of their life. Since March 2020, due to the pandemic, organized classes have been suspended due to the high risk of COVID-19. The participants of the experiment were given methodical and practical recommendations for independent physical exercises. Immediately after the resumption of organized classes, a sociological survey and testing of the level of physical fitness were conducted.

Results and conclusions. A break in organized physical exercises for older women caused the following changes in their psychophysical state: all participants in the experiment noted a lack of physical activity; in 35% of the subjects during the pandemic, their own weight increased from 2 to 6 kg; 25% experienced a depressed psychological state associated with limited communications and prolonged solitude, and 30% of the participants in the experiment, by the end of the pandemic, noted a significant deterioration in well-being. The reasons for the decrease in the indicators of motor activity of the subjects are associated with irreversible age-related changes in the psychophysiological state of the organism of the participants in the experiment, supplemented by a forced two-year period of motor restrictions, as well as the lack of organized physical exercises with an instructor.

Keywords: *age group, motor activity, independent studies, restriction, period, organized classes.*

Introduction. The research results confirm the need for longevity in older people. Among the main motives for the desire to prolong life are the desire to see more (65%) and affection for relatives and friends (60%) [1]. To maintain health, most older people use health-improving procedures, baths and saunas, nutritional supplements, vitamins in their daily lives, follow proper nutrition and prefer to relax in sanatoriums. About 65% of older people devote their free time to watching TV, reading or doing household chores that do not require significant physical effort.

And only about 25% prefer outdoor walks. However, in the last decade, physical exercises have become increasingly popular among this contingent of the population: about 20% prefer an organized form of exercise and visits to fitness centers, and 60% are convinced of the need for regular physical activity to maintain and improve health.

Objective of the study was to assess the level of physical activity and its impact on the indicators of physical fitness of older people before and after the end of the pandemic.

Methods and structure of the study. Since 2018, a pedagogical experiment has been conducted at the Faculty of Physical Education of the National Research Tomsk State University to study the effect of physical activity of older people on the duration and quality of their life. [3]. Since March 2020, due to the pandemic, organized classes have been suspended due to the high risk of COVID-19. The participants of the experi-

ment were given methodical and practical recommendations for independent physical exercises. After the removal of covid restrictions, organized classes were resumed and continued in the same format. Immediately after the resumption of organized classes, a sociological survey and testing of the level of physical fitness were conducted.

Results of the study and their discussion. A sociological survey of the participants in the experiment (n=35) showed that the level of motor activity during the pandemic decreased in almost all respondents by 40-80% or more. In this regard, it was necessary to find out how the forced restriction of motor activity affected the well-being, health status and physical fitness of the participants in the experiment, as well as what forms of motor activity were used by the subjects on their own, to what extent and with what intensity.

As the survey showed, the main forms of physical activity used by respondents during the period of forced restriction of motor activities were mainly related to the satisfaction of household and physiological needs (hygienic procedures, cleaning of premises, shopping for food, etc.). At the same time, it should be noted that almost all respondents did not use the services of volunteers and purchased the necessary products and goods on their own. Less than half of the respondents (about 40%) used daily walks in the fresh air, lasting from 1 to 2 hours, as physical activity. About 30% of the respondents in the summer months made up for the lack of physical activity by physical labor at their dacha or garden plot.

Unfortunately, for various reasons, only about 25% of the subjects in everyday life used small forms of independent physical exercise, mainly in the form of morning exercises, lasting up to 30 minutes.

The incidence rate of women during the period of forced restriction of motor activity did not exceed the level of the pre-pandemic period of their life. Some surprise was the information about the incidence of COVID-19 among the participants in the experiment; only two representatives of this age group were ill with it, both of them in a mild form.

A sharp transition from physical activity, implemented in the form of two organized physical exercises per week, to a forced restriction of the daily volume of motor actions had a negative impact on the psychophysical state of the participants in the experiment.

Almost all 100% of the respondents felt a lack of physical activity after the introduction of restrictions, which was indirectly reflected in the deterioration of the general condition of the body and manifested itself in unwillingness to do household chores, weakness, apathy, deterioration in well-being, lack of need for communications and other forms.

A two-year period of forced restriction of motor activity of women of this age group had a negative impact on the psychological state and anthropometric indicators of the participants in the experiment. Thus, 35% of women had a depressed psychological state associated with limited communications and prolonged solitude, and their own weight increased from 2 to 6 kg, 30%, by the end of the pandemic, noted a significant deterioration in well-being. And only 10% of respondents did not feel significant differences in the state of their body before and after the pandemic.

Comparative analysis of materials characterizing the levels of physical fitness of the subjects obtained as a result of testing using three control exercises (long jump from a place, forward bend, standing on a gymnastic bench, flexion, extension of the arms, lying down) in March 2020 before termination organized classes and their continuation in May 2022 showed that most of the participants in the experiment had a significant decrease in performance.

It should be noted that the study materials received in 2022 are not differentiated by the affiliation of the participants to the experimental and control groups, since, regardless of their affiliation, both groups of tested women had a two-year break in organized classes, so they were on an equal footing. conditions.

The results of testing speed-strength qualities, flexibility and strength showed that their levels after the resumption of organized physical exercises were far from unambiguous. To a greater extent, the decrease in indicators was noted in the state of speed-strength qualities and, to a lesser extent, in flexibility indicators. Mathematical analysis of the obtained results showed the following: in 62.5% of the subjects, a decrease in the level of development of speed-strength qualities from 1 to 25 cm was noted. At the same time, in 56.25%, the decrease was significantly significant ($p>0.05$); in 25%, the result remained unchanged, in 12.5% of the participants in the experiment, an improvement in the result from 5 to 25 cm was noted in the control exercise.

In the second control exercise, changes in indicators were less pronounced than in the first. After testing using the control exercise, bending forward while standing on a gymnastic bench, the absolute majority of the subjects (88.2%) showed a decrease in the de-

velopment of flexibility after the resumption of organized activities, and only 5.9% of the subjects showed a significant increase in the indicator (+13 cm on average). And here it should be noted that in 88.2% of women of these age groups, changes in the decrease in indicators were noted mainly at the level of a negative trend, and of them, only in 11.8% of those tested, they reached a qualitative level.

Similar results were recorded in the development of strength qualities (flexion, extension of the arms in emphasis). 64.7% showed a decrease in the indicator at the level of a negative trend, for 23.5% the result remained at the same level, an improvement in the indicator, also at the level of a positive trend, was demonstrated by only 7.3% of the participants in the experiment.

Conclusions. A significant decrease in the motor activity of the subjects can be explained by two reasons. The first is associated with irreversible age-related changes in the psychophysiological state of the organism of the participants in the experiment, supplemented by a forced two-year period of movement restrictions. The second is the lack of organized physical exercises, which also had a negative impact on their physical condition.

A sociological survey showed that almost all participants in the experiment are more motivated to organize physical exercises under the guidance of an instructor, since most of the participants in the experiment do not have the necessary conditions for independent exercises, and there are a large number of confusing factors at home, which are for most subjects irresistible for self-study.

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Some indicators of the sensorimotor systems of students aged 7-10 at the beginning of a one-year educational cycle in a special (I-II type) correctional and general education schools

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Abstract

Objective of the study was to study some indicators of sensorimotor systems in students aged 7-10 at the beginning of a one-year educational cycle in a special correctional I-II type and general education schools.

Methods and structure of the study. The survey involved 311 healthy schoolchildren aged 7-10 years and 96 peers suffering from sensorineural hearing loss (III-IV degree). The Neurosoft-NS-Psychotest complex was used. In children, a simple visual-motor reaction (VMR) was studied; reaction to a moving object. We analyzed the results obtained in the methods of "reaction time of discrimination" and "reaction time of choice".

Results and conclusions. As we grow older, the period of the sensorimotor reaction decreases, which is associated with the process of maturation of the central structures of the brain and the improvement of the functional state of the neuromuscular apparatus. In children 9-10 years old, the degree of balance between the processes of excitation and inhibition is greater in strength, which indicates the balance of nervous processes and the stability of the functioning of the nervous system at this age. With increasing age in children, the mobility of nervous processes is optimized. The functioning of sensorimotor systems in children 7-10 years old with auditory deprivation, in comparison with practically healthy peers, showed that the development of the mechanisms of central regulation of movements is somewhat slow.

Keywords: *indicators of sensorimotor systems; children 7-10 years old; auditory deprivation.*

Introduction. The Ministry of Education of the Russian Federation, in order to organize the process of physical education in general educational institutions, recommends a number of exemplary programs. A comprehensive analysis of these programs allows us to conclude that they show the key components of physical education: the development of physical qualities, the improvement of the health of students, the formation of the motor base of children, etc. [10]. However, the issues of using sections of physical culture activities related to the emotional-volitional, cognitive, psychophysiological spheres of the development of the student's body remain practically unresolved [5].

The basic task of developmental physiology and school pedagogy is the explication of the functioning of the central and autonomic nervous and sensory systems that form the characterological qualities of children of the first and second childhood, since the "plasticity" of their nervous processes is at a relatively low "level". At the same time, there is an increased interest among researchers in acquiring scientific knowledge regarding the functioning of sensorimotor systems in younger schoolchildren, since, according to teachers and physiologists, the parameters characterizing these systems are the most objective and representative [1, 7, 9].

Nothing else than the disproportion of the training load to the compensatory capabilities of the student's body entails a disorder in the state of physical health [4]. In this regard, children with auditory deprivation deserve special attention, since they have functional "disorders" of a number of organs and body systems. At the same time, the parameters of the sensorimotor systems of children suffering from auditory deprivation are indicators of the health of students [11].

In a number of scientific studies [2, 3, 8], only fragmentary works have been published, devoted to the study of the impact of physical education classes on the functional state of sensorimotor systems in 7-10 year old students in special correctional and secondary schools.

Objective of the study was to study some indicators of sensorimotor systems in students aged 7-10 at the beginning of a one-year educational cycle in a special correctional I-II type and general education schools.

Methods and structure of the study. The scientific experiment was carried out on the bases: laboratories of the Department of Anatomy and Sports Medicine of the Kuban State University of Physical Culture, Sports and Tourism, gymnasium No. 18, school No. 63 and a special correctional boarding school in Krasnodar. The survey involved 311 healthy junior schoolchildren 8-10 years old (boys - 149, girls - 162) and 96 (boys - 49, girls - 47), peers suffering from sensorineural hearing loss (III-IV degree). The hardware-software complex "Neurosoft - NS-Psychotest" with an IBM-compatible computer was used in the work.

Since within the framework of one article it is technically difficult to show the full complex, reflecting the functional state of sensorimotor systems, a fragment of the study was taken. In children, a simple visual-motor reaction (VMR) was studied (the classical technique of chronoreflexometry, which determines lability in the functioning of nerve centers). A kind of complex sensorimotor reaction (in addition to the sensory and motor components, it also includes a period of complex signal processing (sensory) of the central nervous system) - a reaction to a moving object (RMO). Along with this, the results were analyzed in the "reaction time of discrimination" (RTD) and "reaction time of choice" (RTCh) methods.

The studies were carried out at the beginning of the annual educational cycle many times, with the registration of the protocol for each student. Participation in the observations was carried out on a voluntary basis, informed consent was obtained from parents.

The information obtained during the study was processed on IBM-compatible computers according to standard statistical methods [6].

Results of the study and their discussion. As the obtained data showed, in healthy boys of 7 years old, when studying VMR, significantly high reaction time parameters (324.1±10.4 ms) were recorded in comparison with schoolchildren aged 8-10 years (301.8±12.5 ms; 275.1± 9.7 ms, 264.3±11.4 ms, $p<0.01 – p<0.0001$).

At the same time, schoolchildren aged 9-10 were the most "fast", however, there were no significant differences between these groups ($p>0.05$). Differences were not registered in boys of 8-9 years old, although in comparison with schoolchildren of 8 and 10 years old they are noted ($p<0.05$).

In the analysis of the received data of VMR in healthy girls, a similar pattern is noted, as in boys. Along with this, unlike boys, there was no difference in the parameters of 7- and 8-year-old girls (321.5±10.6 ms; 298.4±13.3 ms).

Conducting a study in boys of a special correctional school showed the following. Significantly higher indicators in the test were in 7-year-olds (352.4±13.6 ms) in comparison with schoolchildren aged 9 and 10 (282.8±14.3 ms; 278.9±9.2 ms; $p<0 .01 – p<0.001$), while no difference was noted with 8-year-olds (318.2±15.4 ms) ($p>0.05$). In turn, 8-year-old boys demonstrated significantly higher values in the PVMR test relative to 10-year-old boys ($p<0.05$). Differences were not registered in boys aged 8-9 years and 9-10 years ($p>0.05$).

As for girls from a special correctional school, at the age of 7 years (351.2±14.6 ms) they showed significantly greater time spent in testing in relation to all the considered age groups (303.4±9.8 ms; 295 .9±11.6 ms; 289.3±10.5 ms; $p<0.01 – p<0.05$). Other indicators within the group of girls aged 8-10 did not differ ($p>0.05$).

When conducting the "reaction to a moving object" test, it was revealed that the indicators of boys 7 years old (92.3±5.1 ms) and 8 years old (80.8±7.3 ms) did not differ, while the obtained data in comparison with boys aged 9 and 10 (76.2±4.5 ms; 62.7±3.9 ms) showed an almost 20% significant difference ($p<0.01 – p<0.001$).

It should be noted that the values of this parameter did not differ among schoolchildren aged 9-10 ($p>0.05$). In other words, 10-year-old boys show a balanced type of nervous processes.

When analyzing the data revealed in girls in the test "reaction to a moving object" (RMJ), it was found that significant differences in time between the studied 7, 9 and 10 years (96.2±8.7 ms; 75.6±4.9 ms; 64.7±6.9 ms, $p<0.05$ – $p<0.001$). There were no differences between the obtained parameters in girls aged 7 and 8 (84.4±7.6 ms).

As shown by the data obtained in the RMO test in boys studying in a special correctional school, a similar pattern was noted as in practically healthy schoolchildren, that is, there were no differences in indicators between 7- and 8-year-olds (101.7 ± 4, 8 ms; 92.1±5.3 ms; $p>0.05$) and the parameters differed significantly between the studied 7, 9 and 10 years (83.3±7.4 ms; 74.8±3.9 ms). In turn, when comparing this indicator between schoolchildren of 8 and 9 years old, 9 and 10 years old, no difference was noted ($p>0.05$).

Analyzing the data obtained from girls studying in a special correctional school, it should be noted that between schoolgirls of 7 and 10 years old, significant different values were obtained (98.4±6.9 ms; 72.3±5.7 ms; $p<0.01$), in other cases, the parameters in the RMO test were not observed in the study population (8 and 9 years old - 87.5±8.2 ms; $p>0.05$).

When analyzing response strategies, both boys and girls from a correctional school, it should be noted that they more often showed a reaction to a moving object with a delay in the appearance of a signal.

In the observed children, studying the complex sensorimotor reactions "reaction time of discrimination" (RTD) and "reaction time of choice" (RTCh), the following data were established: the largest values of RTD in time (they practiced a reaction to one specific impulse out of several) were noted in boys 7 years (438.8±14.3 ms), low - in schoolchildren aged 9 and 10 (387.6±8.9 ms; 369.5±12.4 ms; $p<0.001$; $p<0.001$), the difference in indicators in this test were also registered between 8-year-old (411.2±11.6 ms) and 10-year-old observed ($p<0.01$).

When analyzing the results of RTD in girls, the following is noted: schoolgirls of 10 years (378.7±18.2 ms) showed less time during testing in relation to 7-year-olds (441.5±15.5 ms; $p<0.01$). When comparing other age groups (8-9 years old: 418.9±14.3 ms; 396.4±17.7 ms) there were no significant differences in the indicators.

During the RTCh test (several subjective reactions to the proposed impulses were used) as in boys (7 years old - 465.3±16.5 ms; 8 years old - 458.4±13.2 ms; 9 years old - 446.8±6 .7 ms; 10 years old - 431.3±9.2 ms) and in girls (7 years old - 471.3±17.1 ms; 8 years old - 449.4±12.6 ms; 9 years old - 451 .6 ± 9.7 ms; 10 years - 458.8 ± 14.7 ms) data were obtained that did not have significant differences in age groups.

When conducting a study in the RTD test in boys of a special correctional school, it was found that in children 7 (457.4 ± 10.2 ms) and 8 (436.2 ± 9.4 ms) years old, significantly lower values of indicators were recorded in relation to schoolchildren 10 years (398.3±8.9 ms; $p<0.001$ – $p<0.01$). The same pattern was observed in girls (472.7±13.6 ms; 446.5±11.9 ms; 398.4±18.2 ms; $p<0.01$).

In the study of RTCh in boys (7 years old - 479.6±17.3 ms; 8 years old - 461.2±14.7 ms; 9 years old - 449.7±9.5 ms; 10 years old - 430.8±15 .4 ms) and girls (7 years old - 470.5±12.8 ms; 8 years old - 450.7±14.3 ms; 9 years old - 449.8±19.2 ms; 10 years old - 448.2± 16.7 ms) of the considered age groups, no significant differences in the parameters were found.

The obtained indicators in the RTD and RTCh allow us to assert the mobility of the nervous processes, with increasing age in children there is a significant decrease in the number of delayed and advanced reactions, which is determined by the intensive development of the central structures.

Conclusions. The established parameters of a simple visual-motor reaction are determined by the anatomical properties of the analyzer, the characteristics of the nervous processes of the body and the motor-coordination capabilities of the subject. That is, as they grow older, the period of the sensorimotor reaction decreases, which is associated with the process of maturation of the central structures of the brain and the improvement of the functional state of the neuromuscular apparatus.

In children 9-10 years old, the degree of balance between the processes of excitation and inhibition is greater in strength, which indicates the balance of nervous processes and the stability of the functioning of the nervous system at this age.

With increasing age in children, the mobility of nervous processes is optimized. The functioning of sensorimotor systems in children 7-10 years old with auditory deprivation, in comparison with practically healthy peers, showed that the development of the mechanisms of central regulation of movements is somewhat slow. There was an increase in the time spent in the visual-motor reaction in girls and in the reaction to a moving object in boys of 10 years old, as well as low values of the reaction time of discrimination in boys of 9 years old ($p<0.05$), which is of considerable interest in the context of the study of adaptive reactions children with auditory deprivation.

The study of the features of the functioning of sensorimotor systems in children 7-10 years old with auditory deprivation in comparison with practically healthy peers showed that the development of the mechanisms of central regulation of movements is somewhat slow. The degree of deviations in the activity of sensorimotor systems corresponds to the level of auditory deprivation. There was an increase in the time spent in the VMR in girls and a reaction to a moving object in boys of 10 years, as well as low values of the reaction time of discrimination in boys of 9 years ($p<0.05$), which is of considerable interest in the context of studying the adaptive reactions of the body of children with auditory deprivation.

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Sports orientation of children as a vector of introduction to sports

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We invite scientists to publish articles aimed at finding and creating pedagogical conditions conducive to the active involvement of children in sports.

Abstract
The article is devoted to the problem of involving children in sports. The significance and role of sport in the formation of significant mental, physical qualities of a person, his social attitudes are substantiated. It is noted that the leading vector of introducing children to sports is sports orientation, built on the formation of interest, ideas about sports, motor experience, and the creation of unified starting opportunities for beginner athletes. It is emphasized that, given the cultural, heuristic and pedagogical potential of sports, it is necessary to skillfully use it in educating the younger generation. Sports orientation should be purposefully carried out by teachers with children, starting from preschool age.

Keywords: *sports selection, sports orientation of a person, interest, sport phenomenon.*

Introduction. Involving children in sports makes it possible to systematically solve two important socio-pedagogical tasks: on the one hand, ensuring the influx of talents as a sports reserve, on the other – creating opportunities for development and recovery for children, as well as organizing free time in socially significant activities. It is known that sports can effectively affect the internal and external environment of a person, including physical qualities, motor abilities, physique, health, and at the same time form knowledge, skills, interests, needs, value orientations associated with this activity.

It has been repeatedly proved that sport plays an important role in the formation of mental qualities, acting as a kind of school of "character formation, courage, will", since sports competitions and preparation for them are always extreme activities that require the manifestation of strong–willed qualities and active self-realization.

The phenomenon of sports, as a rule, is often identified with gaming activity. The world of the game is an artificial reality in which emotions manifest themselves, motivation to engage in your favorite sport is formed. Competitiveness determines emotionality, pleasure, self-realization; creates an atmosphere for the expression of personal qualities of an athlete. Here the creative possibilities and creativity of those involved are revealed, since victory can be achieved only by determining the correct strategy and tactics of a duel, a sports match or a race.

The world of sports is a kind of model of public life, where justice, rules of life, conflict resolution in a "soft form" are manifested.

Sport has integrative and communicative capabilities, which is important in the era of informatization, when communication is transferred to virtual social networks and does not create a real space for the development of a sense of community, friendship, cooperation.

Along with this, moral qualities are brought up in sports, ethical norms are formed, conditions for self-improvement, self-education and self-determination are created. Participation in competitions gives an athlete the opportunity to feel the joy of victory over an opponent, compare their abilities with others, but the main thing is to overcome their weaknesses, show will, diligence, character.

Taking into account the cultural, heuristic and pedagogical potential of sports, it is necessary to skillfully use it in the education of the younger generation. Sports orientation should be purposefully conducted by teachers with children, starting from preschool age.

The sports orientation of a person is understood as an integral personal characteristic that determines a person's selective conscious emotional-value and effective attitude to a certain type of sport or type of competitive exercises. In the content of sports orientation, taking into account the solved particular tasks, three components are distinguished: motivational, cognitive and motor.

The task of the motivational component is to encourage and direct a person to a certain type of sport and competitive exercises. The duration and effectiveness of sports activities largely depend on the development of this component. The cognitive component of sports orientation provides knowledge and understanding of the objective requirements of sports activities and their capabilities. The criterion for the development of the cognitive component is the adequacy of self-assessment of their abilities to carry out sports activities. The motor component provides practical implementation of a certain type of sports activity, which is the subject of sports specialization. The criteria for its development are the compliance of the chosen sport with the features of the physique and motor abilities.

The active use of knowledge about the peculiarities of physical development will allow to individualize the process of formation of a sports orientation of a person by defining the tasks of its implementation, selecting the appropriate content, means and methods [1].

The problem of introducing children to sports is actualized in a study conducted by Professor D.V. Kachalov, associate Professor E.S. Naboychenko and S.O. Istomin [2]. To form the sports orientation of preschool children, specialists propose a structural and functional model based on the implementation of pedagogical conditions, including the construction of an individual trajectory, the introduction of digital tools and sports training technologies in the process of introducing a child to hockey lessons.

In conclusion, I would like to emphasize that the leading vector of introducing children to sports is sports orientation, built on the formation of interest, ideas about sports, motor experience, and the creation of unified starting opportunities for novice athletes.

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Structural and functional model of involving preschool children to hockey activities

UDC 796.966

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Abstract

Objective of the study was to determine the effectiveness of the implementation of the structural-functional model of introducing children aged 5-7 years to hockey.

Methods and structure of the study. Conducted pedagogical experiment, quantitative and qualitative analysis; methods of mathematical statistics. The contingent of the study is children aged 5-7 years (n=120) who have been studying at the Sports school of the Olympic Reserve "Spartakovets" for three years (2014-2016).

Results and conclusions. Groups of children in which the structural-functional model of introducing children aged 5-7 years to hockey lessons was implemented have a high level of involvement in sports activities according to the criteria: motivational, emotional-volitional, evaluative-behavioral, physical readiness. The presented results can be used in the implementation of sports and recreation programs with elements of the chosen sport.

Keywords: *introducing children to sports activities; criteria, indicators and levels of involvement of children aged 5-7 years in hockey; young hockey players, structural-functional model.*

Introduction. Exploring the specifics of the concept of involvement in sports activities, based on the analysis of existing studies, Dvorkina N.I., Adashkavichene E.I., Manzheley I.V. [1-3], it can be noted that the introduction of children of senior preschool age to sports activities acts as a process aimed at forming interest in sports activities, awareness in sports and its types, striving to achieve goals, the formation of motor experience, activity and independence. in sports activities, the specificity of which is to create unified starting opportunities for children of senior preschool age. In this regard, the question arises of possible ways of constructing the process of initiation.

In our opinion, the process of introducing sports activities will be effective if a structural and functional model is developed for introducing children aged 5-7 years to hockey. Such models, as a rule, are used in the study of various pedagogical processes, when it is necessary to reveal the interaction of subjects, which results in the formation of complex personal qualities [4].

Objective of the study was to determine the effectiveness of the implementation of the structural-functional model of introducing children aged 5-7 years to hockey.

Methods and structure of the study. The study of the process of involving children aged 5-7 years in hockey can be approached as a certain pedagogical system. This implies the allocation of components in the structure of the model and the pedagogical conditions for its implementation.

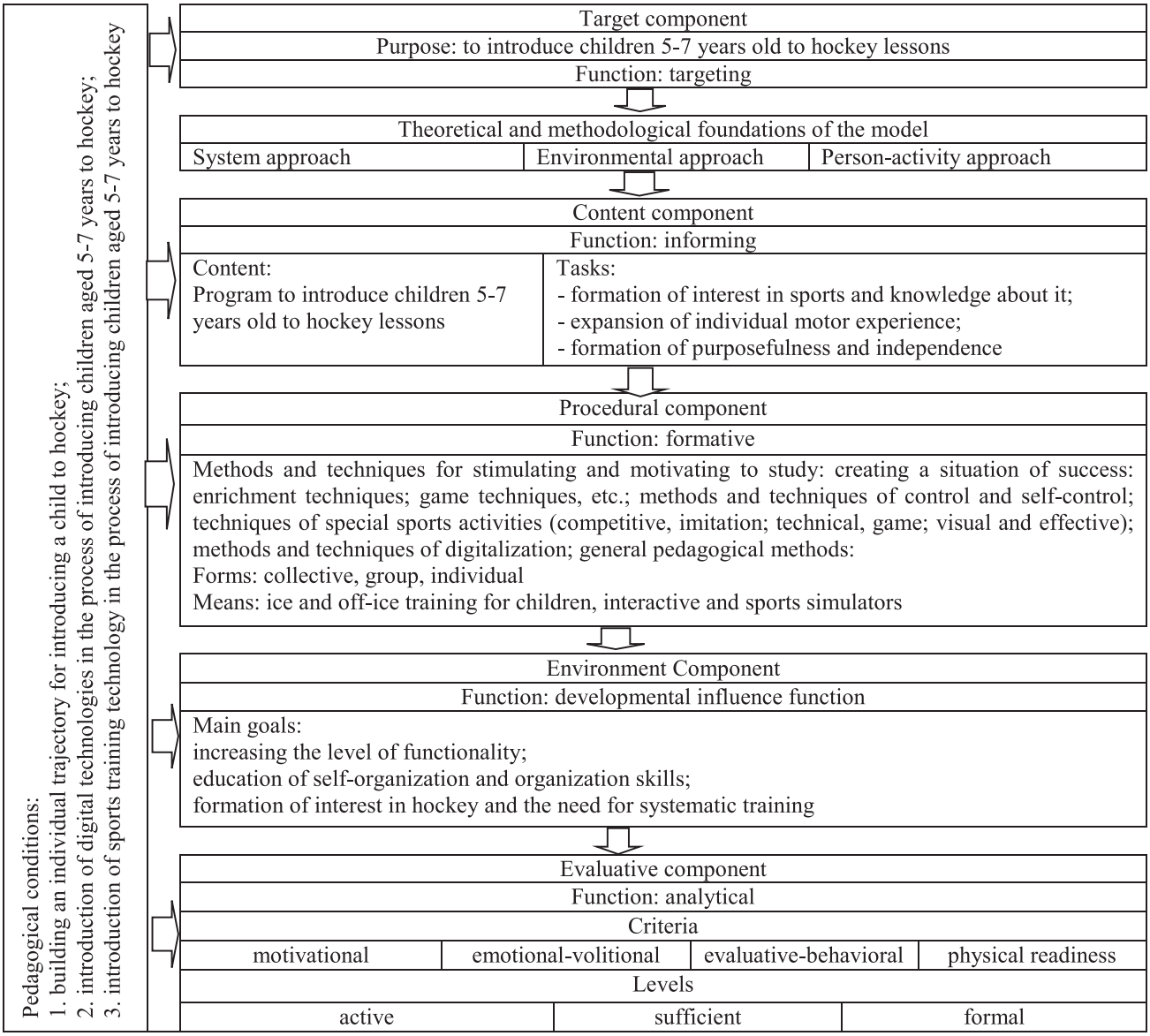
The structural components of the developed model reveal the internal organization of the process of introducing children aged 5-7 to hockey, are responsible for the constant interaction between the elements of this process and include: target, content, procedural, environmental and evaluative-effective.

By pedagogical conditions we understand the totality of the possibilities of the educational and material-spatial environment that affect the personal and procedural aspects of this system and ensure its effective functioning and development.

Based on this provision, considering the pedagogical conditions for introducing children 5-7 years old to hockey, we mean the totality of the possibilities of the environment of a sports organization that affect the personal and procedural aspects and ensure its effectiveness. We include in the complex of necessary and sufficient pedagogical conditions: building an individual trajectory for introducing a child to hockey; the introduction of digital technologies in the process of introducing children aged 5-7 years to hockey; introduction of sports training technology in the process of introducing children aged 5-7 years to hockey.

The structural-functional model makes it possible to form a holistic view of the phenomenon under study, the degree of influence of pedagogical conditions in the process of its implementation, which is clearly shown in the figure.

The experimental work was carried out in several stages: the ascertaining stage - the selection of scientific and methodological research tools, the definition of goals, objectives and the development of an algorithm and conditions for the experimental work, the identification of the initial level of the subject under study - the level of involvement of children aged 5-7 years in hockey, the definition of experimental groups ; the formative stage - the implementation of the structural-functional model, the verification of the implemented pedagogical conditions for introducing children aged 5-7 years to hockey lessons; generalizing stage - the final evaluation of the results according to the selected indicators, summarizing the results



Structural-functional model of introducing children aged 5-7 years to hockey

and comparing them with the goals and objectives of the study, formulating conclusions.

To carry out the formative stage of the experimental work, the distribution of children (n=120) into four groups was carried out: EG-1, EG-2, EG-3 and CG.

The sampling base for the formative stage of the experimental work at was determined as follows: in EG-1 (n=30), an individual trajectory of initiation was built and the technology of sports training was introduced into the process of introducing children aged 5-7 years to hockey; in EG-2 (n=30), digital technologies were introduced in order to involve children in sports activities and the introduction of sports training technology in the process of introducing children aged 5-7 years to hockey; in EG-3 (n=30) the whole complex of pedagogical conditions was introduced; in the CG (n=30), the structural-functional model of initiation was implemented fragmentarily.

Results of the study and their discussion. As a result of the implementation of the developed structural-functional model, a comparative analysis of the level of involvement of children aged 5-7 years in hockey was carried out (Table 1).

Comparing the dynamics of involvement, it can be noted that the difference between the results of the experimental groups and the control group convincingly indicates that the implementation of the structural-functional model has a positive effect on the involvement of children aged 5-7 years in hockey.

To quantitatively prove the scientific validity, objectivity and reliability of the research results, the data obtained in the course of experimental work were processed by mathematical statistics methods, since the observed changes in the structure of the distribution of involvement levels can, in principle, be due to random facts. The results of calculating the χ^2 criterion based on the results of experimental work in groups, in accordance with the developed levels of involvement of children aged 5-7 years in hockey, are presented in Table 2.

As can be seen from the calculation results presented in Table 2 using the χ^2 criterion based on the results of experimental work at the ascertaining and generalizing stages in the groups of children participating in the experiment, the implementation of the structural-functional model developed by us reliably indicates an increase in the level of involvement of children aged 5-7 years to hockey lessons.

Conclusions. It has been established that the effectiveness of the process of introducing children aged 5-7 years to hockey lessons depends on the implementation of the structural-functional model, which

Table 1. *Comparative data of the results of experimental work*

Stage	Group	Quantity	Formal level		Sufficient level		Active level	
			%	Quantity	%	Quantity	%	Quantity
Stating	EG 1	30	36.67%	11	56.67%	17	6.67%	2
	EG 2	30	30.00%	9	63.33%	19	6.67%	2
	EG 3	30	33.33%	10	60.00%	18	6.67%	2
	KG	30	36.67%	11	60.00%	18	3.33%	1
Formative	EG 1	30	16.67%	5	53.33%	16	30.00%	9
	EG 2	30	16.67%	5	70.00%	21	13.33%	4
	EG 3	30	10.00%	3	56.67%	17	33.33%	10
	KG	30	23.33%	7	70.00%	21	6.67%	2
Generalizing	EG 1	30	13.33	4	40.00	12	46.67	14
	EG 2	30	16.67	5	43.33	13	40.00	12
	EG 3	30	3.33	1	23.33	7	73.33	22
	KG	30	20.00	6	66.67	20	13.33	4

Table 2. *Calculation results of the χ^2 criterion based on the results of the experimental work*

Compared groups	Received value (X^2_{emp})	Table value for significance level		
		0,01	0,03	0,05
EG-1 and EG-1	12,06	9,21	7,4	5,99
EG-2 and EG-2	13,13			
EG-3 and EG-3	29,04			
KG and KG	5,11			

includes: purposeful organization of the process of familiarization; correspondence of the methods and content of classes to the age characteristics of children; phasing; software, the content of which includes an orientation towards the unity of the personal and physical spheres of the child; methodological and procedural support; provision of pedagogical conditions.

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Diagnostic tools for determining the level of involvement of children in hockey

UDC 796.966

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Abstract

Objective of the study was to determine the level of involvement of children aged 5-7 years in hockey (sports activities).

Methods and structure of the study. In the course of scientific work, the following were carried out: interviewing; pedagogical observation; method of studying the products of activity; conversation; testing the general, special and technical readiness of young hockey players aged 5-7 years (n=120), who are engaged in the Sports School of the Olympic Reserve "Spartakovets" in order to determine the level of participation over a period of three years (2014-2016).

Results and conclusions. Children 5-7 years old with an active level of participation in hockey have in the future: one hundred percent enrollment rate; high sports results of the implementation of the sports training program for the sport of hockey in full. The presented results can be used as indicative norms for the selection of young hockey players for the initial stage.

Keywords: *introducing children to sports activities; criteria, indicators and levels of involvement of children aged 5-7 years in hockey; young hockey players selection for the initial stage of sports training.*

Introduction. The specificity of team sports, which include hockey, makes high demands on the individual characteristics of athletes. It can be argued that the level of involvement in hockey is the basis for the successful development of the sports training program for the sport of hockey.

The federal standard of sports training for the sport of hockey defines the minimum requirements for enrolling children aged 8 to undergo sports training at the initial stage in sports organizations [8]. Program standards evaluated in exact units of measurement (meters and seconds) do not reflect and do not take into account such an equally important element as introducing a child to sports activities, expressed by him in the form of interest in playing hockey, manifestation of independence, emotional and volitional qualities, self-organization, knowledge about hockey, motivation for their sports development.

Despite a significant contribution to the development of the theory of physical education for children aged 5-7 years, the studies performed do not fully solve the problem of involving children of senior preschool age in sports activities, its theoretical and methodological foundations, methodological and pedagogical justification for the possibility of involvement.

Senior preschool age is significant for the development of physical qualities, satisfaction of motor needs, attraction to sports activities. Currently, many pedagogical studies consider the problem of involving preschool children in sports activities in the context of forming interest in sports activities, developing motivation in children 5-7 years old by means of playing activities, generating interest in various sports, preparing children for sports, sports education, development of motor creativity [12].

The partial absence of age standards for involvement in sports activities for children aged 5-7 does not

allow to fully carry out the procedure of complex control and selection when enrolling in organizations that provide sports training at the initial stage.

Objective of the study was to determine the level of involvement of children aged 5-7 years in hockey in the context of its consideration as a factor determining success in further sports activities.

Methods and structure of the study. To determine the level of involvement in sports activities and hockey, in particular, diagnostic tools were substantiated in accordance with the criteria and indicators we have identified (Table 1).

In our opinion, the presented diagnostic tools in Table 2 can be considered the most suitable for studying the level of involvement of children aged 5-7 years in hockey (sports activities).

The work was carried out among young hockey players aged 5-7 years (n=120), involved in the sports school of the Olympic reserve "Spartakovets" in order to determine the level of involvement for three years (2014-2016).

Results of the study and their discussion. According to the results of the study, we determined the levels of involvement of children aged 5-7 years in hockey: formal, sufficient and active, which are complex in nature, and the inclusion criteria are equivalent. The results of the study are presented in table 3.

The results obtained were used by us as additional ones when conducting the selection procedure for the stage of initial sports training, all other things being equal, for the test subjects to fulfill the control standards, and also played a special role in the design and monitoring of the individual trajectory of young hockey players' sports training from 2016 to 2022 - a personal way of realizing personal potential every child. The individual trajectory was accompanied by a personal map, which included: personal result and achievements; fulfillment of milestone requirements for general, special and technical-tactical training and reflected their success in sports activities. Indicators of mastering the sports training program by children are presented in Table 4.

As can be seen from the table above, children who have an active level of involvement in hockey (sports

Table 1. *Criteria and indicators of involvement of children aged 5-7 years of age in hockey (sports activities)*

Criteria	Content and indicators of the criterion
Motivational	The need for exercise. Interest in sports activities (games, exercises). Positive attitude towards sports and sports games. Awareness of oneself as a subject of sports activity.
Emotional-volitional	Volitional tension in solving problems of sports activities. Emotional responsiveness to participation in sports activities. The desire to improve physical qualities.
Appraisal-behavioral	Ability to navigate sports activities. Activity and independence shown during the performance of sports exercises. Awareness of one's own active position in sports activities
Physical readiness	Speed, agility, flexibility, spatial orientation, strength, coordination. Performing a wide range of physical exercises. Mastering the basics of technique and tactics of the game of hockey.

Table 2. *Diagnostic tools for studying the criteria for involving children in hockey (sports activities)*

Criteria	Diagnostic methods
Motivational	Methodology for studying the interest of preschoolers in physical exercises and sports games [6]. Diagnosis of motivation for attending sports classes in older preschoolers [4]. Modified methods of T.A. Nezhnova, L.L. Venger, D.B., Elkonin-Davydov [12].
Emotional-volitional	Methods for studying the manifestation of volitional qualities in motor activity by children of senior preschool [3]. Participatory observation of children's behavior in experimental situations. Adapted methods for studying the emotional sphere of a preschooler [5]. Adapted technique «Get the rattle» [11].
Appraisal-behavioral	Diagnostics of the abilities of young hockey players [2]. Methodology for studying the manifestations of motor independence of children of senior preschool age [1]. Verbal test Torrens «Improvement of toys» (modification).
Physical readiness	Technology for assessing the physical readiness of hockey players [7]. Methods that determine the level of motor activity of the child [9]. Control standards for general, special and technical readiness of children aged 5-7 years [10].

Table 3. *The results of determining the level of involvement of children aged 5-7 years in hockey (sports activities)*

Amount of children	Formal level		Sufficient level		Active level	
	%	amount	%	amount	%	amount
120	13,34	16	43,33	52	43,33	52

Table 4. *Individual trajectory of mastering the sports training program from 2016 to 2022, (number of people)*

Involvement level	Research result	Enrollment at the initial stage 2016	Enrollment for the training stage 2019	The presence of a youth category 2020-2021	The presence of a sports category 2021-2022	Member of the national team of the Sverdlovsk region 2021	Member of the national team of the Russian Federation 2022
Formal level	16	8	2	1	0	0	0
Sufficient level	52	38	9	3	0	0	0
Active level	52	52	49	48	34	28	3

activities) have a more successful trajectory of mastering the sports training program upon enrollment.

Conclusions. Thus, it was found that the indicators of the level of involvement of children aged 5-7 years are interrelated with success in passing the individual selection procedure for enrollment in sports organizations and have a correlation with sports results and achievements in mastering the sports training program; the presented results of children aged 5-7 can serve as indicative norms for the comprehensive control and selection of young hockey players.

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