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The journal includes articles which are reflecting the materials of modern scientific researches in the field of physical culture and sports.
The journal is intended for teachers, coaches, athletes, postgraduates, doctoral students research workers and other industry experts.

Contents Themes:

1. Physical education of different population groups.
2. Improving the training of athletes of different qualification.
3. Biomedical Aspects of Physical Education and Sports.
4. Human health, physical rehabilitation and physical recreation.
5. Biomechanical and informational tools and technologies in physical education and sport.
6. Management, psychological-educational, sociological and philosophical aspects of physical education and sport.

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CONTENT

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Structure of the model values of the individual physical education of schoolchildren of different age groups

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The proposed article presents the results of an empirical study, on the basis of which models of individual physical culture of boys and girls are developed.

Purpose: *identification of factors that encourage students to engage in physical exercise and the development of a model of value orientations of the individual physical culture of boys and girls in different age periods.*

Material & Methods: *research was carried out with a contingent of schoolchildren of grades 5–11. The total number of respondents was 628 people (boys – 282; girls – 346), of which 126 respondents (97 boys and 29 girls) are engaged in a certain sport. To solve the problems of our study, at the first stage a survey was conducted of respondents "Determining the motives and interests of schoolchildren in the field of physical culture and sports".*

Results: *according to the results of the survey of respondents we were first created models of value orientations of individual physical culture of boys and girls of different age groups.*

Conclusion: *It was found that the representation of schoolchildren who are not involved in sports about the quality, characterizing a physically cultured person, primarily concerns sports activities. More harmoniously characterize the priority qualities of the individual physical education of the person of a young man who play sports.*

Keywords: *students, boys, girls, physical education, values, individual physical culture.*

Introduction

The lifestyle of modern schoolchildren is characterized by a high level of static, sensory and informational load and at the same time – a low level of general motor activity [6]. Physical education, as an academic discipline in educational institutions, aims to solve not only educational, recreational and educational tasks, but also to form a valuable attitude to health and a healthy lifestyle, nurturing interest and need for physical activity [3]. Unfortunately, today physical culture is losing its value for young people. Children and teenagers prefer to virtual space and social networking. Despite the fact that a school is an educational institution, it directs its activity towards the harmonious development of children, according to the data of scientists, T. Yu. Krutsevich [4], A. G. Sukhareva [8] and other scientists [9–11], there is a significant decrease in the motor activity of schoolchildren, as a result of which their physical condition and morbidity level decreases. According to I. A. Kogut, V. V. Romanenko, G. E. Motylyanskaya, interest in physical education and sports is gradually declining: a long stay at a desk, a rest – mainly at a computer or watching TV. This all limits the motor activity of schoolchildren, which leads to significant disruptions in the functioning of their body [1; 2]. The need to change the attitude of students to physical education is one of the most important tasks in the educational process. It is for this psychological parameter that one can assess how and how much physical education corresponds to the value standards and attitudes of schoolchildren, their condition, needs, interests and motives [5]. This requires the search for scientifically grounded theoretical propositions about the possibility of influencing this process in the course of educational and educational activities, determining the relevance of our chosen research topic. Also in the available literature, we did not find scientific papers that studied the age and sex differences of students in the formation of models of individual physical culture, and justifies the relevance of our scientific research.

Purpose of the study:

– study of the peculiarities of representations of schoolchildren of different age groups on the motivational priorities and value orientations of the individual physical culture of young men and women who are engaged in and not in sports;

– development of a model of value orientations of individual physical education of boys and girls in different age periods.

Material and Methods of the research

Research methods – analysis of scientific and methodological literature, respondent questioning, methods of mathematical statistics.

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

pretations.

To find out the motivation of schoolchildren in the field of physical education and further determination of the ways of its formation, it is necessary to identify their motives and actions, which they are guided by their actions and desires. Therefore, knowing the attitude of students to the subject "Physical Culture", motives, interests and determining the place occupied by physical culture and sports in the life of schoolchildren, it is possible to influence their motivation to physical self-improvement and to some extent improve the process of physical education at school. To solve the problems of our research, at the first stage, a survey was conducted of respondents "Determining the motives and interests of schoolchildren in the field of physical culture and sports". The survey was conducted by a group method, which made it possible to get a fairly high rate of return of high-quality completed questionnaires – up to 95%. This provision indicates a high interest of students and a high level of reliability and reliability of the empirical data. Boys and girls of different ages took part in this survey, regardless of the degree of activity and their participation in various forms of physical culture and sports activities.

Results of the research

According to the results of the survey, it has been established that young men are more likely to choose power sports: taekwondo, wrestling and football. From the 5th to the 11th classes, for various reasons, the number of young people engaged in sports activities are significantly reduced (Fig. 1). Of the 98% of the guys who are engaged in physical education and sports activities in the 5th class, 26,6% of the eight students remained. In early adolescence (15–17 years old) certain relations with the outside world already consist. School age is sensitive for the formation of value orientations. The needs of high school students for self-development, self-improvement and self-realization become urgent, which is an indicator of personal maturity and at the same time a condition for its achievement. Therefore, starting or continuing to play sports at a given age, schoolchildren become more motivated and purposeful. A young man of 15–17 years old is already aware of the purpose of his actions and relates them to the motives of physical self-improvement. Starting playing sports at a given age, young men direct their activities not to a high athletic result, but to a greater degree to the improvement of the body and body shape.

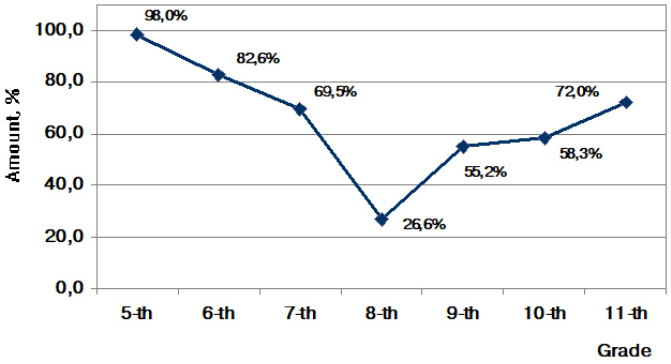

Figure 1. Number of students in grades 5–11 who are engaged in sports and recreational activities (boys), %

After the ranking of the interests of girls in grades 5–11 to sports, it was found that 75% of fifth graders are engaged in sports and recreational activities after hours (Figure 2). They chose the following sports: swimming, volleyball, types of fitness. But 25% of girls who are not involved in sports – 17% want to attend sports clubs. In most cases, this is a type of fitness occupation. In the 6th grade, the percentage of schoolchildren engaged in sporting activities decreased to 70,5%, and in the 7th grade to 33,3%. So, we can observe that from the 5th to the 7th grade girls also revealed some decrease in the interest in sports, as in the guys of this age. Further, we note the positive dynamics: from the 8th to the eleventh grades the percentage of schoolgirls who are engaged in physical culture and sports activities increases from 42% to 53%. Despite the shown age-related positive dynamics in school and sports activities of schoolchildren, the percentage of those who are indifferent to physical activity remained quite substantial. Also with age there is a gradual decrease in the number of schoolchildren who regularly play sports.

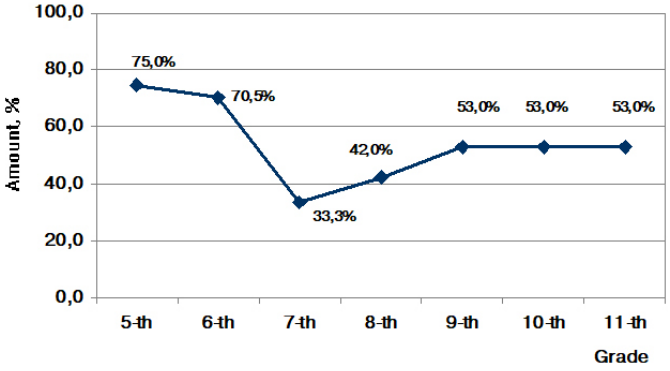

Figure 2. Number of students in grades 5–11 who are engaged in sports and recreational activities (girls), %

Continuing our research in determining the relationship of young people to physical activity and sport, exploring their motivations, interests and hobbies in the sphere of physical culture, we analyzed the answers to the following question: *"What motivates you to exercise?"* (Table 1). The most common among children aged 11–12 years old (grades 5–6) were the answers "give parents advice" and "give advice to a physical education teacher". Pupils of the 7th and 8th grades put the motive of the impulses to exercise "programs on TV" also in the first place. The second place was taken by the answer – "friends advised". For high school students, the first place according to the rating is the answer: "knowledge about the benefits of exercise". That is, a conscious choice of such an answer among young men who are not involved in sports may indicate a sufficient level of external information about the effect of exercise on the general level of physical fitness and physical health of a person. And if they still have not been involved in sports, there is hope that they have sufficiently weighty motivation to engage in physical culture and recreation activities. In the girls of the 5th and 6th grades of the answer: "programs on TV" and "gave advice to a teacher of physical culture" occupy the first positions. That is, we see a slight difference in the answers of boys and girls, about who has more influence on the decision-making, and whether this decision is independent. Thus, among 11–12 year olds, the advice and examples of parents and teachers see a significant role in making this or that decision. But girls at this age are already more independent in making decisions, the emotional

component begins to prevail in them. With age, boys and girls have changed the motivation. Already in the 10th and 11th grades, the girls put the answer "knowledge about the benefits of exercise" in the first place, the answer to the "broadcast on TV" remained in the second place. In young men, the first place was taken by the answer "give advice to friends." The second is "knowledge of the benefits of exercise." Physical education and sports significantly affect the system of values, interests and views of adolescents. And the answer of the respondents "knowledge about the benefits of exercise" indicates the consciousness of the choice of adolescents. Comparing the answers of schoolchildren involved in sports, one can determine that their first priority is the motive of knowledge about the benefits of physical culture and sports. At the young men on the second and third places – "to improve the physical form". Analyzing the motives for conducting physical exercises, we found the difference in respondents' answers by age and sex, and comparing the impulses during physical exercises, we found no significant difference between the answers of boys and girls. So, it has been established that the influence of parents on the decision-making of adolescents at the age of 16–17 decreases, but the authority of other people and their opinion become more influential. Thus, the motivation of adolescents in sports and recreational activities, regardless of whether they are systematically involved in sports or not, have a significant influence on the opinions of parents, friends and on television and the Internet. In older teens and adolescents, a more conscious influence of information that may become a motivated stimulus to exercise.

In order to clarify the value qualities in the imagination of schoolchildren personify physical culture, we raised the question: *"Who do you consider a physically cultured person?* Taking into account the answers of schoolchildren to this question and the qualitative characteristics of their individual physical culture, we have developed models of value orientations of individual physical culture of boys and girls in different age periods (Figure 3, 4). According to the rating, the majority of respondents 11–13 years old put the answer to the first place: "the one who plays sports". The priority qualities of the guys attributed "the one who owns physical skills in various sports" and "the one who achieved and maintains his level of physical health at a high level". The girls of this age have somewhat different priorities: "the one who has achieved and maintains his level of physical health at a high level" and "the one who has achieved the harmony of physical and spiritual development. Boys of 14–15 years old as priorities characterizing a physically cultured person are also considered to be the person involved in sports (1st place) and maintaining a healthy lifestyle (HLS) (2nd place). The third place is occupied by the one who has achieved and maintains his level of physical health at a high level. Girls at this age gave preference to those who play sports (1st place). Further, according to the rating, appeared those who support a healthy lifestyle (2nd place). In the 11th grade, the girls placed the answer in the first place in the definition of a physico-cultural person: "the one who adheres to a healthy lifestyle"; then, according to the rating, the answer is "the one who achieved the harmony of physical and spiritual development" and "the one who supports your level of physical health at a high level". Attention is drawn to the fact that "regular exercise by yourself" according to the rating is in the last places both in boys and girls (Figure 3).

More harmoniously characterize the priority qualities of the individual physical culture of a young man's person who play sports. "Regular exercise by yourself" in them, by rating, is one of the priorities. The representation of schoolchildren who are not involved in sports, about the quality, characterizing a physically cultured person, primarily concerns sports activities. On the 2nd place – knowledge about the effect of exercise on the human body, on the 3rd – compliance with healthy lifestyles. The fourth place is given to the harmony of the physical and spiritual development of a person, on the fifth – possession of a wide range of motor skills and skills, the sixth place is given to the ability to make an individual training program and only then (seventh place) the regularity of independent lessons is taken into account.

Unfortunately, but the main goal of physical education is to achieve a high level of physical health and maintain it for a long period of time, they remain at one of the last places, which indicates the lack of formation of the essence of the concepts of "physical culture" and "sports" in both schoolchildren of both articles.

Table 1

Factors that motivate students to exercise (%)

Grade	Gender	Answer choices							
		Teacher of physical education gave advice	Parents give advice	Friends give advice	TV shows	Knowledge of the benefits of exercise	Attendance of competitions	Publications in newspapers, magazines	Other
5	b	14,3	71,4	19,0	47,6	14,3	14,3	0,0	0,0
	g	11,3	39,6	20,8	50,9	15,1	0,0	28,3	0,0
6	b	34,0	60,0	18,0	30,0	4,0	18,0	14,0	0,0
	g	5,6	24,1	29,6	64,8	18,5	35,2	40,7	0,0
7	b	26,5	14,7	52,9	52,9	5,9	20,6	20,6	0,0
	g	7,7	7,7	41,0	82,1	0,0	7,7	33,3	0,0
8	b	23,6	23,6	32,7	32,7	9,1	9,1	5,5	9,1
	g	14,8	18,5	27,8	61,1	14,8	9,3	38,9	9,3
9	b	14,4	24,4	31,1	53,3	7,8	14,4	2,2	14,4
	g	12,7	20,0	23,6	47,3	0,0	0,0	0,0	20,0
10	b	8,3	8,3	8,3	25,0	58,3	0,0	0,0	16,7
	g	13,3	26,7	20,00	53,3	33,3	6,7	0,0	13,3
11	b	7,3	21,9	21,9	43,9	21,9	12,2	0,0	12,2
	g	7,7	20,0	20,0	30,7	35,4	6,1	3,1	9,2

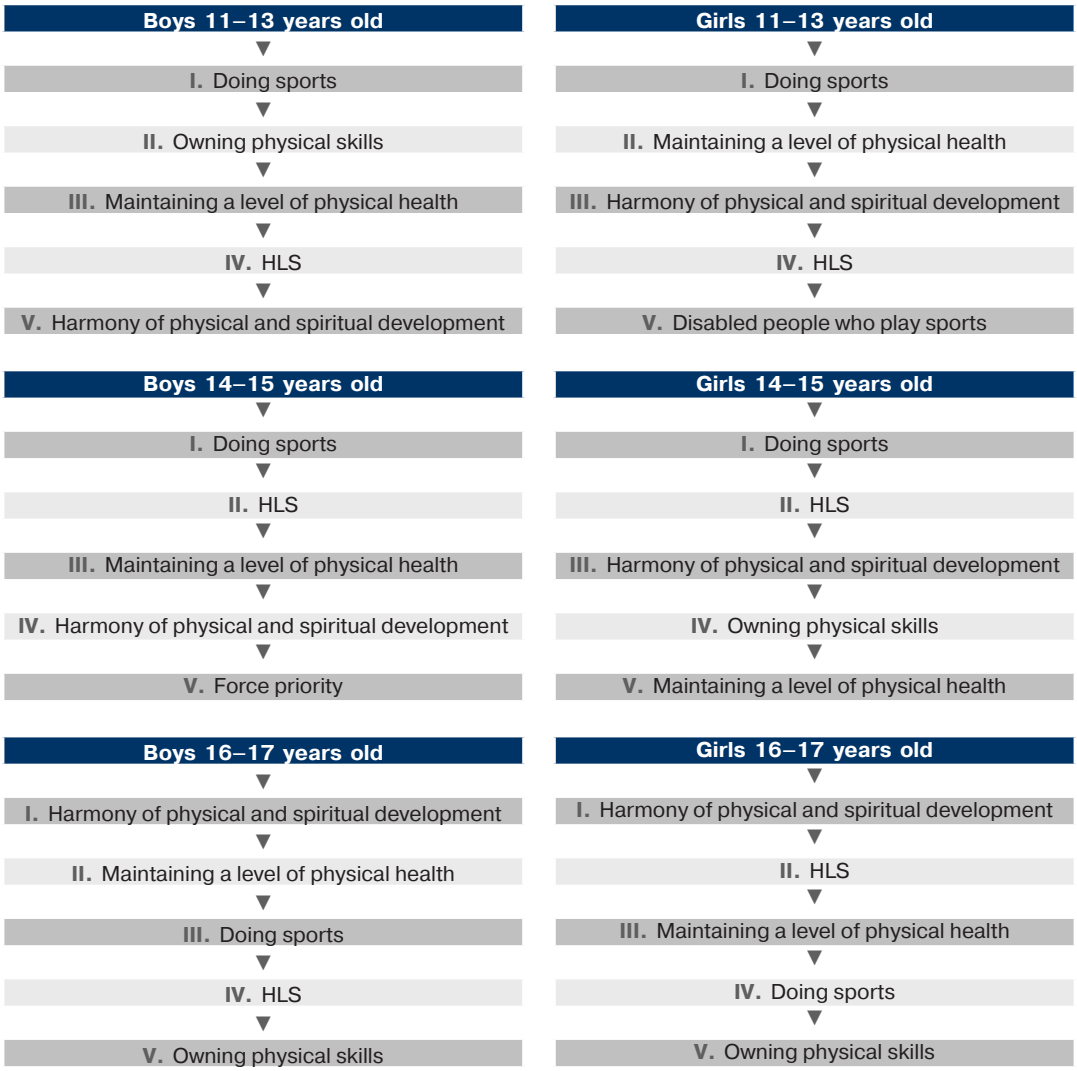

Figure 3. Models of value orientations of individual physical culture of boys and girls in different age groups

Conclusions / Discussion

Today, the authors of most modern publications believe that physical education should be directed to the formation (education) of a person not only certain physical qualities, but also deep knowledge about his body, a means of purposeful impact on the physical condition, preservation and strengthening of health, and moreover the formation of relevant interests, needs, value orientations and real behavior (lifestyle), that is, the "physical culture of the individual" [7, pp. 425]. We fully agree with the opinion of A. A. Tomenko, substantiated and developed a conceptual model of non-special physical education for students. Highlighting its theoretical aspects, the scientist noted the need to distinguish between the specific functions of non-special physical education education and general cultural, based on interrelations with other spheres of life activity [9].

Thus, according to the results of the survey of respondents, we for the first time created models of value orientations of the individual physical culture of boys and girls of different age groups. It was found that the representation of schoolchildren who are not involved in sports about the quality, characterizing a physically cultured person, primarily concerns sports activities. More harmoniously characterize the priority qualities of the individual physical education of the person who play sports. But in general, we can state the fact of insufficient formation of the essence of the concepts "physical culture" and "sport" among schoolchildren of both sexes. At the same time, the study of the formation of the values of individual physical education of schoolchildren allows us to conclude that the general level of non-special physical education that they were supposed to receive in a secondary school when studying the school subject "physical culture" is low. Their representation in this field is based primarily on practical experience and, to a lesser extent, on theoretical knowledge. The results obtained give us the right to argue about the existence of certain differences in both the created models of individual physical culture of boys and girls, and in the motivational priorities of conducting physical activity classes. Therefore, we can admit the idea that in order to form a certain strategy of attracting young people to systematic physical education, studying the interests, motives, value orientations in the field of physical culture, their relation to physical activity, it is impossible to focus only on one of the indicators of biological or psychosocial systems, it is necessary to take into account not only physiological and morpho-functional features of schoolchildren, but also the whole complex of biosocial personality traits, introducing gender and follow in the physical education. Taking into account the foregoing, we consider it expedient to fur-

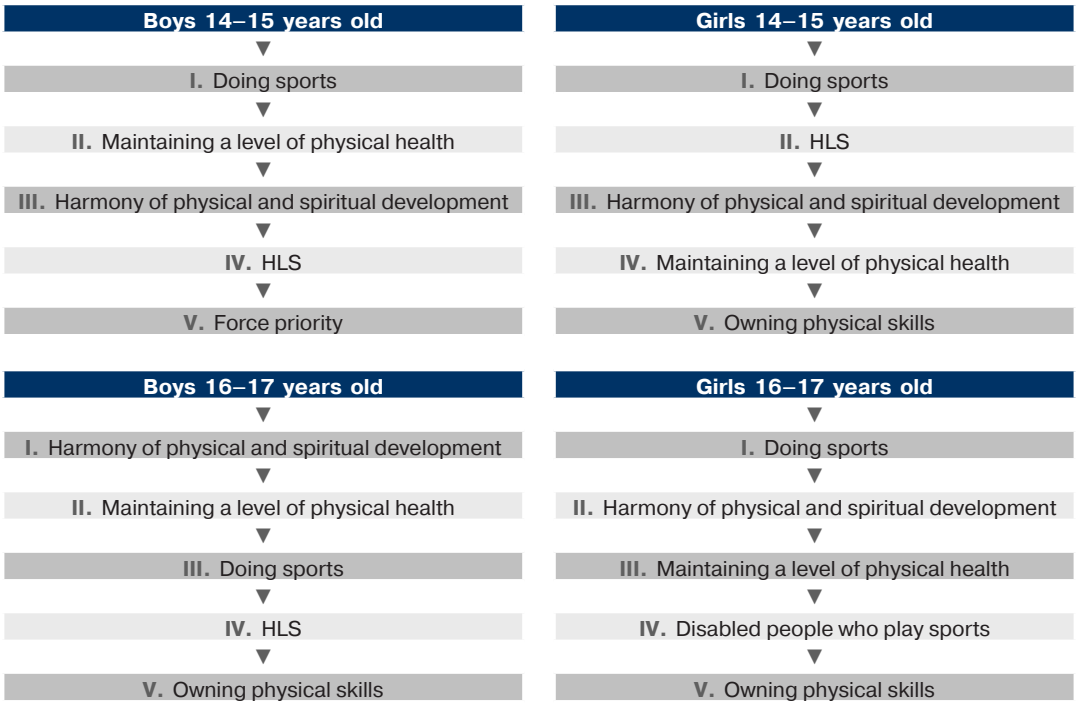

Figure 4. Models of value orientations of the individual physical culture of boys and girls who are engaged in sports

ther develop the concept of a gender approach in education, which will promote the development of individual abilities of schoolchildren of different sexes, overcoming of polo-role stereotypes and more effective formation of their values of physical culture.

Prospects for further research. The next stage of our scientific research will be devoted to identifying the relationship between the psychological gender of the respondents and their models of individual physical culture.

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Impact of physical education and recreational activities with elements of roller skating on the morphofunctional state of schoolchildren in grades 5–6

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Purpose: *to determine the impact of fitness classes with the priority use of roller skating on the morphofunctional state and physical fitness of schoolchildren in grades 5–6.*

Material & Methods: *194 children of 10–12 years old took part in the experiment, 90 of them were boys and 104 girls. The study was conducted on the basis of school number 269, Kiev with in-depth study of the French language. In the process of research, the following methods were applied: pedagogical (pedagogical experiment and observation); anthropometric; physiological (pulsometry, spirometry, functional tests) methods of mathematical statistics.*

Results: *study shows that among pupils in grades 5–6, physical culture and fitness classes with priority use of roller skating means because positive changes in the morphofunctional state and physical fitness. Significant improvements were found after 9 months of regular classes.*

Conclusion: *fitness classes with the priority use of roller skating means have a positive effect on the morphofunctional state and physical fitness of schoolchildren in grades 5–6. It was revealed that the indicators of the functional state (in particular, the cardiovascular and respiratory systems), physical fitness of schoolchildre compared with the initial data are significantly higher ($P(t)<0,01$; $P(t)<0,001$).*

Keywords: *fitness and fitness classes, roller skating, schoolchildren of 5–6 grades.*

Introduction

In the conditions of the development of the national system of general secondary education, the innovative activity of general educational institutions, which is characterized by systemic experimentation, testing and application of innovations (innovations) in the educational process, is of great importance.

In connection with the deterioration of health and a decrease in the level of physical preparedness of schoolchildren, the search for new ways to improve them in the process of physical education is being actively pursued. The introduction of innovative technologies in the field of physical education is the subject of research by many scientists (V. A. Kashuba, 2016; N. V. Moskalenko, 2011; N. E. Pangelova, V. Yu. Ruban, 2015) [1; 3; 5].

A. N. Sainchuk [6] in his work "Programming physical education and health activities Scandinavian walking in physical education of younger schoolchildren" notes that the low efficiency of the school system of physical culture is associated with the lack of sustainable motivational attitudes on physical activity, outdated approaches and means of organization and constructing both lesson and extracurricular forms of employment. Modernity requires a reorientation of teachers of physical training in the application of innovative health and fitness technologies in physical training of studying youth, where the structure of employment would have been closer to the type of sports training, based on the scientific achievements of sports and sports industry and definitely would have been determined in perspective, that is, program-controlled.

T. G. Kozhedub [2] proposed an innovative technology for theoretical training of schoolchildren, which made it possible to improve the indices of physical activity, the level of physical preparedness, physical development and the state of health of schoolchildren, which makes it advisable to use it in the system of physical education for children of middle school age.

T. G. Omelchenko [4] substantiated the model of the pre-anozological condition of the organism of junior schoolchildren (not counting anthropometric, physiological (cardiovascular), psychophysiological indicators, coefficient of physical development and mental state of the organism), and on the basis of it developed the technology of control and correction of the pre-organism state of the organism on an example of physical education and fitness classes with elements of fitball-aerobics.

But the introduction of innovative technologies in the process of school physical education remains limited, which actualizes the scientific search in this direction.

The proposed innovative approach is the organization of extra-curricular activities with the priority use of roller skating means. High emotionality, effective development of aerobic abilities determine the great popularity of roller skating and determine this type of motor activity as one of the most common. Nowadays around 15 million people are engaged in roller skating [8; 11].

The physiological value of this type of motor activity is a posi-

tive effect on the cardiovascular, respiratory, musculoskeletal and muscular systems. As a result of performing specific movements that require constant monitoring of balance and balancing, the work of the vestibular apparatus is improved, as well as coordination abilities. This releases the hormone endorphin (the hormone of "happiness"), which contributes to elevated mood [9; 12].

Roller skating is especially important for schoolchildren who are overweight. So, for an hour of skiing at a uniform pace of medium intensity, it is possible to lose 400 kcal, and intensive skating with acceleration "burns" 900 kcal. In addition, in the process of such studies, the metabolism is normalized.

Simple skating is possible to diversify with active games. Practically any sports games can be adapted for game activity. The most attractive of them, which correspond to the specifics of movement on roller skates, are dynamic and mobile games, the holding of which does not require a large area size. Unlike sports, roller skating does not require a specially equipped playground or sports equipment [10; 13].

Biomechanical features of roller skating allow you to include in the work of such muscle groups that are difficult to develop with the help of other exercises. The effectiveness of classes is largely determined by the technical equipment: roller skates, special clothing, a helmet, knee pads and elbow pads [7].

It has been established that the age of 10–12 years is favorable for the improvement of aerobic abilities, therefore the development of physical-health programs for this type takes on exceptional importance. Skating on roller skates is an effective means of recovery, uses a large number of muscles, while not going beyond the limits of the aerobic energy supply mode.

Purpose of the study: to determine the impact of physical education and health-improving classes with the priority use of roller skating on morphofunctional state and physical fitness of schoolchildren in 5–6 grades.

Material and Methods of the research

The experiment involved 194 children, 10–12 years of age, of which 90 boys and 104 girls. The study was conducted on the basis of school number 269, Kiev. With in-depth study of the French language.

In each age group, control and experimental groups were created. The control group consisted of 97 schoolchildren, and in the experimental – 99.

Pupils who entered the experimental groups regularly attended extracurricular activities 2–3 times a week with elements of roller skating. Duration of one lesson is 60–70 minutes. In the course of the study, testing was conducted to determine the morphofunctional state, physical fitness and health status of schoolchildren in grades 5–6 at the beginning of the experiment and at the end (in September 2017, initial indicators were recorded; in May 2018, indicators were recorded after 9 months of practice with roller skates).

The program "Roller Skates: Innovative Vector in Education" was developed, the content of which included both traditional means of physical education and innovative using skating means on roller skates, was experimentally tested in the process of extracurricular organizational forms of physical education (Figure 1).

The proposed innovative program does not replace and does not exclude the generally accepted organizational forms of physical exercises in the secondary school. We are talking about the inclusion in the physical culture and health of the elements of innovative technologies that enhance the physical condition of the student and were interpreted by us in accordance with the goals and objectives of the study.

In the process of research, the following methods were applied: pedagogical (pedagogical experiment and observation); anthropometric; physiological (pulsometry, spirometry, functional tests) methods of mathematical statistics.

Table 1

Indicators of the morphofunctional state of schoolchildren in 5 grades of the control and experimental groups

Indicators	Before experiment				After experiment											
	general (n=97)				control (n=47)				experimental (n=50)				girls		boys	
	girls (n=51)		boys (n=46)		girls (n=25)		boys (n=22)		girls (n=26)		boys (n=24)					
	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	t	p	t	p
Body length, cm	143.7	0.88	140.1	0.83	147.2	1.31	144.2	1.3	148	0.98	144.1	0.89	0.5	>0.05	0.06	>0.05
Body weight, kg	35.4	0.67	34.3	0.73	37.9	0.9	38.1	1.14	37.2	0.87	37.5	0.83	0.56	>0.05	0.42	>0.05
Circumference of the chest, cm	69.1	0.64	67.8	1.46	70.1	0.75	71.1	1	70.5	0.97	70.6	0.85	0.32	>0.05	0.38	>0.05
HR present rest, beats. min^{-1}	76	0.9	76.1	1.1	73	1.18	72	1.58	69	0.83	68	1.12	2.78	**<0.05**	2.06	**<0.05**
VC, ml	1782.6	27.98	1763.5	30.67	1852	37.35	1844.1	44.98	1953	24.74	1950.42	26	2.25	**<0.05**	2.03	**<0.05**
Sample Stange, s	28.5	0.65	32.3	0.84	29.7	1.12	32.8	1.06	36.4	1.31	36.9	1.18	3.9	**<0.05**	2.59	**<0.05**
Gench test, s	15.7	0.4	18.5	0.57	17.1	0.37	19.8	0.7	20	0.79	23.9	1.2	3.33	**<0.05**	2.97	**<0.05**
Index Rufie, points	18.3	0.56	6.8	0.53	7.2	0.35	6.7	0.4	5.8	0.26	5.4	0.3	3.86	**<0.05**	2.6	**<0.05**
Robinson index, condition units	87.2	1	88.24	1.25	88.16	1.29	86.36	1.89	83.65	1.12	83.58	1.56	2.65	**<0.05**	1.13	>0.05

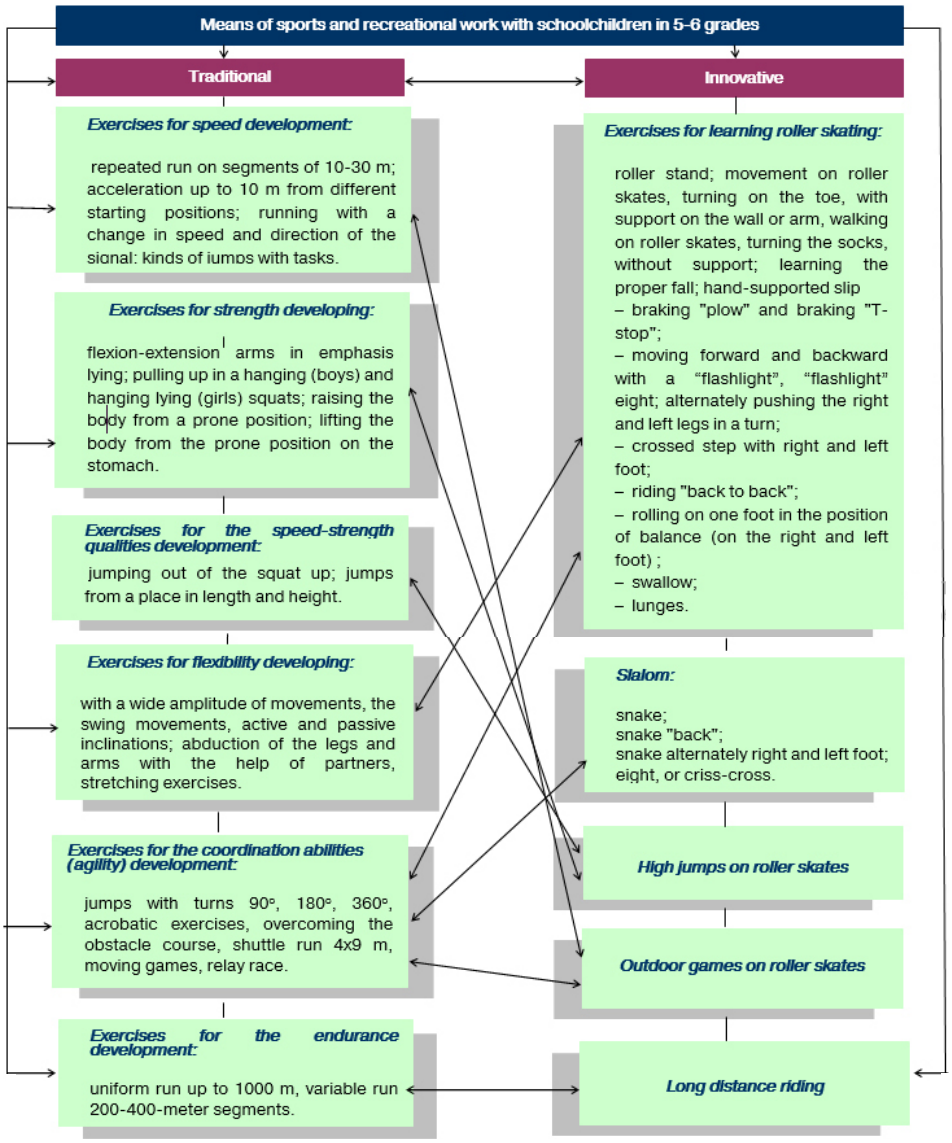

Figure 1. Content of the program "Roller Skates: Innovative Vector in Education"

Results of the research

In order to test the effectiveness of introducing innovative technology into the process of physical education of schoolchildren of grades 5–6, we conducted a comparative analysis of indicators of morphofunctional state, physical fitness and state of health of schoolchildren, obtained after the main stage of the pedagogical experiment (May 2018).

In the process of analyzing the results of the molding pedagogical experiment, it was revealed that such indicators of physical development as length, body weight, chest circumference in pupils of 5–6 grades, both the control and experimental groups were approximately the same.

With regard to the functional capabilities of the studied groups, it can be noted that in the experimental groups of schoolchildren in grades 5–6, both in boys and girls, spirometry, pulsometry, Rufier, Stange, Genchi, Robinson index were higher (except for Robinson in grade 5 children) with a significant difference with the control groups ($p<0,05$) (Tables 1, 2).

This allows us to conclude that an innovative program with the use of rollerblading means has been positively influenced to improve the adaptation mechanisms of the body of schoolchildren in grades 5–6 to physical exertion.

Physical training of schoolchildren of 5–6 classes after completion of pedagogical experiment was determined by the following test: run 30 meters, running 1,000 meters, shuttle 4x9 m run, standing long jump, pulling up, flexion-extension arms in emphasis lying, leaning forward from sitting.

The calculation of the Student's t-test allows us to speak about the significant advantage of the children of the experimental groups over their peers in terms of physical fitness. This is clearly seen among schoolchildren in grades 5–6 in terms of speed-strength abilities, endurance, muscle strength of the arms, flexibility and coordination abilities (Figure 2, 3).

Analyzing the results of studies of physical preparedness of schoolchildren in grades 5–6, it should be noted that all indicators showed positive changes in the experimental and control groups, both in girls and boys, but with different rates of their growth.

The largest percentage growth rates observed in the tests "pull-ups" and "flexion-extension arms in emphasis lying", characterizing the level of development of the strength of the

Table 2

Indicators of the morphofunctional state of schoolchildren in 6 grades of the control and experimental groups

Indicators	Before experiment				After experiment											
	general (n=97)				control (n=45)				experimental (n=52)				girls		boys	
	girls (n=51)		boys (n=46)		girls (n=25)		boys (n=20)		girls (n=28)		boys (n=24)					
	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	$\bar{X}$	m	t	p	t	p
Body length, cm	150.3	0.96	148.8	1.14	153.3	1.27	152.1	1.43	154.4	1.44	153.4	1.66	0.57	>0.05	0.59	>0.05
Body weight, kg	40.6	0.93	40.3	1.03	43.3	1.21	43.4	1.3	41.9	1.13	44.3	1.39	0.88	>0.05	0.47	>0.05
Circumference of the chest, cm	72.2	0.59	73	0.69	74.3	0.74	75.2	0.96	73.3	0.93	75	0.97	0.84	>0.05	0.15	>0.05
HR present rest, beats·min^{-1}	70.3	0.81	71.2	0.84	69.1	0.92	66.6	1.56	65.8	0.61	62.25	1.29	2.67	**<0.05**	2.15	**<0.05**
VC, ml	1899	24.27	2063	29.2	1945	32.21	2092	41.98	2044	28.6	2202	24.8	2.31	**<0.05**	2.25	**<0.05**
Sample Stange, s	33.2	0.85	40.1	1.1	35.5	0.92	42	1.6	39.4	1.28	46.58	1.3	2.46	**<0.05**	2.22	**<0.05**
Gench test, s	17.8	0.5	21.2	0.56	19.2	0.62	22.8	0.66	21.7	0.57	26.58	0.7	2.98	**<0.05**	3.9	**<0.05**
Index Rufie, points	8	0.62	6.2	0.5	6.9	0.34	5.7	0.4	5.3	0.23	4.5	0.2	3.9	**<0.05**	2.72	**<0.05**
Robinson index, condition units	84.15	0.94	83.11	1	83.6	1.07	81.7	1.36	80.25	0.9	77	1.32	2.41	**<0.05**	3.91	**<0.05**

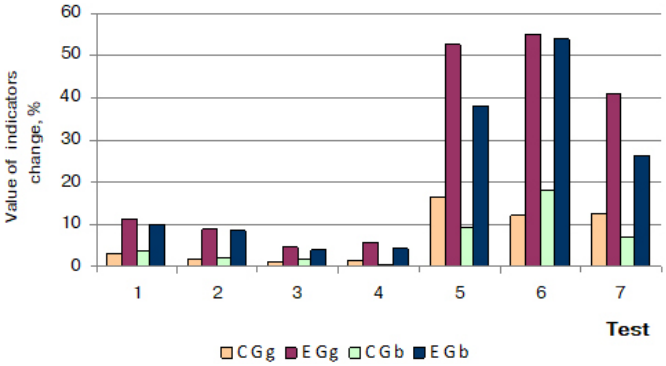

Figure 2. Changes in physical preparedness indicators of girls and boys of the 5th grade of the studied groups after the experiment:
1 – running 30 m; 2 – 1,000 m 3 – shuttle run 4x9 m; 4 –standing long jump; 5 – flexion-extension arms in emphasis lying; 6 – pulling up; 7 – torso forward from the sitting position. CGg – control group, girls; EGg – experimental group, girls; CGb – control group boys; EGb – experimental group, boys.

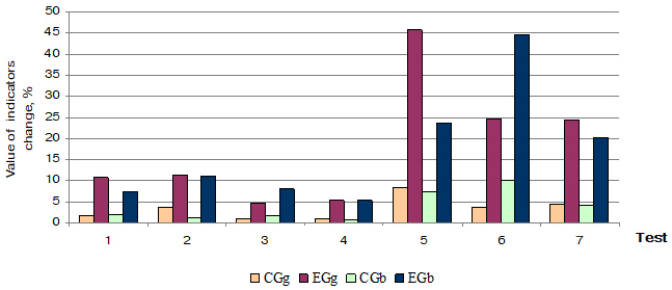

Figure 3. Changes in physical preparedness indicators of girls and boys of the 6th grade of the studied groups after the experiment:
1 – running 30 m; 2 – 1,000 m 3 – shuttle run 4x9 m; 4 –standing long jump; 5 – flexion-extension arms in emphasis lying; 6 – pulling up; 7 – torso forward from the sitting position. CGg – control group, girls; EGg – experimental group, girls; CGb – control group boys; EGb – experimental group, boys.

arm muscles. This ability develops most intensively in children 10–12 years old. In the experimental groups in the "pull-up" test, we obtained the following results: for girls in the 5th grade – 54,9%, and for men – 44%. In the control groups, there was also a high growth rate – among girls of the 5th grade – 11,9%, among boys – 18,2%; for schoolchildren in grade 6th 3,6% and 10,2%, respectively. In the experimental groups in the test "flexion-extension arms in emphasis lying" such an increase in indicators: among girls of the 5th class – 52,6%, among boys – 38,1%; among pupils of the 6th grade – 45,7% and 23,6%, respectively. In the control groups, there were also improvements in the results: for girls in the 5th grade, 16.4%, for men – 9,3%; in sixth-graders – girls – 9,3%, boys 7,3%, respectively.

We also note the high growth rates in the indices of the "torso-leaning in the sitting position" test, which characterizes flexibility in pupils of experimental groups (grade 5 – girls – 40,9%, guys – 26,1%, grade 6 – girls – 24,.2%, children – 20,2%) and in the control groups – for pupils of 5 classes – 12,3% and 7,2%; Grade 6 – 4,5% and 4,2% respectively.

Indicators of the "standing long jump" test, characterizing speed-strength abilities, also increased. You can talk about positive dynamics in schoolchildren of both the 5th and 6th grades: 5th grade – girls – 5,6%, guys – 4,3%; Grade 6 – 5,1% and 5,3% respectively.

It is necessary to note the improvement in motor test results, which characterize the level of speed and coordination abilities, as well as endurance in schoolchildren of experimental groups, both in girls and in boys (running 30 m – girls – 10,7–11,2%, guys – 10–10,7%, "shuttle" running 4x9 m – girls – 4,7%, boys – 3,8–8%; running 1000 m – 8,9–11,3% and 8,5–10,9% respectively).

The obtained results testify to the positive influence of the innovation program "Roller skates: an innovative method in

physical education" on the physical preparedness of schoolchildren 5–6 classes.

Conclusions / Discussion

As a result of a formative experiment conducted during 9 months, it can be stated that fitness classes with priority use of riding on roller skates means have a positive effect on the morphofunctional state and physical preparedness of schoolchildren in grades 5–6. It was revealed that the indicators of the functional state (in particular, the cardiovascular and respiratory systems), physical fitness in comparison with the initial data are significantly high ($P(t) < 0,01$; $P(t) < 0,001$). Thus, rationally constructed lessons on the priority use of rollerblading means contribute to the improvement of the functioning of organs and systems, and therefore – the functioning of schoolchildren as a whole.

The prospect of further research is to develop organizational and methodical bases of use of means of riding on roller skates in the system of physical education of high school schoolchildren.

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Functional dichotomy (symmetry – asymmetry) of physical development in men who are engaged in triathlon

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Purpose: *explore the dichotomy of the physical development of men who are engaged in triathlon and long-distance running on the highway.*

Material & Methods: *under the conditions of the exercise test with a hip strength of 94 physically active men, the reaction of the cardio-respiratory system to physical activity was investigated. Body composition was determined using the bioelectric impedance method. For paired signs, the asymmetry coefficient was calculated. (C_{AS}).*

Results: *largest groups of work at the level of maximum oxygen consumption were allocated groups assess the level of fitness of athletes. With an increase in the level of physical performance, individual indicators of the maximum response of the cardiorespiratory system to stress have a multidirectional tendency. The development of the muscles of the lower extremities is characterized by right-sided asymmetry for all groups of athletes. At the same time, the value of C_{AS} increases with the increase in the level of physical performance from the 1st to the 4th group. In amateur with a high level of preparedness, a decrease in this coefficient is observed.*

Conclusion: *most amateur athletes who practice triathlon or long-distance runner on the highway have an asymmetry in their lower limbs. The most pronounced asymmetry has athletes with a performance at the level of maximum oxygen consumption of 4,0–4,5 $W \cdot kg^{-1}$. In the first to fourth groups, an increase in the asymmetry of the lower extremities is observed, whereas in the group with high performance (4,6–5,5 $W \cdot kg^{-1}$), the asymmetry decreases, which may be a necessary condition for achieving high results.*

Keywords: *physical performance, dichotomy (symmetry-asymmetry), physical development, triathlon.*

Introduction

The problem of studying the functional properties of an organism is one of having not only theoretical, but also practical significance in various areas of scientific knowledge – medicine, biology, psychology, as well as in the field of physical education and sports. It is known that the functional asymmetry of the muscles of the human body is one of the indicators of physical development, health, as well as coordination and coordination of movements, guided by the central nervous system. At the same time, the principle of optimal functioning and proper coordination of movements is considered one of the main ones in the process of vital activity, since it is an expression of harmony, orderliness and organization of living systems. The implementation of sports activities is closely related to the increased requirements for the functional state of the musculoskeletal system, since the latter is essential for achieving sports results and preventing possible injuries [12; 13; 17]. It was shown that functional muscular asymmetry can negatively affect the athlete's neuromuscular system, disrupting proprioception and regulation of movements, which can worsen not only the technique of their execution, but also lead to injury or diseases of the musculoskeletal system [1; 11; 20]. In addition, the data sources of the literature show that functional asymmetry can adversely affect athletic performance in various sports. In particular, basketball players have established differences in indicators of unproductive techniques in the performance of the last leading and non-leading hands [2]. The jumpers in the water show the negative effect of the asymmetry of the lower extremities on the technique of performing the jump, which is manifested in the early separation of one leg from the support and the asymmetric lift [3]. It has also been established that football players who have more than 3 years of sports experience have a large mass of tibia, a total lumbar section and voltage indices of one of the limbs, which is a consequence of constant impact-resistant gravitational loads on the supporting leg [16]. Therefore, taking into account and stabilizing the individual profile of asymmetry-symmetry of an athlete is a significant reserve in improving the efficiency of the training process and finding ways to improve the sports result [5; 12].

Purpose of the study: explore the dichotomy of the physical development of men who are engaged in triathlon and long-distance running on the highway.

Material and Methods of the research

When conducting complex biological surveys with the participation of amateur athletes, they adhered to the Helsinki Declaration of the World Medical Association on the ethical principles of medical research with human participation as the object of study [6]. The content of the maximum test loads and procedures for measuring physiological parameters complied with international rules and requirements for biomedical research involving human subjects. Testing was con-

ducted after a day of rest with a standardized food and drinking regime. Persons tested were familiarized with the content of tests, measurement procedures and agreed to conduct them. 94 practically healthy (according to the data of dispensary examinations) physically active men who are planning to engage in triathlon and longer run on the highway took part in the testing. The study of body composition was carried out using bioelectric impedance analysis (analyzer Tanita-BC-418MA, Japan) [14], the results of which correlate with the results of reference measurements using dual-energy x-ray absorptiometry [21]. The response of the cardiorespiratory system of the body to the physical stresses of the aerobic and anaerobic nature of energy supply was studied under standard laboratory conditions using the LE200C treadmill and the Oxoscopo Ergospirometric Complex (Viasys Healthcare, USA-Germany). Considering that measurements were made in an open system, the external breathing parameters were brought to BTPS conditions, and gas exchange – to STPD conditions. To assess physical performance, we used a test with a stepwise increasing load from an initial speed of 8 km h^{-1} every 2 minutes the speed (by 0,5 km h^{-1}) and the track inclination angle (by 0,2%) increased. Testing was carried out until the moment of "volitional fatigue" (arbitrary refusal of the subject to continue working) or to the impossibility of maintaining a given speed of movement within ±5%. According to the test results, the level of maximum oxygen consumption (VO2max), absolute and relative power of work (W, W kg^{-1}) [4] were determined. Heart rate (HR, beats min^{-1}) was recorded by radiotelemetric pulsometry (Sport Tester Polar-810i, Finland). Statistical processing of the results was performed using an application package Statistica 6.0. The data were checked for normal distribution using the Shapiro-Wilk test. Since the data had an abnormal distribution, non-parametric methods were used. To establish differences between groups, the Kruskal-Wallace test was used [10]. The asymmetry coefficient (C_{AS}) for paired signs was calculated by the formula: C_{AS}=100%(XY)/X, where X is the value of the larger of the symmetric indicators, Y is the value of the smaller of the symmetric indicators.

Results of the research

Earlier, we showed that the level of physical performance of amateur athletes depends on the length of sports training and the age at which amateurs began to systematically train, and also groups for assessing the level of fitness according to the "critical" power of work were distinguished [9]. In addition, an interrelation was established between the main indicators of physical performance and component composition of the body, as well as individual hematological parameters [7; 8]. We found that amateur athletes exhibit a sufficient level of aerobic capacity, overall working capacity, cardiac cycle efficiency, and the ability of skeletal muscles to absorb oxygen [7].

The results of these studies have shown that with relative power of work at the level of maximum oxygen consumption, all the isolated groups have significant differences among themselves (Table 1).

At the same time, with an increase in the level of physical performance, individual indicators of the maximum response of

Table 1

Indicators of physical performance in amateur athletes of different groups (Me [25%; 75%])

Indicators	Groups by relative power of critical load, W kg^{-1}				
	2,4–2,7	2,8–3,3	3,4–3,9	4,0–4,5	4,6–5,5
	1-st (n=8)	2-nd (n=22)	3-rd (n=35)	4-th (n=23)	5-th (n=6)
Work power, W	226 [201; 238]	265 [250; 278] **	290 [272; 311] ▲▲▲■■■	328 [282; 358] □□□♯♯♯♦♦	370 [357; 392] ◊◊●●●♯♯
Maximum level of pulmonary ventilation, l min^{-1}	114,5 [98,5; 131,5]	130,5 [117,0; 142,0]	136,0 [118,0; 144,0]	144,0 [130,0; 153,0] □	153,5 [144,0; 166,0] ◊◊●●♯
Maximum level of oxygen consumption, ml min^{-1}	3172 [2878; 3747]	3763 [3265; 4030]	3890 [3568; 4237] ▲▲	3907 [37334; 4433] □□♯	4256 [3974; 4341] ◊◊●
Maximum level of oxygen consumption, ml min^{-1}·kg^{-1}	38,4 [36,6; 41,6]	43,6 [40,7; 45,7] *	47,7 [46,0; 52,7] ▲▲▲■■■	51,3 [49,2; 55,5] □□□♯♯♯♦♦	53,4 [47,0;59,5] ◊◊●●
Heart rate, beats min^{-1}	188 [176; 194]	183 [177; 186]	187 [177; 195]	185 [178; 189]	182 [180; 185]
O_2/HR, ml·$beats^{-1}$	18,9 [15,6; 21,8]	21,5 [18,6; 23,5]	21,9 [20,0; 26,6] ▲	24,3 [21,1; 26,7] □□♯	23,4 [22,2; 24,0] ◊

Remark:

** – p<0,05, ** – p<0,01 – group 2 regarding to group 1;*
▲▲ – p<0,01, ▲▲▲ – p<0,001 – group 3 regarding to group 1;
□ – p<0,05, □□ – p<0,01, □□□ – p<0,001 – group 4 regarding to group 1;
◊ – p<0,05, ◊◊ – p<0,01 – group 5 regarding to group 1;
■■■ – p<0,001 – group 3 regarding to group 2;
♯ – p<0,05; ♯♯♯ – p<0,001 – group 4 regarding to group 2;
● – p<0,05, ●● – p<0,01, ●●● – p<0,001 – group 5 regarding to group 2;
♦♦ – p<0,01 – group 4 regarding to group 3;
– p<0,05, ## – p<0,01 – group 5 regarding to group 3.

the cardiorespiratory system to stress had a multidirectional tendency. So, if the maximum levels of pulmonary ventilation and oxygen consumption increase in each subsequent group, the HR indicators, although they do not have significant differences between themselves, in the 4th group were less corresponding in the 1st and 3rd groups, and the median values HR 5th group was the lowest among all other groups (Table 1). The oxygen pulse rate (O_2/HR) in the 5th group of athletes was also smaller than the previous one and had significant differences between the groups (Table 1). In general, such dynamics of indicators indicates that athletes with the highest level of physical fitness, the effectiveness of the heart cycle is growing not due to an increase in heart rate, but due to an increase in systolic volume, which is consistent with the data of other authors [22].

We also carried out an analysis of body composition in different groups of physical performance in amateur athletes. The results showed that in age and height athletes of different groups do not differ among themselves, and there are significant differences in body weight only between athletes of the 2nd and 4th groups (Table 2).

Indicators of body mass index athletes in the first three

Table 2

Body composition of amateur athletes in different groups of physical performance (Me [25%; 75%])

Indicators	Groups of amateur athletes				
	1-st (n=8)	2-nd (n=22)	3-rd (n=35)	4-th (n=23)	5-th (n=6)
Age years	37,5 [31,5; 47]	35,5 [31; 40]	33 [30; 40]	31 [29; 33] □‡	34,5 [33; 36]
Height, cm	178 [174; 180]	181 [173; 184]	180 [176; 183]	180 [175; 185]	176 [176; 178]
Body weight, kg	79,5 [74,2; 86,3]	84,7 [78,3; 89,1]	78,9 [74,2; 85,2]	75,1 [69,7; 85,7] ‡	77,4 [71,4; 78,6]
Body mass index, kg m^{-2}	25,5 [24,3; 27,1]	26,2 [24,0; 28,1]	24,9 [23,9; 26,2]	23,5 [22,0; 24,9] □□‡‡‡♦♦	24,5 [23,1; 25,2]
Fat content, %	19,6 [17,1; 21,8]	20,1 [15,4; 22,9]	16,7 [13,2; 16,4]	12,6 [10,4; 15,9] □□□‡‡‡♦♦	12,7 [11,0; 16,7] ◊●
Fat mass, kg	16,2 [13,8; 17,9]	16,5 [12,3; 20,3]	12,8 [11,2; 16,4] ■	9,3 [7,8; 12,0] □□‡‡‡♦♦	10,7 [7,9; 13,1] ◊●
Weight without adipose tissue, kg	64,2 [62,3; 68,1]	67,7 [65,4; 71,6]	67,1 [61,6; 72,3]	65,1 [60,9; 73,9]	64,9 [63,6; 68,2]
Water content, kg	46,9 [45,6; 49,8]	49,8 [47,2; 52,4]	49,2 [45,1; 52,9]	47,6 [44,5; 54,1]	47,5 [46,5; 49,9]
Water content, %	58,9 [57,2; 60,7]	58,5 [56,5; 61,9]	61,3 [59,0; 63,9]	64,0 [61,6; 65,6] □□□‡‡‡♦	63,9 [60,9; 65,1] ◊●
Segmental body composition analysis					
Right leg					
Fat content, %	17,5 [15,2; 18,5]	17,8 [13,5; 20,1]	14,8 [12,6; 17,9]	11,4 [9,9; 13,0] □□□‡‡‡♦♦♦	13,6 [9,3; 16,3] ◊
Fat mass, kg	2,3 [2,0; 2,5]	2,4 [1,8; 3,0]	2,0 [1,6; 2,4]	1,5 [1,2; 1,8] □□□‡‡‡♦♦	1,9 [1,2; 2,1] ◊●
Weight without adipose tissue, kg	10,9 [10,4; 11,9]	11,9 [10,9; 12,1]	11,5 [10,8; 12,2]	11,3 [10,5; 12,6]	11,0 [10,9; 11,2]
Estimated muscle mass, kg	10,3 [9,9; 11,0]	11,3 [10,3; 11,5]	10,9 [10,3; 11,6]	10,7 [10,0; 11,9]	10,5 [10,3; 10,6]
Left leg					
Fat content, %	17,2 [15,7; 18,9]	17,3 [13,4; 20,3]	15,5 [12,6; 18,0]	12,0 [10,9; 13,9] □□□‡‡‡♦♦	14,0 [11,2; 16,3] ◊

Table 2 continued

Fat mass, kg	2,25 [2,0; 2,4]	2,4 [1,8; 3,0]	2,0 [1,6; 2,3]	1,5 [1,3; 1,8] □□ǂǂǂ♦♦	1,9 [1,3; 2,1] ●
Weight without adipose tissue, kg	10,7 [10,2; 11,6]	11,6 [10,8; 11,9]	11,2 [10,5; 12,0]	10,9 [10,3; 12,1]	10,7 [10,5; 10,8]
Estimated muscle mass, kg	10,2 [9,7; 10,9]	11,0 [10,3; 11,3]	10,6 [10,0; 11,4]	10,4 [9,8; 11,5]	10,2 [10,0; 10,2]
Right arm					
Fat content, %	18,0 [16,4; 20,8]	17,4 [15,3; 18,7]	15,5 [13,3; 17,0] ▲■	14,5 [11,8; 15,7] □□□ǂǂǂ♦	14,3 [12,7; 15,7] ◊●
Fat mass, kg	0,85 [0,75; 0,96]	0,8 [0,7; 0,9] **	0,7 [0,6; 0,9]	0,6 [0,5; 0,8] □□ǂǂǂ♦	0,65 [0,5; 0,7] ◊●
Weight without adipose tissue, kg	3,7 [3,6; 3,9]	4,1 [3,8; 4,2]	3,9 [3,7; 4,4]	3,8 [3,5; 4,4]	3,8 [3,7; 3,9]
Estimated muscle mass, kg	3,5 [3,4; 3,7]	3,8 [3,6; 4,0]	3,7 [3,5; 4,1]	3,6 [3,3; 4,1]	3,6 [3,5; 3,7]
Left arm					
Fat content, %	18,2 [16,3; 19,9]	17,7 [15,7; 19,8] ***	16,3 [14,4; 17,7] ▲	15,2 [12,3; 16,1] □□ǂǂǂ♦	14,1 [11,8; 15,4] ◊●
Fat mass, kg	0,9 [0,75; 1,0]	0,9 [0,7; 1,0] **	0,8 [0,6; 0,9] ■	0,6 [0,5; 0,8] □□ǂǂǂ	0,7 [0,6; 0,8] ●
Weight without adipose tissue, kg	3,8 [3,7; 4,1]	4,1 [3,8; 4,2]	3,9 [3,8; 4,5]	3,9 [3,4; 4,4]	3,9 [3,7; 4,3]
Estimated muscle mass, kg	3,6 [3,4; 3,8]	3,9 [3,6; 4,0]	3,7 [3,6; 4,2]	3,6 [3,2; 4,2]	3,7 [3,5; 4,0]
Torso					
Fat content, %	21,2 [18,1; 23,6]	21,4 [16,3; 25,4] ***	17,7 [12,8; 20,4] ■	12,8 [10,2; 17,4] □□ǂǂǂ♦	13,3 [11,2; 16,7] ◊●
Fat mass, kg	9,7 [8,1; 11,1]	9,9 [7,3; 12,4] ***	7,2 [5,7; 9,8] ■	5,9 [3,9; 7,3] □□ǂǂǂ♦	5,8 [4,3; 7,3] ◊◊●
Weight without adipose tissue, kg	35,6 [34,2; 36,9]	37,3 [35,2; 39,2]	36,8 [33,3; 39,6]	36,2 [33,3; 40,5]	35,6 [34,5; 38,2]
Estimated muscle mass, kg	34,2 [32,9; 35,5]	35,9 [33,8; 37,7]	35,4 [32,0; 38,1]	34,8 [32,0; 38,9]	34,2 [33,2; 36,7]

Remark:
*** – p<0,01, *** – p<0,001 – group 2 regarding to group 1;*
▲ – p<0,05 – group 35 regarding to group 1;
□ – p<0,05, □□ – p<0,01, □□□ – p<0,001 – group 4 regarding to group 1;
◊ – p<0,05, ◊◊ – p<0,01 – group 5 regarding to group 1;
■ – p<0,05 – group 3 regarding to group 2;
ǂ – p<0,05; ǂǂǂ – p<0,001 – group 4 regarding to group 2;
● – p<0,05 – group 5 regarding to group 2;
♦ – p<0,05, ♦♦ – p<0,01, ♦♦♦ – p<0,001 – group 4 regarding to group 3.

groups were higher, while the 4th and 5th ones were within the age range [23]. At the same time, athletes of the 4th and 5th groups, the absolute and relative fat content, both in individual segments of the body, and in general, was statistically significantly lower than the corresponding indices in other groups (Table 2). That is, the higher the level of general physical performance of an amateur athlete, the lower his fat content. Our results are consistent with the data of other authors who obtained similar data on the negative association of fat content and developed load capacity for representatives of other sports [18; nineteen]. The relative water content of the athletes of the 4th and 5th groups was also significantly

higher in this way in men with a lower level of physical performance (Table 2).

In addition, we analyzed the relationship between the level of physical performance and manifestations of the asymmetry of the physical development of amateur athletes on the sagittal plane. The results indicate that the development of the muscles of the lower extremities is characterized by right-sided asymmetry for all groups of athletes (Table 3). At the same time, the value of C_{AS} increases with the increase in the level of physical performance from the 1st to the 4th group. But fans with a high level of preparedness have a decrease in this ratio. This suggests that the increase in the level of physical performance in amateur athletes leads to a decrease in the asymmetry of the physical development of the lower limbs along the sagittal plane.

Conclusions / Discussion

In most locomotives included in the triathlon and stadium race, the main work is performed by the muscles of the lower extremities. The muscles of the upper limbs are involved only at the triathlon swimming stage. In stair race, the muscles of the hands do not perform a significant amount of work, so their development during the training is practically not happening. The time of the swimming stage in the triathlon competitions is considerably shorter than the cycling and running stages, and the developed muscles of the hands, although helping to increase the speed of swimming, become an additional mass at other stages. So it is shown that a decrease in the mass of the limbs that perform the movement, as well as a decrease in the amount of fat and inactive muscle mass leads to a decrease in the energy cost of running [15]. In our opinion, the limited training loads on the muscles of the upper extremities are caused by the need to reduce inactive muscle mass when running and cycling and determines the constancy of the asymmetry factors of the upper limbs in groups with different specific power levels at the maximum oxygen consumption level (Table 3).

But, with the development of the functional capabilities of the muscles of the lower extremities, the volume and intensity of the training loads on them are significantly higher for such arm muscles. When performing training exercises, a redistribution of the load between the muscles of the left and right side in favor of the stronger half can occur. Asymmetry of the load leads to uneven development of muscles and an increase in asymmetry in groups from first to fourth in terms of aerobic power. In a group with a high level of aerobic power, the increase in capacity is due to the equalization of the functional capabilities of the muscles of the left and right lower limbs in connection with the achievement of the boundaries of functional

Table 3

Value of the asymmetry coefficient (C_{AS}) in the lower and upper limbs relative to the sagittal plane in different groups of amateur athletes (M±SD)

Indicators	Groups	Fat mass, kg	WA, kg	EMM, kg
Right leg	1	2,29±0,45	11,01±0,79	10,45±0,73
	2	2,33±0,76	11,73±1,08	11,12±1,02
	3	2,05±0,73	11,56±1,12	10,96±1,05
	4	1,53±0,36	11,64±1,50	10,92±1,08
	5	1,70±0,50	11,15±0,98	10,57±0,91
Left leg	1	2,21±0,41	10,84±0,79	10,28±0,72
	2	2,34±0,71	11,43±1,04	10,85±0,97
	3	2,50±0,68	10,98±2,05	10,68±1,05
	4	1,59±0,37	11,13±1,10	10,56±1,03
	5	1,72±0,52	10,85±0,87	10,30±0,84
C_{AS}, %	1	3,13	1,59	1,68
	2	3,49	2,02	1,91
	3	3,99	2,62	2,57
	4	5,28	3,23 □□ǂǂ	3,24 □ǂǂ♦
	5	3,74	2,62	2,53
Right arm	1	0,84±0,15	3,69±0,31	3,49±0,31
	2	0,84±0,21	4,02±0,46	3,77±0,43
	3	0,74±0,23	4,03±0,55	3,79±0,52
	4	0,63±0,17	3,93±0,50	3,70±0,46
	5	0,60±0,18	3,85±0,36	3,65±0,36
Left arm	1	0,86±0,16	3,75±0,40	3,54±0,37
	2	0,89±0,23	4,06±0,49	3,82±0,47
	3	0,75±0,26	4,06±0,61	3,82±0,58
	4	0,65±0,18	3,94±0,57	3,71±0,56
	5	0,63±0,19	3,95±0,52	3,72±0,45
C_{AS}, %	1	1,028	1,032	1,022
	2	1,058	1,013	1,019
	3	1,059	1,020	1,022
	4	1,056	1,020	1,024
	5	1,028	1,032	1,022

Remark:
WA – weight without adipose tissueEMM – estimated muscle mass;
□ – p<0,05, □□ – p<0,01 – group 4 regarding to group 1;
ǂ – p<0,05; ǂǂ – p<0,01 – group 4 regarding to group 2;
♦ – p<0,05 – group 4 regarding to group 3.

reserves, enhances endurance at the work of the legs. Also, lower indicators of asymmetry of the lower extremities may be a necessary condition for achieving high levels of functionality characteristic of the fifth group. This can be achieved through specially organized technical training. The difference in factors that increase aerobic performance in the group with its highest level in comparison with other groups, and a decrease in the asymmetry of the lower extremities in the athletes under study may be interrelated phenomena.

Thus, the majority of amateur athletes who engage in a triathlon or stair ride along the highway have an asymmetry of the lower extremities. The most pronounced asymmetry of the lower extremities was athletes of the fourth group, that is, with working capacity at the level of maximum oxygen consumption 4,0–4,5 $W \cdot kg^{-1}$. In groups with the first to fourth, an increase in the asymmetry of the lower extremities is observed, whereas in a group with a high working capacity (4,6–5,5 $W \cdot kg^{-1}$) this tendency is violated, which may be a necessary condition for achieving high results.

The prospect of further research may be to establish a relationship between the indicators of asymmetry and the direction of physical and technical readiness.

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Application and influence of the complex program of physical therapy on the state of the cardiovascular and autonomic nervous system of young women, patients with alimentary obesity

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Purpose: *to investigate the dynamics of the types of reaction of the cardiovascular system to the dosed physical load using the Martine-Kushelevsky test and determine the functional state of the autonomic nervous system (ANS) using the Kerdo index of young women suffering from alimentary obesity under the influence of the developed comprehensive physical therapy program.*

Material & Methods: *study was based on the clinical and functional examination of 50 women aged from 18 to 30 years old, patients with alimentary obesity I–II degree.*

Results: *conducted and analyzed the state of the cardiovascular system on the dosed exercise with the help of the Martine-Kushelevsky and vegetative nervous system tests according to the Kerdo index.*

Conclusion: *use of a physical therapy program, which includes a low-calorie diet, massage, therapeutic gymnastics with elements of sports-oriented aerobics, dosed walking in combination with breathing exercises taking into account the activity of the ANS, helps to normalize the functional state of the cardiovascular and autonomic nervous system.*

Keywords: *obesity, physical therapy program, cardiovascular system, autonomic nervous system, examination of patients.*

Introduction

Obesity is an important risk factor for many serious medical problems leading to a decrease in the quality of life, a significant increase in morbidity and premature death. Due to increased food consumption, on the one hand, hypokinesia and reduced energy costs during work (mechanization and automation of heavy physical labor), on the other, obesity has become one of the social problems in industrialized countries, where people suffering from various forms of obesity make up 20–30% of the total population. Studies conducted in Ukraine have shown that the prevalence of obesity among people over 45 can be 52,6%, and overweight – 33,4%. Normal body weight is manifested only in 13,2% of the adult population of Ukraine. A large-scale study conducted simultaneously in 15 countries of the European Union, which was attended by 15,239 people over the age of 15, showed that obesity and weight gain are closely linked to a slow-moving lifestyle [9; 30].

Recently, the World Health Organization, the US National Institutes of Health, Organization of Healthy People 2010 offered recommendations for the classification of weight status by determining body mass index. The main reason for the increase in the prevalence of obesity and its complications is the energy imbalance between the excess energy in the body in the form of food and its expenditure due to a decrease in the physical activity of a modern person [26; 38]. This disease is an important risk factor for many serious medical problems, disrupts the activity of the cardiovascular system, and this is one of the main 3; [manifestations of obesity [17; 20; 28]. It is obesity that leads to the development of myocardial dystrophy, atherosclerotic vascular lesion, coronary heart disease, hypertension [19; 25; 27]. Disruption of the cardiovascular system may be complicated by the development of myocardial infarction, stroke, cardiovascular failure. With the progression of obesity with increasing body weight, fat is deposited in the connective tissue layers of the myocardium, making it difficult to contractile function. These changes in the myocardium lead to a marked decrease in the contractility of the heart muscle [36; 40; 41].

Obesity is often combined with such severe comorbidities, such as type 2 diabetes. This disease is one of the most important problems of modern medicine, which is associated with both the steadily growing prevalence and the high frequency and severity of complications of this disease [12; 39; 44]. Obesity is visceral, plays an important role in the development of insulin resistance (insufficient response of the body's cells to insulin with its sufficient content in the blood). Due to the insufficient effect of insulin, the percentage of glucose in the blood increases. This in turn affects the secretion (secretion) of insulin and the sensitivity of tissues to it, and this closes the vicious circle in the development of type 2 diabetes [16; 33; 47].

The negative effect of obesity on the respiratory system largely consists in the formation of respiratory and then heart failure in persons suffering from this pathology [13; 14]. In obesity, the function and function of the respiratory system is impaired, resulting from compression of the lungs, changes in blood circulation in the lung tissue [34; 35]. An increase in

body weight leads to the development of a high standing of the diaphragm, deformation of the chest, a decrease in its elasticity. In patients with obesity often develop acute and chronic bronchitis, pneumonia, pneumosclerosis. These patients are prone to frequent acute respiratory infections, influenza. Subsequently, they develop chronic pulmonary insufficiency. Violation of pulmonary ventilation against the background of a decrease in non-specific resistance is often accompanied by the development of long-lasting inflammatory processes, such as bronchitis, pneumonia [14; 21].

There are problems with the gastrointestinal tract [15; 18; 23]. Abundant nutrition leads to an overload of the gastrointestinal tract and its anatomical changes: an increase in the size of the small intestine, the absolute weight of which increases by 20–40%. The function of the gastrointestinal tract is changed in more than 55% of obese patients. It has been established that in 64% of patients an increase in gastric secretory function and the development of chronic gastritis is observed [22; 43; 45]. Obesity leads to the development of concomitant diseases of the nervous, reproductive, urinary, musculoskeletal system. These data suggest that in fact there is not a single organ, no system that would not suffer from obesity [2; 7]. Therefore, the treatment of obesity should be comprehensive, include physical therapy [1; 5, 34; 35], herbal medicine [11], massage [1; 6; 10], physiotherapy, diet therapy [5; 29], drug therapy and many other means of physical therapy [8].

Purpose of the study: analysis of the reaction of the cardiovascular system to the metered physical load and the state of the autonomic nervous systems of patients alimentary obesity under the influence of the developed comprehensive program of physical therapy during the rehabilitation process.

Material and Methods of the research

Examination of patients with alimentary obesity was carried out on the basis of the Kharkiv City Student Hospital. Under our supervision there were 50 women of the first mature age, patients with alimentary obesity of the I–II degree. They were arbitrarily divided into two groups: the main and control groups – 25 patients each. The average age of patients with MG was 24,49±0,71 years, CG – 24,06±0,57 years.

In the course of the study, the international instruments for the regulation of biomedical research were adopted: "Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects", adopted by the General Assembly of the World Medical Association (VMA, 1964, 1975, 1983, 1989, 1996, 2000, 2002, 2004, 2008, 2013) [51]; "Universal Declaration on Bioethics and Human Rights" (UNESCO, 2005) [49]; "Convention on the Protection of Human Rights and Dignity in Connection with the Application of the Achievements of Biology and Medicine", adopted by the Council of Europe (1997) [50].

For the purpose of determining and assessing the type of reaction of the cardiovascular system to the dosed physical load of the examined women, a Martine-Kushelevsky test was used – 20 squats for 30 s [24]. The results of functional tests were assessed by the following indicators: the degree of increased heart rate (%), changes in systolic and diastolic pressure, recovery time values of pulse and blood pressure after exercise, was determined by the indicator of quality reaction (IQR), which was calculated by the formula (1):

$$IQR\,(c.u.) = PP_2 - PP_1 / PS_2 - PS_1, \quad (1)$$

where PP_2 – pulse pressure on the 1st minute of the recovery period; PP_1 – pulse pressure before load; PS_2 – pulse in the 1st minute of the recovery period; PS_1 – pulse before o load.

In norm IQR = 0,5–1,0 c. u. [24].

With the help of the Martine-Kushelevsky test, the type of reaction to the measured physical load is determined:

– *Normotonic* – the pulse increases by 60%, systolic blood pressure increases by 20–40 mm Hg., diastolic blood pressure decreases by 5–15 mm Hg. or does not change, the pulse pressure increases, the recovery time of the pulse rate and blood pressure 2–3–4 minutes.
– *Hypotonic* – pulse increases by more than 120%, systolic blood pressure does not practically change, diastolic blood pressure decreases slightly or does not change, and pulse pressure does not change, recovery time of pulse frequency and blood pressure – 3–4–5 minutes, sometimes longer.
– *Hypertonic* – the pulse responds as in the normotonic type, the systolic blood pressure rises to 180–200 mm Hg., diastolic blood pressure rises to 90 mm Hg. and higher, the pulse pressure increases, the restoration of the pulse rate and blood pressure for 3–4–5 minutes may not take place.
– *Dystonic* – pulse reacted as in normotensive type, systolic blood pressure – as in normotensive type, diastolic blood pressure falls to 0 (the phenomenon of an infinite or zero pitch), the pulse pressure increases, the recovery heart rate and blood pressure – 3–4–5 minutes can and not take place.
– *Step increase in maximal arterial pressure* – the pulse responds as in the normotonic type of reaction, systolic blood pressure is 2–3 times longer than the first, the diastolic arterial pressure is as in the normotonic type of reaction, the recovery time is 3–4– 5 minutes or recovery is delayed.

Dissociated reactions – proceed according to the type of so-called "scissors", when there is a negative phase on the part of one of the indicators (pulse or systolic blood pressure). When the pulse rate decreases with an increase in systolic blood pressure, a reaction like cardiovascular dystonia occurs, and, conversely, in the presence of a negative phase from the systolic pressure, a reaction of the type of cardiovascular dissociation.

To study the status of ANS, which would allow to register relatively small changes in vegetative activity using a simple tool, while having any effect on the activity of the organism, we used the definition of the *vegetative Kerdo index* (V.I.) [46] and methods of mathematical statistics. V.I. calculated by the formula (2):

$$V.I. = (1 - d/p) \cdot 100, \quad (2)$$

where V.I. – vegetative index Cerdo, d/p – the ratio of diastolic pressure / pulse rate.

Estimation of the calculation of the Cerdo index are presented in Table 1.

Results of the research

According to the literature [4; 7, 9] it is known that the course of alimentary obesity, depending on the severity, is compli-

Table 1
Assessment of the vegetative index Cerdo

Indicators	Areas of ANS
from +16 to +30	sympathicotonia
≥ +31	expressed sympathicotonia
from –16 to –30	parasympathicotonia
≤ –30	expressed parasympathicotonia
from –15 to +15	balance of sympathetic and parasympathetic influences

Remark. *Norm: from –10 to +10%. A positive index value reflects the predominance of sympathetic regulation. Negative – predominance of parasympathetic regulation.*

cated by coronary artery disease, hypertension, vegetative dysfunction. The data obtained during the initial examination showed the absence of economization of the cardiovascular system, the presence of dysfunction of the autonomic nervous system, which was determined using the Kerdo vegetative index, in the direction of the predominance of the sympathetic section, confirming the data from literary sources [46; 49]. The Kerdeo vegetative index was determined in patients with alimentary obesity at the beginning and at the end of the study, as well as before exercise therapy sessions for timely correction, regulated breathing exercises, taking into account sympathic, parasympathicotonia or eutonia. Using the repeat definitions of the index, one can determine which shifts in the autonomic tone of the examined patients occurred during the time between individual studies [46; 48].

In determining the vegetative index of Cerdo, we found in the main group 23 people with sympathicotonia and 2 people with parasympathicotonia. In the control group of 22 people sympathicotonia was observed and 2 people had parasympathicotonia. Eutonia was not observed during the initial examination in the ExAg, in the control group we found 1 patient with the balance of the sympathetic and parasympathetic divisions of the ANS (Fig. 1).

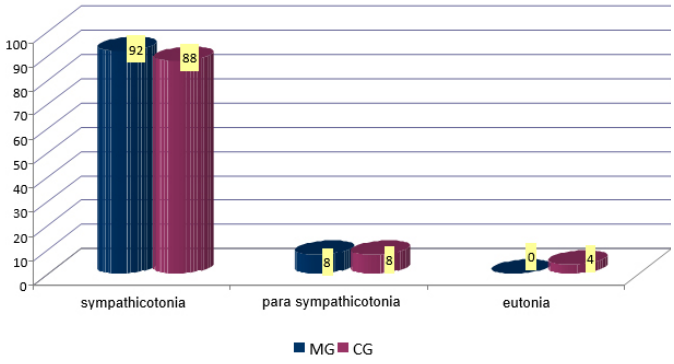

Figure 1. Predominance of ANS activity in patients of the main and control groups during the primary study (%)

The obtained data indicate a shift in Vagal-sympathetic balance towards weakening of vagal and sympathetic domination in patients of both groups, which is also confirmed by the Kerdo vegetative index (–7,00±1,23 – in patients with MG and –4,4±1,47 patients with CG) (p>0,05) [46] (Table 2).

When determining the type of reaction to the dosed physical load during the initial examination in both groups of people

Table 2
Hemodynamic parameters and the Kerdo index of women in the examined groups during the initial study (M±m)

Indicators	Norm	Survied groups		t	p
		MG, n=25	CG, n=25		
Kerdo index, c. u.	0±0,15	–7,00±1,23	–4,4±1,47	1.35	>0,05

with the normotonic type of reaction was not found. In both groups, the hypertonic type of reaction prevailed. So, in the main group 88,0% were detected with the hypertonic reaction type, with the dystonic type – 8,0%, with the hypotonic reaction – 4,0%; 84,0% were detected in the control group with the hypertonic type of reaction; with dystonic type – 8,0%, with hypotonic – 8,0% (Fig. 2).

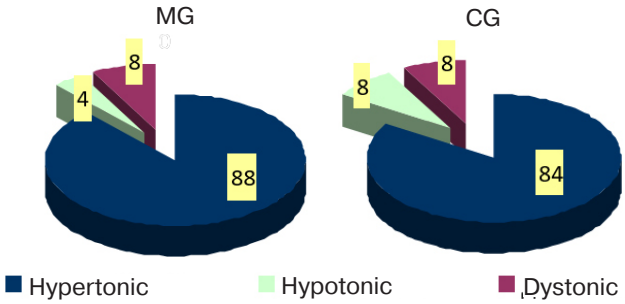

Figure 2. Types of reaction to the dosed physical load of women in the MG and CG during the initial study (%)

According to the data of the primary examination in the main and control groups the IQR in the Martin-Kushelevsky sample was less than the norm, which indicates an unsatisfactory reaction of the cardiovascular system of patients with physical exercise (Table 3).

Table 3
Indicators of the quality of the reaction in the sample Martin-Kushelevsky surveyed groups during the initial study (M±m)

Indicators	Norm	Survied groups		t	p
		MG, n=25	CG, n=25		
IQR, c. u.	0,5–1,0	0,44±0,01	0,45±0,01	0,57	>0,05

Thus, the initial examination of patients for alimentary obesity I–II degree showed that the indicators of the general condition of women in the main and control groups did not differ significantly, which indicated the homogeneity of the studied groups.

The program of physical rehabilitation for the patients of the main group consisted of: low-calorie diet number 8 [5; 29]; massage according to the method of P. B. Efimenko (2013) [10]; therapeutic gymnastics with elements of sports-oriented aerobics [8; 37], in which simple series of movements are used, as well as jumps, running in place; morning hygienic gymnastics; dosed walking in combination with breathing exercises, taking into account the activity of the ANS. In the control group of patients, a program of physical therapy was applied, which included physiotherapy exercises according to the method of S. N. Popov (2005, 2008) [34; 35], diet therapy

using a low-calorie diet was used [5; 29] and therapeutic massage according to the method of A. F. Verbova (2006) [6].

When analyzing the status of the ANS, a statistically significant improvement in indicators characterizing the imbalance of the sympathetic and parasympathetic parts of the ANS was observed. Thus, during repeated examinations in patients of the main group, eutonia was observed in 10 (40,0%), sympathicotonia – in 5 (20,0%), parasympathicotonia – in 10 patients (40,0%). In patients of the control group, eutonia was observed in 3 patients (12,0%), sympathicotonia – in 2 patients (8,0%), parasympathicotonia – in 20 (80,0%) (Fig. 3).

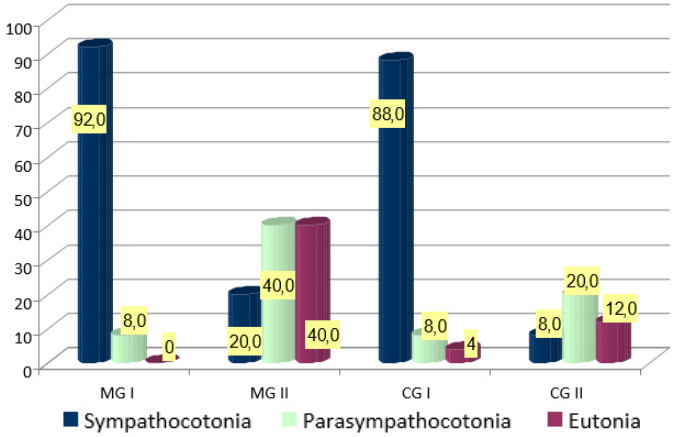

Figure 3. Dynamics of indicators of the state of the autonomic nervous system in patients of the main and control groups during the primary and repeated research (%)

When comparing the Kerdo index in a repeated study in both groups, we found a statistically significant difference in the main and control groups, indicating a greater positive effect of the author's program of physical therapy on the ANS tone (Table 4).

Table 4

Kerdo index in patients of both groups after repeated research (M±m)

Indicators	Norm	Survied groups		t	p
		MG, n=25	CG, n=25		
Kerdo index, c. u.	0±0,15	1,87±0,76	–0,2±1,26	1,81	<0,05

The introduction of complex physical rehabilitation has had a positive effect on the indicators of the quality of the reaction of the cardiovascular system on the metered physical load of patients with alimentary obesity I–II degree, as evidenced by the indicators of the functional test of Martine-Kushelevsky.

When determining the type of reaction to the dosed physical load during the re-examination in the MG, 9 (36,0%) were detected with the normotonic type of reaction, 14 (56,0%) with the hypertonic type of reaction (22% (88,0%) in the primary), with dystonic type – 2 (8,0%) (in the primary – 2 (8,0%) people), with the hypotonic type was not detected (in the initial study – 1 (4,0%). In the control group, with the repeated examination, 4 (16,0%) people were found with the normotonic type of reaction, 17 (68,0%) with the hypertonic type (with the primary group – 21 (84,0%) people); the number of patients with dystonic and hypotonic type remained at the same level – 2 people each (8,0%) (Figure 4).

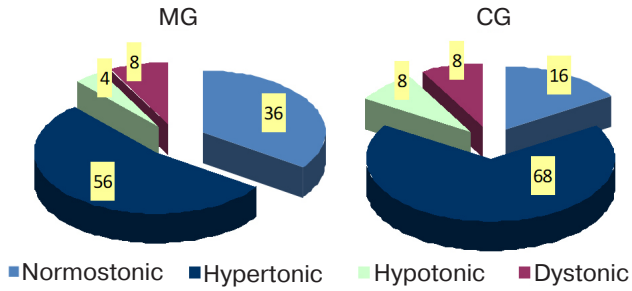

Figure 4. Types of reaction to the dosed physical load of women in the OG and KG during repeated research (%)

As a result of the application of a comprehensive program of physical therapy at the outpatient stage for 4 months in patients of the main and control groups, the quality indicators of the reaction according to the Martin-Kushelevsky sample significantly changed. Thus, in the main group of IQR increased by 47,7%, in the control group – by 24,4% (Table 5).

Conclusions / Discussion

Among the large number of works on the problem of rehabilitation / therapy for obesity, there are no generally accepted methods of physical exercise, there is no classification of the most physical exercises, and there are conflicting data about the exact methods of monitoring and regulating physical activity according to the condition of patients, that is, the optimal pedagogical control during group exercises in gymnastics with people who are overweight. In addition, recommendations for the use of diet therapy, massage and physiotherapy are rather contradictory and not individualized..

To increase the effectiveness of rehabilitation treatment of patients with alimentary obesity of grades I–II, we first developed, substantiated and applied in the main group of patients a differentiated program of physical rehabilitation. In developing a comprehensive physical rehabilitation program, we were guided by the tasks that should be solved when it is introduced in patients with alimentary obesity: stimulation of the metabolism due to the effect of exercise on the endocrine system; increase in energy consumption and weight loss through improved redox processes; improving the functional state of the cardiovascular and autonomic nervous systems and improv-

Table 5

Dynamics of indicators of the quality of the reaction in the Martin-Kushelevsky test in patients of both groups during the primary and repeated studies (M±m)

Indicators	Groups	Norm	Study periods		t	p
			Primary study	Repeated study		
IQR, c. u.	Main group	0,5–1,0	0,44±0,01	0,65±0,01	5,35	<0,05
	Control group		0,45±0,01	0,56±0,12	2,87	<0,05

ing the physical performance of patients [30; 31; 32; 42].

Thus, our studies have confirmed the need to correct the functional state of the autonomic nervous system and the type of cardiovascular system response to measured physical activity in patients with alimentary obesity I-II degree in order to reduce the severity of the disease, prevent the occurrence of complications and reduce the severity of concomitant pathology.

The prospect of further research is to study the peculiarities of the psychological status of young women with obesity.

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Legal regulation of physical culture and sports activities in Ukraine

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Purpose: *analyze the characteristics of the functioning of the existing system of legal regulation of physical culture and sports activities in Ukraine.*

Material & Methods: *literature review; analysis of documentary materials; system method, formal legal method.*

Results: *analysis of documents of state bodies shows that simultaneously issued acts contradicting each other. This indicates the absence of structure, synchronizes functions in the organism of the state, and provides communication between all parts of the state structure. In turn, on the part of the legislators, there is an imperative reflection of their imagination in opposition to the actual social conditionality.*

Conclusion: *in the system of organization of the management process, in particular, the peculiarities of the legal regulation of physical culture and sports activities in Ukraine, there is completely no consideration of the main provisions of the organization of legal activities; the management process is not regarded as an action, proceeds at a certain speed, regulated by the course of social transformations in society; the statistical determination of the occurrence of these processes in obtaining an equifinal result and the tolerance of the event space in which this process is carried out is not taken into account; there is no understanding of the theory of the dynamics of legal regulation of administrative management in the context of reforming social and political transformations.*

Keywords: *legal system, legal regulation, state authorities, law, decree, order.*

Introduction

Physical culture, as a sociocultural heritage, existed long before the appearance of any written language and was governed by the need for social relations that developed. As an activity, its development was associated with the pleasure of the collective need for physical improvement, which, above all, was based on the need to ensure the protection and fulfillment of the relevant work activity. As an integral part of the general sociocultural heritage, it has been preserved and reproduced the types of motor activity most in demand in the relevant living environment.

Nowadays, activities in the field of physical culture and sports within the state are regulated by laws adopted by the Verkhovna Rada of Ukraine and subordinate acts developed on the basis of them: decrees and orders (Cabinet of Ministers of Ukraine), decrees (President of Ukraine), orders of the Ministry of Youth and Sports of Ukraine, as well as decisions, programs, instructions, regulations, statutes and the like. The resolution of specific issues of physical culture and sports activities is influenced by legislative acts from the field of economics, education, medicine and other industries.

Based on the above, we can say that at present there is a need to develop scientifically grounded conceptual provisions of the theory of regulation of physical culture and sports activities in the context of the problem of organizational and legal constructions of the norms of regulation of legislation of the field of state power.

Analysis of recent research and publications only indicates an episodic study of the system of legal regulation of physical culture and sports activities in Ukraine. The researchers focus on the consideration of individual issues of the formation of the national branch of the law "sports law of Ukraine" [1]; organizational and legal foundations of public administration [8]; regulatory, functional and methodological foundations of the formation of public administration at the level of administrative-territorial entity [19], the mechanism of state administration of physical culture and sports in Ukraine [2].

However, a comprehensive scientific research and solutions require the functioning of the existing system of legal regulation of physical culture and sports activities in Ukraine. The relevance of this work is also emphasized by the order of the Ministry of Education and Science of Ukraine dated 15.05.2018.

Purpose of the study: to analyze the characteristics of the functioning of the existing system of legal regulation of physical culture and sports activities in Ukraine.

Material and Methods of the research

The study used the following research methods: analysis of literary sources; analysis of documentary materials; system method, formal legal method. The analysis of literary sources was used to determine the degree of scientific elaboration of the studied questions and the interpretation of the data obtained when comparing different points of view on the studied problem. Official normative legal acts regulating activities in the field of physical culture and sports were also analyzed, which allowed defining the characteristic features of the functioning of the existing system of legal regulation of physical culture and sports activities in Ukraine. The system method allowed to investigate the legal system, the state as complex phenomena, systematize and evaluate the accumulated data.

Using the formal legal method, state-legal categories were described, their external and internal forms (in particular, the competence of state bodies, etc.) were investigated.

Results of the research

The significant importance of the sphere of physical culture and sports in the development of society was determined by the Law of Ukraine "On Physical Culture and Sport", adopted in 1994 [7]. The unsuccessful attempt to implement the Law of Ukraine "On Physical Culture and Sport", adopted in 1994, led to the adoption in 2009 of the Law of Ukraine "On Amendments to the Law of Ukraine" On Physical Culture and Sport " [6], which was enacted on January 1, 2011.

In the course of our study, it turned out that the lack of legal regulation of physical culture and sports activities in the legal framework of Ukrainian legislation and the accuracy of defining the functions of physical culture and sports activities does not always lead to a violation of the legal norms regulating physical culture and sports activities.

In particular, in 1996 Decree of the Cabinet of Ministers of Ukraine No. 80 approved the Regulation on state tests and standards for assessing the physical fitness of the population of Ukraine [12]. This resolution was sent in pursuance of Article 26 of the Law of Ukraine "On Physical Culture and Sports" and the State Program for the Development of Physical Culture and Sports in Ukraine. This task was assigned to the Ministry of Education and Science, the Ministry of Defense, the Ministry of Internal Affairs, the Security Service of Ukraine with the aim of introducing tests and standards for assessing the physical fitness of children, students, students, and people of military age, personnel of the Armed Forces, internal affairs agencies and other military formations established in accordance with the law.

Control over the implementation of the resolution of the Cabinet of Ministers of Ukraine of January 15, 1996 No. 80 was assigned to the Ministry of Youth and Sports. After 12 years, this Resolution, and did not have sufficient implementation, was canceled by the resolution of the Cabinet of Ministers of November 5, 2008 No. 992 [16] as having lost its force. In this case, the Prescription of the commands of the imperativeness of the authorities does not reflect the actual social conditionality of the Resolution of the Cabinet of Ministers of Ukraine of November 5, 2008 No. 992.

In our opinion, the cancellation of tests was not the right decision, since the test is a standard test of the effect of directional content. Used tests exist and are used for thousands of years; the direction of their action is determined by the arsenal of life in the appropriate habitat. The directionality of the action has a quantitative measurement value in terms of time, strength and spatial characteristics of the performance, allows us to enter the criterion of the complexity of its implementation. Existing tests fully met these requirements.

It should be noted that the introduced standards were also impractical to abolish, and as in any measurement, there should be a standard in relation to which the comparative indications are read. A randomly selected standard or "conditional rate" in statistics is defined as a "conditional average" value. Regarding its value, the "true norm" is defined, which characterizes the average level of the current value of the studied indicator.

Practically, the execution of the Decree of the Cabinet of Ministers of Ukraine of January 15, 1995 No. 80 should have led to the restoration of departmental sports societies and sports clubs, as it was before. But they are canceled completely as an unprofitable structure, forgetting that a physically trained worker has high labor productivity and brings more benefits to the enterprise.

In our opinion, the failure to comply with the resolution is primarily due to the lack of feedback or sufficient observability of the performance of the assigned work by the performers, which are specified in the resolution, and the lack of an item of financial expenses for its implementation.

In the course of our study, regulatory and policy documents of our government were also analyzed. So, in 2011, the Cabinet of Ministers of Ukraine issues an order dated August 31, 2011 No. 828-p "On approval of the Concept of the National Targeted Social Program for the Development of Physical Culture and Sports for 2012–2016" [11]. The concept of the program presents the existing problems in sufficient detail, the causes that caused these problems, the purpose of the Program, the possible ways to solve the problems identified, the overall indicative amount of expenses provided for the implementation of the Program objectives in the amount of 32.2 billion UAH. However, neither the tests nor the standards for monitoring physical development, physical fitness and physical condition have been established. We believe that without them the implementation of the Program is almost impossible.

In the Concept of the National Targeted Social Program for the Development of Physical Culture and Sport for 2012–2016. It was noted that the lifestyle of the population of Ukraine and the state of the sphere of physical culture and sports pose a threat and is a significant challenge for the Ukrainian state at the present stage of its development. This statement was characterized by several reasons, the main of which were:

✓ demographic crisis, due to the decrease in the number of Ukraine's population from 52,2 million in 1992. Up to 45,8 million in 2011;
✓ unformed traditions, established and motivated to physical education and mass sports as an important factor of physical and social well-being, improving health, maintaining a healthy lifestyle;
✓ deterioration in the health of the population with sharply progressing chronic heart diseases, hypertension, neurosis, arthritis, obesity and other diseases, which led to a decrease in the number of people who can be involved in the sport of higher achievements, which can train, withstand significant physical exertion and achieve high sports results;
✓ compared to 2007, the number of persons who, for health reasons, are classified as a special medical group, increased by 40%, which led to a decrease in the number of children and young people in youth sports schools by 110 thousand;
✓ non-compliance with the requirements of modernity and a significant backwardness from the world standards of resource, personnel, scientific and methodological, medical and biological, financial, material and technical, information support [11].

The term of the Program is over, but the indicators of the state of development of physical culture and sports in Ukraine have somewhat deteriorated. Massiveness in sports and recreational physical culture has decreased even more. The suc-

cess of Ukrainian athletes on the world stage has sharply decreased, sports schools continued to close, physical education in higher educational institutions was taken out of the number of compulsory classes. It is worth noting that all these changes pass through the decision of the Cabinet of Ministers of Ukraine. This indicates a rather large inconsistency of the decisions taken and their groundlessness [10].

Complementing the above, for example, we cite the Resolution of the Cabinet of Ministers of Ukraine of December 9, 2015 No. 1045, which approved the "Procedure for conducting an annual assessment of the physical fitness of the population of Ukraine" [13]. According to the decree of the Ministry of Youth and Sports, the Ministry of Education and Science, the Ministry of Internal Affairs, the Ministry of Defense, regional state administrations are tasked to develop tests and standards for 2016 to conduct an annual assessment of the physical fitness of the population of Ukraine and, starting in 2017, conduct an annual assessment of the physical fitness of the population of Ukraine, and by December 1, submit to the Ministry of Youth and Sports of Ukraine information on conducting an annual assessment of the physical fitness of the population of Ukraine to summarize it and submit it before December 30 of the Cabinet of Ministers of Ukraine. Coordination of the implementation of activities of central and city executive authorities on the annual assessment of the physical fitness of the population of Ukraine is entrusted to the Ministry of Youth and Sports of Ukraine without considering the capacity of the potential of this Ministry.

On the same date, December 9, 2015, the Order of the Cabinet of Ministers No. 1320-p welcomes the Concept of the State target social program for the development of physical culture and sports for the period up to 2020 [10] and specifies the decree of the Cabinet of Ministers of Ukraine of August 31, 2011 No. 284 "On approval of the Concept of the National Targeted Social Program for the Development of Physical Culture and Sport for 2012–2016".

The essential feature of the new Concept of the State target social program for the development of physical culture and sports for the period up to 2020 is that the priority of the development of state policy is the introduction of European standards of living in Ukraine. In terms of the Concept, problems are actually covered, without which the idea of introducing European standards is practically impossible. It is possible to speak only of the desire for such standards, since standards derive from their social conditionality, and not the will of the law. On March 1, 2017, the Cabinet of Ministers of Ukraine issued a decree "On approval of the State targeted social program for the development of physical culture and sports for the period up to 2020" [3].

An analysis of nationwide targeted social programs for the development of physical culture and sports, which change one for the other, showed that they contain figures for the decline in the population of Ukraine. Initial indicators of 1992 record that the population of Ukraine was 52.4 million. In 2010, this figure dropped to 45.8 million people in 2014, it already reached an estimate of 42.2 million people. A further decrease in the population of Ukraine does not appear in the reports, because the real account of its number is not conducted due to the social situation in the country.

Particular attention should be paid to the legal support of the activities of the central executive body in the field of physical culture and sports. In 2015, the Cabinet of Ministers of Ukraine developed a draft Law of Ukraine "On Amendments to Article 6 of the Law of Ukraine" On Physical Culture and Sport (regarding the clarification of certain powers)" [17] in order to ensure effective management of the sphere of physical culture and sports and in accordance with of the decree of the President of Ukraine of January 12, 2015 No. 5 "On the Sustainable Development Strategy" Ukraine 2020" [18], resolutions of the Cabinet of Ministers of Ukraine of August 13, 2014 No. 408" Issues of restrictions imposed on inspections by state inspectorates other regulatory authorities" [15] and on September 10, 2014 No. 442" On the optimization of the system of central bodies of executive power" [14].

According to the initiators of the bill, it will help ensure the fulfillment of the functions entrusted to the Ministry of Youth and Sports of Ukraine to form and implement state policy in the field of physical culture and sports, ensure a reduction in the regulatory influence of the state on sports and maximize delegation of authority in the field of physical culture and sports to civil society, as well as the co-sponsorship of the Sustainable Development Strategy "Ukraine-2020".

As is known, until 2010, the central executive body in the field of physical culture and sports provided: licensing of business entities in the field of physical culture and sports and monitoring compliance with the licensing conditions for the implementation of physical culture and health and sports activities; organizing and conducting sports activities of professionals and sports enthusiasts; activities to prepare athletes for competitions in various sports, recognized in Ukraine [17].

At the same time, in 2010, paragraph 18 of Section I of the Law of Ukraine "On Amendments to Certain Legislative Acts of Ukraine Concerning the Restriction of State Regulation of Economic Activities" [5] Article 8 of the Law of Ukraine "On Physical Culture and Sports" (regarding the organization of licensing physical culture and sports) was excluded [7].

In addition, Decree of the President of Ukraine dated January 12, 2015 No. 5 approved the Sustainable Development Strategy "Ukraine 2020" [18], which notes that the medium-term goal of further reforms in this area is to create a favorable environment for doing business, developing small and medium-sized businesses, attracting investment, international trade and improving the efficiency of the labor market. The strategy establishes requirements for reducing the number of permissive documents and types of economic activities subject to licensing, the abolition of regulatory acts that make it difficult to conduct business, reducing the number of state supervisory (control) bodies.

Decisions of the Cabinet of Ministers of Ukraine of August 13, 2014 No. 408 "Issues of restrictions on inspections by state inspectorates and other regulatory bodies" [15] and September 10, 2014 No. 442 "On optimizing the system of central executive bodies" [14] does not exercise state supervision (control) in the field of economic activity.

At the same time, according to the theory of public administration, it is known that the body that makes appropriate management decisions should have the right to control them or entrust this function to other bodies subordinate to it. Consequently, the question arises of the need to form an inspection,

one of the main tasks of which is the implementation of state supervision (control) in accordance with the requirements established by the Law of Ukraine "On central executive authorities" [4]. At the same time, in accordance with paragraph three of part two of Article 18 of the Law of Ukraine "On Central Executive Authorities", inspections are formed if the majority of the functions of the central executive body are control and supervisory functions.

To implement the control mechanism, annually an organizational-administrative document of the Ministry of Youth and Sports should approve a plan for inspections of activities of economic entities in the field of physical culture and sports, which today numbers more than 12,0 thousand Units. However, for this it is necessary to take measures to attract additional human resources, which will ensure the organization of control over the quality of health and fitness and sports services, in turn, given the financial and economic situation in the country, will lead to additional costs from the State Budget of Ukraine.

In addition, the Order of the Cabinet of Ministers of Ukraine dated October 23, 2013 No. 902 approved the "List of enterprises, institutions and organizations related to the management of the Ministry of Youth and Sports", whose powers include the organization of control over the quality of sports and sports services [17].

Conclusions / Discussion

From the analysis of documents of state bodies it can be seen that at the same time acts are issued that contradict each other, which indicates the missing structure of the synchronizing function in the body of the state, provides communication between all parts of the government. In turn, on the part of the legislators, there is an imperative reflection of their imagination of actual social conditionality.

In the system of organizing the process of management, in particular, the peculiarities of the legal regulation of physical culture and sports activities in Ukraine, there is a complete lack of consideration of the main provisions of the organization of legal activity. The management process is not considered as an action, it proceeds with a certain speed, regulated by the course of social transformations in society, with the power of manifestation and heterogeneity of their territorial location.

The statistical determination of the occurrence of these processes in obtaining an equifinal result and the tolerance (inaccuracy, fuzziness) of the event space in which this process is carried out, does not take into account the possible complexity (availability) of the ability to solve the problems, and not the desired level of its achievement.

There is no necessary observability system based on the results of management actions taken and the centralized structure of its construction. There is no understanding of the theory of the dynamics of legal regulation of administrative management in the context of reforming the sociopolitical transformations of society, leading to the need for an adequate redistribution of the government's potential to ensure its policy of achieving the goal stated in the basic law of the state, which is the Constitution of Ukraine.

Prospects for further research. These shortcomings determine the need for theoretical development of the legal regulation of physical culture and sports activities in Ukraine, taking into account the different significance of each of the constituent concepts and their functions in ensuring the functioning of the state. In this case we are talking about physical culture and sports activities.

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Assessment of risk factors associated with the level of physical activity in childhood and at the time of the survey in postmenopausal women with osteoporosis and vertebral body fractures

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Today, discussions are continuing on the effect of regular exercise in childhood in preventing bone loss in postmenopausal women, as well as the positive effect of physical exercise (PE) in the prevention of osteoporotic fractures in older age groups.

Purpose: *to assess risk factors associated with the level of physical activity (PA) in childhood and at the time of the examination in postmenopausal women with osteoporotic and vertebral body fractures.*

Material & Methods: *in a one-time study examined 115 postmenopausal women aged 50–89 years. For analysis, the patients were divided into two groups: I (control) group – persons without any osteoporotic fractures in history (n=84), II (main) group – patients with vertebral body fractures at the level of the thoracic and lumbar spine (n=31). With the help of a specially developed questionnaire, the authors evaluated the characteristics of the PA of patients at different age periods of life and at the time of the survey.*

Results: *no significant differences were found in the frequency and types of sports in childhood between groups, depending on the presence of vertebral body fractures. The majority of patients with vertebral fractures (85,7%) began regular exercises of PA in childhood with the age of 10 years (41,7% in the control group, p=0,04), and in 57,1% of individuals the duration of these exercises was 1–4 years and did not differ from the control group. The frequency, type and duration of physical activity classes and the duration of physical therapy procedures, as well as the level of daily physical activity, did not significantly differ in women depending on the presence of vertebral body fractures, although the proportion of people who worked on a regular basis in sections was significantly higher among patients with vertebral fractures (41,9%) compared with individuals without fractures (10,7%, p=0,0002). In addition, the proportion of women in the control group who were physically active 6 or more hours per day was significantly higher (14,3%) compared with the corresponding indicator of the main group (3,2%, p=0,04).*

Conclusion: *women with vertebral fractures were more often practiced regularly in sections and less physically active than those without fractures. The duration, regularity and age of starting sports in childhood can affect the risk of vertebral fractures in postmenopausal women, requires further study.*

Keywords: *physical activity, childhood, postmenopausal women, osteoporosis, vertebral fractures.*

Introduction

Discussions about the effects of regular exercise in childhood in preventing bone loss in postmenopausal women [1–3], as well as the positive effect of moderate exercise in the prevention of osteoporotic fractures in older age groups [4–7], continue to this day. Some reviews of literary sources indicate the absence of a long-term protective effect of physical activity (PA) and regular physical exercise (PE) in childhood and adolescence on bone health in adults, which, in particular, may also be due to the lack of promising long-term studies [2]. However, given the results of recent studies that the development of osteoporosis in adults is associated with the formation of a peak in bone mass in childhood and adolescence, it is obvious that special attention should be paid to primary prevention of osteoporosis at an early age, contributing to the formation of a maximum peak in bone mass during maturation of the skeleton. It is important to develop in children and adolescents an understanding of the importance of a healthy lifestyle, regular exercise and adequate physical activity for the effective prevention of osteoporosis and its complications [3; 8].

According to the results of a meta-analysis [9] on the effect of regular PA or sports on the state of bone tissue in various groups of subjects, it was found that a slight positive effect of physical activity is observed only in boys in the pre- or early puberty (relative risk (RR) – 0,17; 95% confidence interval (CI): 0,02–0,32), but not for girls in puberty (RR=0,01; 95% CI: –0,18–0,17), boys (RR=0,10; 95% CI: –0,75–0,95) and adolescent girls (RR=0,21; 95% CI: –0,53–0,97), premenopausal women (RR=0,00; 95% CI: –0,43–0,44) and postmenopause (RR=0,00; 95% CI: –0,15–0,15).

Modern literary data confirm that jumping exercises increase the mineral content of bone in prepubertal children, and bone

mineral density (BMD) is higher in adolescent athletes who engage in wagon-and-sexual exercises. Aerobic exercises in combination with strength (for strengthening muscles) and exercises to improve coordination increase BMD indicators, reduce the severity of back pain, improve coordination of movements and quality of life in young women and premenopausal women, and also prevent falls, which is especially important for postmenopausal women and older men. The authors also note that the sport and the type of exercise that is used must differ according to the life cycle [1, 10–13]. Thus, multi-purpose complexes of physical therapy (PT) and individually selected PE in accordance with the life cycle are important strategies for the prevention of osteoporosis and vertebral body fractures.

Purpose of the study: assess the risk factors associated with the level of physical activity in childhood and at the time of the examination in postmenopausal women with osteoporosis and vertebral body fractures.

Material and Methods of the research

On the basis of the Ukrainian Scientific Medical Center for Osteoporosis Problems, the State Institution "Institute of Gerontology named after DF Chebotarev NAMS of Ukraine" in a one-time study, 115 postmenopausal women aged 50–89 years were examined. This study was approved by the Ethics Committee of the State Institution "Institute of Gerontology named after DF Chebotarev NAMS of Ukraine", all patients signed informed consent to participate in the study. The surveyed completed questionnaires independently under the control of the researcher. For analysis, two groups were identified: the first (control) group was women without any osteoporotic fractures in the history (n=84), the second (main) group – patients with fractures of the vertebral bodies at the level of the thoracic and lumbar spine (n=31) The features of the menstrual function (age of menarche, menopause, duration of the postmenopausal period), body composition (height, weight, body mass index) and using a specially designed questionnaire (table) were studied. The features of the PA of patients in different age periods of life and at the time of the survey (sports, PA, duration and regularity of classes, type of PE, body position during the day).

Analysis of the anamnestic parameters showed no significant differences in the age of menarche (respectively, in the control and main group women, 13,7±1,4 and 13,8±1,5 years (t=0,46; p=0,64)) the age of menopause (49,3±4,7 and 48,6±4,3 years, respectively (t=1,08; p=0,28)) and the duration of postmenopause (respectively 17,1±9,1 and 19,1±8,2 years (t=1,65; p=0,10)).

When analyzing the indicators of objective examination, we found reliable low growth rates in patients with vertebral fractures compared with the corresponding control indicators (155,9±6,2 and 158,0±5,6 cm (t=2,59; p=0,01)). Also significantly lower were the indicators of body weight (respectively 69,6±13,4 and 80,4±15,7 kg (t=5,10, p=0,000001)) and body mass index (respectively 28,6±4,7 and 32,2±5,9 conventional units (t=4,62, p=0,000006)). Obviously, a decrease in growth is associated with the presence of vertebral body fractures, and low body mass index is an independent factor of osteoporotic fractures, which is consistent with the results of existing literature sources [14; 15].

The statistical processing of the results of the study was carried out using the "STATISTICA-10.0" program package. The differences between the groups were established using Student's criterion, χ^2 test, and a comparison test of two proportions. A critical level of significance was considered $p<0,05$.

Results of the research

When analyzing the frequency (%) of sports or any type of PA in childhood and young age, we did not establish significant differences between groups depending on the presence of vertebral fractures (control group – 28,6%, main group – 22,6% (p=0,52)). However, when assessing the regularity of sports in childhood and young age, a tendency was established (according to the results of a comparison test of two

Questionnaire on the level of physical activity

№	Question	Possible answers		
1.	Did you play sports or any kind of physical activity in childhood and young age? (school, institute, etc.)	No	Yes	
2.	**a)** What sports (physical activity) did you do? **b)** How long? (weeks, months, years). **c**) At what age did you start playing sports? **a**_____ **b**_____ **c**_____			
3.	Do you do any kind of physical activity (gymnastics, yoga, walking or sports) at the moment?	No	Yes	
4.	What type of physical activity do you do? _____ _____			
5.	How much time (minutes) does one procedure take for your physical activity?	Write _____		
6.	How long have you been doing? (weeks, months, year)	Write _____		
7.	How much time per day are you physically active, without taking into account sports or special gymnastics?	Write _____		
8.	Type of physical activity you perform most often? (underline or write)	easy – walking, dusting, washing dishes	medium – floor washing, hand washing	heavy – move furniture, work in the country
9.	Types of Exercise Are You Using More? (underline or write)	walking, running, swimming, biking, etc.	exercises with loads	flexibility exercises, increased coordination
10.	In what position, most often, is your body during the day? (underline)	standing	sitting/lying	in motion

proportions: p=0.10) to more frequent regular sports activities among women in the control group (27,4%) compared with the corresponding indicator of the main group (12,9%).

In evaluating the types of exercises that the respondents were engaged in in childhood (cyclic exercises, sports types of games), there were also no significant differences between the groups depending on the presence of vertebral body fractures. 58,3% of the control questionnaires and 57,1% of the main group (p=0,96) were engaged in cyclical sports in childhood. The corresponding indicators for playing sports games amounted to 33,3% for the control and 28,6% for the main group (p=0,84). However, when assessing difficult coordination exercises that were performed in childhood, it was found that women in the control group were significantly less likely (p=0,01) to do this type of exercise (45,8%) compared with patients of the main group (100%).

In addition, when assessing the duration of sports activities in childhood among patients who were engaged in them, there were also no significant differences in groups depending on the presence of vertebral body fractures. So, 1–4 years were studied by 50,0% of women in the control group and 57,1% of those in the main group (p=0,74), 5–9 years – 37,5% of the control group and 42,9% of patients in the main group (p=0,77). However, in the control group, we identified 12,5% of persons who had been engaged for more than 10 years, whereas in the main group no women were found whose duration of PA classes in childhood would be more than 10 years.

When analyzing the indicator of the age at which they started studying various types of PA in childhood, it was found that its average was 8,9±2,4 years for the control group and 7,3±1,8 years for patients of the main group (p=0,11), although it did not differ significantly depending on the presence of vertebral fractures. However, an analysis of the distribution of the examined by age, from which regular PE began in childhood, found significant differences between the groups. Thus, in the control group, 41,7% of women started classes from 5 to 9 years old, whereas in the main group the corresponding figure was 85,7%. From 10 years of age, 58,3% of the examined control and 14,3% of the main group of patients (p=0,04).

In assessing the level of physical activity (physical therapy exercises, including in sections) at the time of the survey, we did not establish significant differences between groups depending on the presence of vertebral body fractures. The results of patients with vertebral fractures (67,7%) did not differ from those in the control group (66,7%; p=0,91). However, among the patients of the main group, there was a significantly higher proportion of people working on a regular basis in the sections (respectively, 41,9% of the examined) compared with 10,7% of women in the control group (p=0,0002).

When analyzing the frequency of various types of PA, we also found no significant differences between groups depending on the presence of vertebral body fractures. Thus, 19,0% of the main and 21,4% of patients in the control group (p=0,84) were engaged in cyclic sports. Also, no significant differences were found in the proportion of the surveyed who were involved in coordination types of physical exercises (physical therapy, yoga, Pilates) between the control groups (96,4%) and the main group (100%).

When assessing the duration of physical therapy exercises among the surveyed, who gave a positive response regarding regular classes, it was found that its average was 5,3±5,2 years for the control group and 5,6±12,8 years for patients in the main group and not significantly different depending on the presence of vertebral fractures. The distribution of patients depending on the duration of physical therapy exercises also did not reveal significant differences between groups depending on the presence of vertebral fractures. So, it was revealed that 1% of women studied for 1–4 years, 80,4% of the control group and 61,9% of the main group, 5–9 years – 8,9% of the examined patients and 28,6% of patients of the main group, more than 10 years – 9,5% of women in the control group and 10.7% of patients in the main group.

In addition, no significant differences were found between the groups and when analyzing the duration of exercise therapy procedures. Thus, in the majority of patients (75,0% of the control and 85,7% of patients in the main group), the duration of a single exercise therapy was 10–30 minutes, and 25,0% of the control and 14,3% of the patients in the main group did exercise therapy regularly during 45–60 minutes (p=0,30).

When analyzing the types of PE that the patients use regularly during their exercises, exercise therapy also revealed no significant differences between the groups depending on the presence of vertebral fractures. Thus, in the control group, aerobic (cardio) exercises were performed by 37,5% of the examined individuals, whereas in the main group the corresponding representative was 28,6% (p=0,51). Anaerobic (strength) exercises were regularly performed by 55,4% of women in the control group and 47,6% of patients in the main group (p=0,58). Flexibility and coordination exercises were regularly performed by 39,3% of women without vertebral body fractures and 42,9% of patients with vertebral fractures. (p=0,74).

When analyzing the duration of the daily activity (excluding physical therapy classes), we have not established reliable differences in women, depending on the presence of fractures of the vertebral bodies. 28.6% of control women and 38,7% of the subjects in the main group were physically active for 1–2 hours per day (p=0,30), 3–5 hours – 57,1% of the control subjects and 58,1% of the patients the main group (p=0,92). Only the proportion of women in the control group who were physically active 6 or more hours per day (14,3%) was more reliable than the corresponding indicator of the main group (3,2%) (p=0,04).

When assessing the level of physical activity that patients use in their daily activities, we found that in 75,0% of women without vertebral fractures and 80,6% of people with vertebral body fractures, physical activity was mild or moderate (dusting, washing dishes, washing floors, washing by hand), while 25,0% of patients in the control group and 19,4% of patients in the main group are engaged in performing difficult types of work (working in the country, moving furniture, etc.) (p=0,50).

In assessing the position of the body, in which patients are most often found during the day (standing, sitting, lying, or in motion), we have not established significant differences depending on the presence of vertebral body fractures. The women of the main group (32,3%) and the control group (44,0%) were equally sedentary (sitting or lying, standing), and 67,7% of the examined patients with vertebral fractures

and 56,0% of patients without fractures anyway were regularly in motion (p=0,24).

Conclusions / Discussion

To date, the lack of physical activity has been identified as the fourth leading risk factor for global mortality (6% of deaths worldwide) [16]. It has been established that immature lifestyle is observed in people regardless of age and leads to the development of many diseases, in particular, disorders of the locomotor system, premature aging and death. It has now been proven that regular PE (strength, stretching and coordination exercises), as well as walking, reduce back pain, need for analgesics, increase muscle strength, improve coordination of movements and quality of life with osteoporotic fractures [12; 17].

It has also been established that exercise and exercise at young age influence the strength of bone tissue. The process of bone mass accumulation and the rate of mineralization in the age group of 19 to 23 years of age among students regularly engaged in sports, and their peers who lead a sedentary lifestyle, vary significantly. Density of the bones is determined by the specifics of the training activity and increases with the increase of sports skills. The highest dynamics of the rate index of ultrasound propagation was established at athletes (4041,17±82,89 $m \cdot s^{-1}$ at 19 years to 4065,13±90,75 $m \cdot s^{-1}$ at 23 years, respectively ($p < 0,05$)), which is related both to the specifics of motor activity and the nature of physical activity (speed-force, cyclic, complex coordination, etc.). Smaller, though reliable, it was in gymnasts (respectively, from 4012,11±128,26 to 4030,94±104,50 $m \cdot s^{-1}$; $p<0,05$), weightlifters (from 3931,30±137,55 to 3967,11±137,55 $m \cdot s^{-1}$; $p<0,05$) and wrestlers (from 3865,50±71,25 to 3930,63±89,33 $m \cdot s^{-1}$; $p<0,05$). The corresponding figure for students not involved in sports, was respectively: from 4012,09±110,02 $m \cdot s^{-1}$ in 19 years to 4058,30±117,98 $m \cdot s^{-1}$ in 23 years; $p<0,05$) [3].

In studying the relationship between the level of PA in 15, 18 and 23 years and the rates of BMD in 3454 young people (men and women), it was established [18] that the level of PA in a young man of 15 years was reliably related to the parameters of the lumbar spine BMD (β=0,061 $g \cdot cm^{-2}$; 95% RR: 0,02–0,11). In addition, a dose-dependent positive effect of PA on BMD indicators in young men aged 18 years was revealed. Men aged 23, who were in the two highest apartments for PA, had significantly higher BMD indices in all anatomical parts of the spine compared with men who were in the quartile itself. High rates of BMD in men aged 30 years were among those whose PA levels were high in at least one age group (18 or 23 years) compared with physically inactive peers in both groups. Women with a high quartile for PA at 23 had higher BMD at the level of the femoral neck at 30 (β=0,02; 95% RR: 0,001–0,04).

Indicators of BMD and the risk of fractures were studied in a study of M. Tveit et al. [19] football players who are players are retired (30 years after the end of their career) compared to age control. It was established that in male football players 30 years after the completion of a football career, the Z indicator at the level of the entire skeleton was 0,4 SD (0,1–0,6), the lower limbs – 0,5 SD (0,2–0,8), femoral neck – 0,3 SD (0,0–0,5), and the level of all fractures, respectively, 0,6 SD (0,4–0,9), any low-energy fractures – 0,4 SD (0,2–0,9). The authors indicate that the results suggest that regular PE at a young age have a significant effect on bone strength and risk of fractures in old age, and proper PA for young people can reduce the burden of fractures in older age groups.

In a review by R. M. Bielemann and sang [20] analyzed the relationship between PA during life and the indicators of mineral density and bone tissue saturation in young people. Positive associations between PA level and bone mass were found to be more pronounced in men than in women at the level of weight loading anatomical sites (lumbar spine and neck of the femur) than at the level of the entire skeleton, and when measurements of the level of PA were conducted from adolescence to an adult's life than when evaluated only during one of the aforementioned periods of life. However, the authors note the impossibility of a joint analysis of the included studies for their heterogeneity and the use of various tools for assessing the level of PA.

Another literature review by M. S. Zulfarina et al. [21] also confirmed the positive relationship between PA and the formation of a peak in bone mass in adolescents with high changes in the bones, however, as noted by the authors, its strength may differ depending on gender and measurement sites.

To date, due to the lack of promising long-term studies, the estimated long-term sustained protective effect of PA and PE in children and adolescents on the strength of BT in adulthood has not been fully established [2; 19; 21], therefore, studies on the relationship between sports in childhood and the state of BT in postmenopausal women remain important and necessary.

The purpose of this work was to study the risk factors associated with the level of physical activity in childhood and at the time of the survey in postmenopausal women with osteoporosis and vertebral body fractures.

We have not established significant differences in the frequency and types of sports in childhood between groups, depending on the presence of vertebral body fractures. The majority of patients with vertebral fractures (85,7%) began regular exercises of PA in childhood with the age of 10 years (41,7% in the control group, p=0,04), and in 57,1% of individuals the duration of these exercises was 1–4 years and did not differ from the control group. The frequency, type and duration of physical activity classes and the duration of physical therapy procedures, as well as the level of daily physical activity, did not significantly differ in women depending on the presence of vertebral body fractures, although the proportion of people who worked on a regular basis in sections was significantly higher among patients with vertebral fractures (41,9%) compared with individuals without fractures (10,7%, p=0,0002). In addition, the proportion of women in the control group who were physically active 6 or more hours per day was significantly higher (14,3%) compared with the corresponding indicator of the main group (3,2%, p=0,04).

The limitations of this study are its design (one-moment, not longitudinal), sample size, inclusion of only female population, and analysis conducted only in individuals with one type of osteoporotic fractures (fractures of vertebral bodies), does not allow making reliable conclusions about the long-term effects of PA rate of loss bone tissue and the risk of fractures in older persons and requires a full study.

The study showed that women with vertebral fractures are more often regularly engaged in PE in sections and less physically active compared to those without fractures. The duration, regularity and age of starting a sport in childhood may influence the risk of vertebral fractures in postmenopausal women, requires **further study.**

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Relationship of indicators of oxygen-containing blood elements with the duration of systematic triathlon training for amateur athletes

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Purpose: *to investigate the nature of changes in the indicators of oxygen-containing blood elements in amateur athletes with different duration of systematic triathlon training.*

Material & Methods: *peripheral blood taken from 96 physically active men examined was considered as an object of study. Indicators of oxygen-containing blood elements were determined using an automatic hematological analyzer (MicroCC-20 Plus, США).*

Results: *amateur athletes showed a link between the duration of regular triathlon classes and red blood indicators, in particular, a significant increase in the content of red blood cells and hematocrit was shown in the sixth month of triathlon training for non-athletes. Revealed a significant decrease in the average red blood cell volume in the blood of amateur athletes for 12 months of triathlon training compared to untrained individuals.*

Conclusion: *most pronounced changes in oxygen-containing blood parameters are observed in amateur athletes in the first 4–6 months and depend on the duration of systematic aerobic exercise. With the duration of systematic classes of 1 year, there is a stabilization of indicators, which may be associated with the achievement of the optimal level of functioning of the blood system. The decrease in oxygen-containing blood parameters during long periods of systematic training may be associated with inadequate intensity of training loads or intense competitive activity.*

Keyword: *amateur athletes, indicators of oxygen-containing blood elements, triathlon.*

Introduction

Today, one of the most priority directions of state policy in Ukraine is the formation and preservation of public health [9; 18]. Evidence of a certain state attention to this problem is the approval of the National Doctrine of Development of Physical Culture and Sports [22], the State Targeted Social Program for the Development of Physical Culture and Sports for the Period up to 2020 [20] and others. The need to adopt these documents is due to a steady trend in recent years to a decrease in the level of public health, primarily in combination with other adverse factors, associated with a lack of physical activity. Despite the fact that the analysis of the level of coverage of mass sports in the world shows that, unfortunately, the Ukrainians are several times inferior to the leading countries of the world in this indicator [9], it is noteworthy that in modern Ukrainian society the interest of citizens in a healthy lifestyle is increasing [18].

World experience shows that systematic exercise in an optimal way provides for improving the state of human health, increasing its general working capacity and endurance, improving the functional state [24; 27; 34; 39; 41]. The study of the direction of motor activity of members of fitness clubs revealed that amateur athletes have a kind of fitness priorities, which are caused by real circumstances, opportunities, requirements, as well as individual tastes [2]. However, it should be noted that the beginning of recovery after a long break, or intensive training in amateur sports clubs, despite their absolute benefits, is a stress for the unprepared to perform intense physical activities of the human body. To prevent training for beginner athletes and individuals engaged in recreational physical culture, serious testing, and the task of medical control during sports and wellness training is an objective assessment of the functional state and functional capabilities of the body of this category of people. In addition, the effectiveness of classes in any form of physical exercise (from professional sports in medical physical culture) largely depends on the degree of fitness for physical activity and the adequacy of their dosage. It also needs to take into account the age, gender and individual characteristics of the body of those involved. Only the coordination of the functioning of organs and systems of different levels, their adaptation to the conditions of active life, makes it possible to talk about an adequate response of the body to physical exertion of different volume and intensity [1; 13].

At the moment, the question of the possibility and between the use of indicators of peripheral blood to assess the effect of physical activity on the human body in scientific literature remains open. The basic ideas about the diagnostic significance of hematological indicators in the physiology of sports activities are that in general they are within the normal range for healthy individuals, and their quantitative changes can be related to a number of specific and nonspecific factors, in particular, professional, as well as individual tolerance of various hematological indicators to a certain type of muscular activity [8].

It is known that the systematic implementation of physical exercises aimed at the development of endurance, lead to

adaptive changes in many physiological systems of the body. According to modern concepts, the blood system is not only directly involved in the energy supply of intense muscular activity, but also occupies one of the leading places in the complex of physiological systems that form nonspecific adaptive reactions of the body and provide both the ability to perform these loads and the very existence of the organism [13]. This is due to its ability to quickly respond to various effects of changes in its morphological composition due to the presence of reflex and humoral pathways of blood formation, significant cellular reserves, as well as various functions of blood cells [3; 6; 17].

It should be noted that the scientific literature mainly presents data obtained as a result of studying the effect of physical exertion on blood parameters in individuals who have a long, systematic sports experience and specialize in a particular sport. It is known that the training of athletes is conducted according to a specific program aimed at achieving personal or team results. At the same time, a fairly large category of people involved in sports with recreational and recreational purposes. This kind of training has a slightly different training regime, and, consequently, a different nature of the body's reactions. In addition, data on the medical and biological assessment of the morphological or functional state of such a group of people in the literature are practically absent.

The study of the influence of sports training on various parts of the blood system today is relevant because, on the one hand, amateur athletes sometimes achieve such intensity of training as qualified athletes, and on the other, they do not recover enough after training and competitive loads, which can negatively affect on the functional state of their body as a whole [11].

Purpose of the study: to investigate the nature of changes in the indicators of oxygen-containing blood elements in amateur athletes with different lengths of systematic triathlon classes.

Material and Methods of the research

The study involved 96 physically active men – amateur athletes, average age 32,0 (23,0–51,0) years old, who began to engage in triathlon and long-distance running on the highway. Of these, 40 beginners constituted a control group that had not previously been involved in specialized sports training, or in fitness and recreation activities, and 52 people who were divided into groups depending on the duration of training: Group I – amateur athletes who worked for 2 months; II, III and IV – 4, 6, 8 months, respectively; V, VI and VII – amateur athletes who were engaged in 1, 2 and 3 years respectively.

Amateur athletes who participated in the study were healthy, as evidenced by health certificates from medical institutions. In addition, all persons were informed about the content of the tests, measurement procedures and gave their consent to conduct testing and to use their personal data in scientific research. Examination of amateur athletes was carried out in compliance with the international principles of the Helsinki Declaration of the World Medical Association [23; 46], the UNESCO Universal Declaration on Bioethics and Human Rights (2005) [4] and in accordance with the Law of Ukraine "Fundamentals of Ukrainian Legislation on Healthcare" [7] on ethical norms and rules for conducting biomedical research involving human.

The study was conducted after a day of rest with a standardized food and drinking regime. Capillary blood sampling was carried out in the morning on an empty stomach before training. Determination of the quantitative and percentage content of erythrocyte levels in a sample (hemoglobin (HGB) erythrocytes (RBC), hematocrit (HCT), as well as determination of the mean cell volume (MCV), mean cell hemoglobin (MCH), mean hemoglobin concentration in the erythrocyte (MCHC)) was performed using an automatic hematology analyzer (MicroCC-20 Plus, USA).

Statistical processing of the research results was performed using generally accepted methods of variation statistics [21]. Used non-parametric research methods. Statistical significance adopted at $p<0,05$. For the analysis and interpretation of data, the application package GrafPad Prism 4.0 (GrafPad SowtwareInc., USA) was used.

Results of the research

Analysis of the erythrocyte link of the hemogram in the obtained samples showed that in amateur athletes they are within the limits of the physiological norm [16]. The results are shown in the table.

When analyzing the data obtained, it was found that in group I amateur athletes there is a decrease in the content of HGB, MCHC and MCV by 3,3%, 4,5% and 4,2%, respectively, compared to the control group, with almost unchanged red blood cell content. With a decrease in hemoglobin there was a decrease in MCH of more than 11% compared with the control group. It should be noted that the difference between these indicators compared with the control group was not reliable ($p>0,05$).

Indicators of the erythrocytic link of the hemogram of amateur athletes, depending on the duration of systematic training (x±SD)

Indicators	Control group	I (n=7) 2 months	II (n=8) 4 months	III (n=7) 6 months	IV (n=8) 8 months	V (n=11) 12 months	VI (n=8) 24 months	VII (n=3) 36 мс.
HGB, g l^{-1}	153,8±11,01	148,8±5,74	153,7±11,68	153,2±15,97	153,3±8,33	153,5±11,40	152,8±10,44	153,2±10,53
RBC, x10^{12}/l	4,98±0,53	5,04±0,50	5,20±0,22	5,40±0,47*	5,31±0,10	5,29±0,20	5,24±0,20	5,20±0,15
HCT, %	45,50±3,35	47,38±3,26	47,77±3,61	48,51±2,93*	47,77±1,65	45,57±2,58	44,93±2,77	44,08±1,34
MCV, fL	91,79±6,36	87,90±5,73	90,17±1,86	90,14±3,50	89,97±1,55	87,01±4,74*	88,46±4,31	87,72±2,61
MCH, pg	31,21±3,14	27,65±1,37	29,60±1,25	28,56±3,37	28,20±1,13	29,00±1,79	28,80±2,22	29,1±2,66
MCHCg/l	340,1±27,07	324,8±15,63	328,3±13,58	326,7±33,96	324,0±7,00	333,0±20,98	329,3±23,30	337,6±22,61

Remark. ** – p≤0,05 compared to the control group.*

It is shown that in group II of amateur athletes there is a tendency to increase in the content of HGB relative to the corresponding indicator in group I, followed by its unchanged content in groups III, IV, V as compared with the control. In group VI, the average HGB content decreased in comparison with the V group. An increase in the RBC content in the II and III groups by almost 4.5% and more than 8% ($p<0,05$), respectively, relative to the control group, followed by a decrease in the IV, V, VI, and VII groups compared to group III was also detected. At the same time, the concentration of HCT grew in groups I, II and III by more than 4%, 5% and 6,6% ($p<0,05$) compared with the control, followed by a decrease in IV, V and VI and VII groups compared with group III.

It was shown that MCV decreases, starting from group III to group VII by almost 2% in Groups II, III and IV, respectively, by 5,2% ($p<0,05$), 3,6% and 4,4% in V, VI and VII groups, respectively, for control. The same trend is observed in changes in the MCH and MCHC indicators, but there was no significant difference between these indicators.

Conclusions / Discussion

In analyzing our data, a reduction in hemoglobin in the blood during the second month of occupation (group II) was shown among amateur athletes, with the level of erythrocytes almost unchanged. A decrease in the hemoglobin content on the background of relatively unchanged values of the mean values of erythrocytes in the blood may be due to the presence of interconnection of the average hemoglobin content in erythrocytes with hemoglobin in the blood, which most likely indicates a deficiency in the body of plastic materials (protein and / or iron). Iron deficiency can be caused by loss of it as a result of sweating, while the amount of exogenous iron is inadequate to the growing needs of the body. The presence of the relationship of the average hemoglobin content in erythrocytes with the concentration of erythrocytes probably indicates an excess of the rate of formation of erythrocytes over the rate of hemoglobin stimulation.

It is known that the correct training system contributes to the gradual growth of training, but in order to have a training effect, the training load must be sufficiently long. This concerns both individual physical exercises in the training session, the training session itself, and the training cycle as a whole. The intensity and duration of training loads and their relationship with the training effect depends primarily on the orientation of the sports training. It is proved that the total threshold duration of physical activity, in which the training effect is manifested, namely, there are signs of an increase in the level of training, is 3–4 months [10].

An increase in the mean values of hemoglobin, erythrocyte hematocrit and a decrease in MSV, MCH and MCHC, beginning with group II (4 months of classes), and a significant increase in group III (6 months of classes) compared to control indicates a gradual increase in fitness. Amateur athletes probably need more time to achieve a training effect.

It is known that important factors for maximum aerobic capacity and physical performance are blood volume, hemoglobin content and mass of red blood cells. During muscular activity, especially when performing exercises of primarily aerobic nature, the body's need for oxygen increases dramatically, which is satisfied by an increase in blood flow velocity, as well as a gradual increase in the amount of hemoglobin in the blood due to a change in the total blood mass [15; 36]. Thus, endurance training leads to a significant increase in circulating blood volume, while the higher this indicator, the greater the blood flow rate and the longer the red blood cell is in the microcirculation, the smaller the blood supply to the internal organs and the working muscles, which ultimately leads to an increase in the buffer capacity blood [6]. An increase in hemoglobin concentration in the blood can legitimately be associated with a true increase in the volume of circulating plasma and a subsequent increase in the hemoglobin content in erythrocytes, which constitutes a sequential chain of adaptive shifts that occur under the influence of aerobic exercise [3; 12; 14]. Increased hematocrit is associated with an increase in hemoglobin concentration caused by physical exertion, due to the transfer of a portion of plasma from the vascular bed to the extracellular space [30]. The increase in hematocrit concentration is aimed at increasing the oxygen capacity of the blood to ensure the energy needs of the body of athletes. However, a significant increase in oxygen capacity leads to an increase in blood viscosity, an increase in blood flow resistance and a further voltage of other blood circulation subsystems, and may be accompanied by activation of cardiac activity. [30].

J. A. Pierez G. et al. [38] showed that in the group of healthy women over 55 years of age, after a four-month program of aerobic physical training, a significant increase in hemoglobin, hematocrit, MSV, MCH and maximum oxygen consumption was observed. However, there were no significant changes in the content of red blood cells and MCHC.

Mayr A. et al. [37] when comparing changes in the blood indices of skaters and non-athletes, no significant difference was found between these groups. It was shown that in the group of sportsmen MSV was large, the MCH also increased, but not significantly in relation to the group of people who did not play sports. At the same time, there was a decrease in MCHC in the blood in the group of athletes compared with the control group. An increase in MSV and a decrease in MCHC in the blood can probably be the result of changes in the erythrocyte membrane properties caused by acidosis and increased osmolarity during exercise.

It should be noted that with the growth of the intensity of endurance training in the tissues of the body, the oxygen demand increases, thereby increasing the load on the system of oxygen supply to the body. In stressed endurance exercises, hemodilution occurs, which results in a reduction in hemoglobin, hematocrit and deficiency, or a disruption of the functioning of the erythrocytes due to their structural damage, despite an increase in the total mass of hemoglobin [32; 43]. The decrease in hemoglobin in the blood of athletes, despite the increase in the total mass of hemoglobin in athletes [26], is called sports anemia [35]. Such a phenomenon is considered to be a normal physiological response to intense loads [29; 37]. There were several hypotheses [40] that explain sports anemia in athletes who develop endurance: increased iron loss or reduced iron absorption [33; 45], a decrease in erythropoiesis [31] and an increase in plasma volume [31]. These processes in the body of a person involved in sports, due to the presence of one of the possible ways of the reaction of the blood system to training loads. The data we obtained on a slight decrease in the content of hemoglobin and erythrocytes in amateur athletes after long systematic studies confirm the

above literature data.

It should be noted that in the scientific literature data on changes in the indices of the red blood of individuals for a long time train endurance, contradictory and relate in most cases to professional athletes. So, F. Sanchis-Gomar et al. [42] showed that an increase in physical activity may justify a significant decrease in the content of red blood cells and hemoglobin. On the other hand, Schumacher et al. [44] reported that training did not cause changes in hemoglobin in the blood of athletes compared with untrained individuals. However, in a study by Yu. A. Petrov [19], it has been shown that athletes, who endurance training compared with those not involved in sports, reduced the number of red blood cells and hemoglobin. Bojadjiev and Taralov [28] have shown that chronic (that is, more than one year) high intensity exercise reduces hemoglobin content in a mature male population. In the works of other authors it was shown [25] that the values of hemogolobin values decreased in athletes engaged in cycling in the competitive period compared with the values of this indicator before the start of training and / or competitions. Different focus of the results may be related to conducting research at different stages of the training process and gender-age differences of the contingent under study.

The results of this study show that the most pronounced changes in blood parameters are observed in amateur athletes in the first 4–6 months and depend on the duration of systematic aerobic exercises. With the duration of systematic classes of one year, the indicators stabilize, which may be due to the achievement of the optimal level of functioning of the blood system. Reduced blood counts during long periods of systematic training may be associated with inadequate intensity of training loads or intense competitive activity.

The prospect of further research may lie in the study of the individual characteristics of changes in peripheral blood indices of amateur athletes, taking into account the increase in fitness in the dynamics of systematic triathlon classes.

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Search for indicators that determine the effectiveness of overcoming acyclic sections at 50, 100 and 200 meters in freestyle swimming

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Purpose: *to establish the most significant indicators affecting the athletic performance of highly skilled swimmers during the overcoming of acyclic sections at 50, 100 and 200 meters in freestyle swimming.*

Material & Methods: *theoretical analysis and synthesis of scientific and methodical literature, pedagogical observation, video filming, timekeeping, methods of mathematical statistics. The surveyed group (n=24) consisted of highly qualified swimmers (MS, MSIG, HMS), take on at a distance of 50, 100 and 200 meters freestyle.*

Results: *the peculiarities of overcoming starting and turning sections at distances of 50, 100 and 200 meters of freestyle were studied. The level of significance of the underwater phase after performing starts and turns relative to the 15 m mark is established. The degree of correlation relationship between time, speed and distance for the underwater phase for the speed of passage of various segments of distance is revealed.*

Conclusion: *improvement of starting and turning techniques, due to the increase in speed and distance of the underwater phase, is one of the reserves for the further growth of the skill of swimmers who specialize in freestyle.*

Keyword: *swimming, freestyle, start, turns, underwater phase.*

Introduction

Today, there is an increased interest of scientists and practitioners to study the structure of the competitive activity of swimmers, in which movements of a cyclical and acyclic nature are distinguished. Cyclic work regardless of the length of the distance at 70–80% determines the sports result. The effectiveness of overcoming the start and turn is determined by the technique of their performance, the capabilities of the swimmer, which often has a decisive influence on the sporting result [2–6]. Depending on the length of the course, the role of acyclic work in the structure of the swimmer's competitive activity varies.

After the start and turn, most swimmers on the world stage try to swim most of the distance under water, up to the 15-meter mark permitted by international competition rules, performing powerful wave-like dolphin legs. Overcoming the underwater phase – "exit", allows the swimmer to reach a speed 10–15% higher than the distance, because when swimming under water, the resistance to wave formation disappears [2; 3; 9].

The analysis of the special literature showed that today there are different approaches to determining the length of individual sections at different distances. There are discrepancies in the length of the starting segment of 10 m or 15 m, the segment of swimming 5 m or 7,5 m, repulsion from the rotation of 5 m or 10 m, the finishing section of 5 m and 10 m [1–3; 5; 7]. Limiting the length of diving sites to 15 meters makes it a convenient point for determining the effectiveness of overcoming acyclic sections [4; 7; 8; 9]. In turn, issues related to the study of the characteristics of the underwater part of the distance ("exit") by swimmers remain insufficiently studied.

Purpose of the study: to establish the most significant indicators affecting the sports result of highly skilled swimmers during the overcoming of acyclic sections at distances of 50, 100 and 200 meters in freestyle swimming.

Objectives of the study:

1. Determine the features of the overcoming of acyclic sections at distances of 50, 100 and 200 meters in freestyle.

2. Identify the most important indicators of acyclic areas that affect on the athletic performance in freestyle distances of varying lengths.

Material and Methods of the research

Data collection was carried out in the period from 2016–2018. during the championships and cups of Ukraine in swimming in 50-meter pools. The surveyed group (n=24) consisted of highly qualified swimmers (Master of Sports, Master of Sports of International grade, Honored Master of Sports), performing at 50, 100 and 200 meters freestyle. The processing of the video of the swims made it possible to identify indicators of the speed of the starting and turning sections, to establish the length of the slide and the "exit" after their execution. Were fixed: the length of the segment from the starting stand before the athlete appeared on the surface of the water, the time and speed of swimming at the level of 15 m for each 50-meter segment of distance, the length of the dive after pushing away from the rotary shield of the pool.

Results of the research

The analysis of the structure of competitive activity of highly

qualified swimmers during the overcoming of 50 m in free style allowed to determine the characteristics of the start segment (the length and speed of the "exit", as well as the speed at 15 m) of athletes (Table 1).

On average, the length of the "exit" after the start for athletes is 11,28±0,96 m, which is 22,56% of the total length of the course, and the time for underwater work is 3,86 seconds (17,46%). At the same time, the leaders of the world swimming at a distance of 50 m reach the "exit" after the start: at Сйsar Cielo – 11 m, at Ronald Schumann – 12,5 m, and at Florent Manad – 13 m. performance of the start, an increase in the length of the "exit" at a 50-meter distance may contribute to the further growth of skills of domestic swimmers-sprinters.

The study also established the level of significance of the underwater phase after the start, the length of the "exit" (L), relative to the 15-meter start segment. Thus, the ratio of the lengths of the "exit" and the reference mark of 15 m is 75,22%, and the ratio of time is 70,98% (Figure 1).

Using the method of correlation analysis, the degree of influence of the parameters of time, speed and distance for the underwater phase on the speed of the 15-meter ($V_{15\,m}$) and 50-meter ($V_{50\,m}$) distance segment was revealed. It was established that the speed of the "exit" after the start has the greatest correlation with the indicators $V_{15\,m}$(r=0,96) and the average degree of correlation with $V_{50\,m}$ (r=0,67). In addition, $V_{15\,m}$ affects $V_{50\,m}$ (r=0,81). Also indicators of time $t_{15\,m}$ correlate with $t_{50\,m}$ (r=0,85).

The length of the "exit" after the start correlates with $V_{15\,m}$ (r=0,69), has an inverse relationship with $t_{15\,m}$ (r=–0,75) and has a significant effect on $V_{50\,m}$ (r=0,76), i.e. the final sports result at this distance.

At a distance of 100 m in the freestyle swimming among athletes there were differences when overcoming acyclic sections (Table 1). The length of the "exit" after the start and turn is significantly different (11,17 and 6,43 m, respectively).

The percentage ratio of the length of the underwater phase at the start and the reference mark of 15 m is 74,44%, and in time – 68,55%. The ratio of the length of the "exit" after turning to the mark of 15 m is 42,89%, and the time – 36,60% (Figure 1).

Correlation analysis allowed us to establish the degree of influence of the parameters of time, speed and distance for the underwater phase on the speed of passage of various segments of the distance. Thus, the speed of the "exit" after the start has a sufficient relationship with the indicators $V_{15\,m}$ (r=0,76) and a high degree of relationship with $V_{50\,m}$ (r=0,95). $V_{50\,m}$ m is influenced by the speed of passing the 15-meter mark (r=0,73). Indicators of the length of "exit" after the start correlate with t "exit" (r=0,77).

The speed of the "exit" after turning has a high correlation with the speed indicators in the area "50–65 m" (r=0,96), and in the area "50–100 m" only 0,69. The length of the "exit" after rotation correlates with the t "exit" (r=0,70) and the speed of the second 50-meter segment (r=0,74).

At a distance of 200 m in freestyle swimming, differences were noted during the passage of acyclic sections. The length of the "exit" after the start (9,39 m) and each subsequent turn gradually decreases (4,56 m, 4,36 m and 4,13 m, respectively). Under the influence of growing fatigue, the same trend is observed in terms of swimming speed (Table 1).

The percentage ratio of the "exit" length indicators after the start and the 15 m mark is 62,58%, and the time – 57,27%. The ratio of the length of the exit after the 1st turn to the mark of 65 m is 30,42%, and time – 24,10%. The exit length after the 2nd and 3rd turns to the mark of 115 m and 165 m is 29,08% and 27,50% respectively (Figure 1)

At a distance of 200 m, the correlation analysis showed a different degree of interrelation of indicators of time, speed and distance for the underwater phase to the speed of passage of various segments of the distance. Thus, the speed of the "exit" after the start has an average relationship with the indicators $V_{15\,m}$ (r=0.59) and $V_{50\,m}$ (r=0,57). $V_{50\,m}$ is influenced by the speed of passing the 15-meter mark (r=0,78). The length of the "exit" after the start correlates with $V_{15\,m}$ (r=0,61).

The length of the "exit" after the 1st turn has a high correlation with the speed in the area "50–65 m" (r=0,94) and the speed of the second 50-meter segment (r=0,90). The speed

Table 1

Indicators of technical actions of athletes in acyclic areas in freestyle swimming at distances of 50, 100 and 200 m, $\bar{X}\pm\sigma$

Segments	L exit, m	t exit, s	V exit, $m\cdot s^{-1}$	t 15 m, s	V 15 m, $m\cdot s^{-1}$	t on 50 m, s	V 50 m, $m\cdot s^{-1}$	Result
50 m								
Start – 50 m	11,28±0,96	3,86±0,33	2,93±0,31	5,43±0,48	2,78±0,24	22,11±0,92	2,26±0,09	22,11±0,92
100 m								
Start – 50 m	11,17±0,61	3,71±0,44	3,03±0,23	5,42±0,27	2,77±0,14	23,66±0,82	2,12±0,07	23,66±0,82
Turn –100 m	6,43±1,36	2,41±0,51	2,71±0,37	6,58±0,48	2,29±0,16	25,74±0,60	1,94±0,05	49,40±1,24
200 m								
Start – 50 m	9,39±0,94	3,65±0,36	2,73±0,37	6,37±0,47	2,37±0,18	26,98±1,18	1,86±0,08	26,98±1,18
1st turn – 100 m	4,56±0,69	1,80±0,31	2,57±0,38	7,45±0,57	2,02±0,16	29,20±1,25	1,71±0,07	56,19±2,36
2 nd turn – 50 m	4,36±0,61	1,70±0,41	2,78±1,13	7,83±0,55	1,92±0,13	30,17±1,49	1,66±0,08	86,36±3,72
3 rd turn – 00 m	4,13±0,74	1,66±0,41	2,61±0,76	7,84±0,59	1,92±0,15	30,63±2,27	1,64±0,12	116,99±5,52

$V_{65\,m}$ after the turn correlates with the speed indicators on the second 50-meter segment (r=0,96). The length of the "exit" after the 2nd turn correlates with the speed in the segment "100–115 m" (r=0,85) and the speed of the segment "100–150 m" (r=0,95). The speed of the segment "100–115 m" has a high correlation with the speed indicators in the section "100–150 m" (r=0,90). The length of the "exit" after the 3rd turn is interconnected with the speed on the section "150–165 m" (r=0,83) and the speed of the segment "150–200 m" (r=0,56).

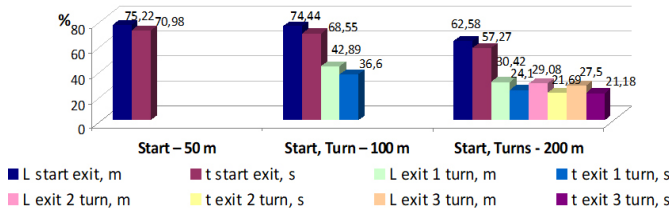

Figure 1. The ratio of the length and time of the underwater phase to the 15-meter mark at distances of 50, 100 and 200 m freestyle

Conclusions / Discussion

The analysis of the overcoming of various competitive distances of 50, 100 and 200 meters in freestyle allowed us to reveal that with increasing length of the distance, the length of the "exit" after starts, turns and speed of overcoming them decreases, as does the ratio of indicators of the length of "exit" and time relative to the mark 15 m.

The speed of overcoming of 15-meter segments of swimmers has a high dependence on the length of the "exit". At the same time, the degree of interrelation between the "exit" speed and the speed of passing 15-meter segments decreases with increasing length of the distance.

One of the reserves for improving the results of athletes in freestyle swimming at distances of various lengths is to improve the technique of performing starts and turns, by increasing the length and speed of overcoming the underwater sections.

Prospects for further research are related to a comparative analysis of swimmers' performance when overcoming acyclic sections of other competitive distances.

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Level of development of motor qualities of children of senior preschool age

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Purpose: *determine the level of development of individual motor skills in children 5–6 years.*

Material & Methods: *study involved 52 pupils of a pre-school institution of 5–6 years old. Such research methods were used as theoretical analysis and synthesis of scientific and methodical literature, pedagogical testing and methods of mathematical statistics.*

Results: *presents a comparison of motor performance indicators in the age, sex aspects and with the corresponding rating scale.*

Conclusion: *in the sexual aspect, it was found that the boys show better results than the girls, with the exception of forward torsion from the sitting position and flexion of the foot, where the results are better for girls; Analyzing the level of development of individual physical qualities relative to age, it should be noted that the results of children improve with age; comparing the results with the standards, showed that the indicators correspond to the "average" level.*

Keywords: *physical qualities, preschool children, physical education.*

Introduction

Complex socio-economic and environmental problems in modern Ukraine lead to a deterioration in the physical and mental condition of the majority of the population. Of particular concern is the fact of the decline in the level of health of children of preschool age. The results of annual medical examinations showed that over the past 15 years, the number of children with cardiovascular diseases, diseases of the musculoskeletal system and overweight has increased. In recent years, a significant increase in the number of children with reduced visual acuity and poor posture has been recorded. The importance of studying the health problems of preschool children is also in the fact that 75% of adult diseases are a consequence of living conditions in preschool and primary school years [6; 9].

In preschool age, the foundations of a person's physical and mental health are laid, the most intensive growth and development of the most important systems of the body and their functions is carried out. Preschool age, according to the authors [1; 3; 8], is a favorable period for the development of many physical qualities.

Physical education is the most effective factor in improving the health of children. However, the physical education system in Ukraine, one of the links of which is the pre-school physical education system, is in a crisis state and cannot always solve its main goal – health promotion..

Currently, quite intensive research is being conducted in the field of physical culture and sports [4; 7; 10; 11]. However, with regard to the problems of preschool physical education, they are definitely not enough compared with studies of other age groups. Thus, all of the above determines the relevance of the study.

Purpose of the study: to determine the level of development of individual motor qualities in children 5–6 years old.

Material and Methods of the research

The studies were conducted on the basis of a children's preschool educational institution "Birch" in the city of Yagotin, Kiev region. They were attended by 52 pupils of 5–6 years old, of whom a group of girls of 5 years was formed, a group of children of 5 years and, accordingly, two groups of children of 6 years. All children who participated in the study were healthy and were supervised by medical staff of the preschool institution..

Such research methods were used as theoretical analysis and synthesis of scientific and methodological literature, pedagogical testing and methods of mathematical statistics. The level of development of the physical qualities of children 5–6 years old was assessed by performing the following exercises: bending the body forward from a sitting position; flexion of the foot; standing long jump; throwing a small ball at a distance; content of static balance and shuttle run 3x10 m.

Results of the research

The results of the level of development of motor skills of children 5-6 years old in the age aspect are presented in Table 1.

Considering the indicators of torso forward for children 5–6 years old in the age aspect, it should be noted that the data of girls and boys 6 years old is better than the results of children 5 years old. It is worth noting that the results of girls have the reliability of differences ($p<0,01$), and the indicators of boys have no reliability of differences ($p>0,05$).

Analyzing the results of exercise, flexion of the foot in the age aspect, it should be noted that the results in children 5 years

Table 1

Comparison of the level of development of the physical qualities of children 5–6 years age, $\bar{X}$±m

Age	n	Bending torso forward (cm)	Foot flexion (cm)	Standing long jump (cm)	Throwing a small ball at a distance (m)	Content of static balance (s)	Shuttle run 3x10 m (s)
				Girls			
5 years	10	6,6±1,30	6,6±0,71	84,2±1,45	6,3±1,39	4,1±0,79	12,2±0,62
6 years	12	14,9±1,64	4,7±0,59	92,5±1,49	6,9±1,30	5,8±1,72	11,1±0,51
t st.		3,55	2,34	3,55	2,34	1,11	1,58
t cr.		2,09	2,09	2,09	2,09	2,09	2,09
p		<0,01	>0,05	<0,01	>0,05	>0,05	>0,05
				Boys			
5 years	15	5,7±0,83	5,7±0,49	88,2±1,15	7,2±1,51	9,7±1,38	11,1±0,49
6 years	15	7,6±1,08	5,5±0,48	105,0±0,90	8,5±1,16	15,6±0,90	11,3±0,58
t st.		1,42	0,20	0,53	1,68	3,60	0,06
t cr.		2,05	2,05	2,05	2,05	2,05	2,05
p		>0,05	>0,05	>0,05	>0,05	<0,01	>0,05

of age are worse than the results of the same exercise in children 6 years old (the results of children do not have any significant differences (p>0,05), and the indicators of girls, on the contrary, they are reliable (p<0,05)).

Comparing the performance indicators of the standing long jump in children of senior preschool age, it should be noted that the results of girls and boys of 5 years old are worse than the results of six-year-old children (the results of children do not have significant differences (p>0,05), and girls differ significantly (p<0,01)).

When comparing the results of an exercise of throwing a small ball over a distance in children 5–6 years old, it is clear that the results of preschool children 6 years old are better than five-year-old children (the results of children have significance of differences (p<0,01), and there are no differences in indicators of girls (p>0,05)).

Analysis of the results of the exercise, the content of static balance in the age aspect showed that girls and boys of five years of age have worse results than children of 6 years. At the same time, in the results of girls, there is no certainty of differences (p>0,05), and the indicators of the guys have a reliable character of differences (p<0,01).

Analyzing the indicators of the 3x10 m shuttle run, it is worth noting that girls and boys of 5 years perform the exercise better than children of 6 years (the results of boys and girls do not have any differences (p<0,05)).

Table 2 presents the indicators of the level of development of the physical qualities of children 5–6 years of age in the sexual aspect.

Comparison of indicators of torso forward in the sexual aspect showed that girls of 5–6 years old perform this exercise better than guys of the same age. At the same time, indicators of children of 5 years of age do not have any significant differences (p>0,05), and data of six-year-old children are reliable (p<0,001).

Comparing the indicators of foot flexion in children of the above age, it is worth noting that girls of 5 years perform this exercise worse than guys. It should be noted that in children of 6 years old, the indicators are better in girls. At the same time, the significance of differences between the indicators is absent (p>0,05).

Comparing the indicators of the standing long jump in the sexual aspect, it should be noted that the results of children 5–6 years old are better than the results of girls of the same age. It should be noted that in children of 6 years of age there is no significant difference (p>0,05), and the results of children of 5 years of age are reliable (p<0,001).

Analyzing these exercises of throwing a small ball to a distance in the sexual aspect, we note that girls of 5–6 years old perform it much worse than guys. It should be noted that the indicators have significant differences (p<0,001).

Analysis of the content of static equilibrium showed that girls of 5–6 years old have worse indicators than guys of this age. Note that the results of children 5–6 years old differ significantly (p<0,001).

Comparison of the results of the 3x10 m shuttle race of children of preschool age in the sexual aspect showed that at the age of five children do this exercise better, and at the age of six it is girls. However, it should be noted that there is no significant difference in indicators (p>0,05).

When comparing the indices of exercise, torso forward in children 5–6 years of age with normative estimates presented by T. A. Tarasova [9], it was found that the results correspond to the "average" level (3 points), with the exception of the data of 6-year-old girls, perform the exercise at the "high" level (5 points).

Comparing the results of flexion of the foot with the evaluation

Table 2

Comparison of the level of development of the physical qualities of children 5–6 years in the sexual aspect, $\bar{X}$±m

Age	n	Bending torso forward (cm)	Foot flexion (cm)	Standing long jump (cm)	Throwing a small ball at a distance (m)	Content of static balance (s)	Shuttle run 3x10 m (s)
				5 years			
boys	10	6,6±1,30	6,6±0,71	84,2±1,45	6,3±1,40	4,1±0,80	12,2±0,62
girls	15	5,7±0,83	5,7±0,48	88,2±1,15	7,2±1,51	9,7±1,38	11,1±0,49
t st.		0,61	1,11	4,31	6,29	3,52	1,36
t cr.		2,08	2,08	2,08	2,08	2,08	2,08
p		>0,05	>0,05	<0,001	<0,001	<0,001	>0,05
				6 years			
boys	12	14,9±1,64	4,7±0,59	92,5±1,48	6,9±1,83	5,8±1,72	11,1±0,51
girls	15	7,6±1,08	5,5±0,48	105,0±0,90	8,5±1,16	15,6±0,89	11,3±0,58
t st.		3,70	1,11	0,83	4,84	5,08	0,16
t cr.		2,10	2,10	2,10	2,10	2,10	2,10
p		<0,001	>0,05	>0,05	<0,001	<0,01	>0,05

criteria proposed by L. P. Sergienko [7], it was established that children of 5 years perform an exercise with "4" points, and six-year-old children with "5" points.

Comparing these exercises with a standing long jump with the norms presented by T. A. Tarasova [9], it was found that children aged 5–6 years perform the exercise at the "average" level ("3" points).

Comparison of the results of the control exercise of throwing a small ball over a distance with the corresponding norms showed that children 5-6 years old have an "average" level (3 points).

Comparing the indicators of static balance content with the norms presented by T. A. Tarasova [9], it was determined that children of 5 years old perform this exercise at the "average" level ("3" points). The following results are observed in six-year-old children: boys have "high" level ("5" points), girls have "medium" level ("3" points).

Comparison of indicators of shuttle running 3x10 m with the corresponding norms [2] in children 5–6 years old showed that children perform the exercise at the level "below average" ("2" point).

Thus, the results of the study showed that in the process of physical education with the studied contingent more attention should be paid to the development of coordination and speed-strength abilities.

Conclusions / Discussion

Analysis of the level of development of physical qualities of children 5–6 years of age in the age aspect found that the results are better in children of 6 years. The exception is the 3x10 m shuttle race in 5-year-old boys, who have better results than 6-year-olds. It should be noted that the differences are mostly unreliable (p>0,05).

Comparison of indicators of the level of development of physical qualities in the sexual aspect showed that in exercises the inclination of the body forward from the sitting position and flexion of the foot results are better for girls. Exercises long jump from a place, throwing a small ball at a distance, the content of static equilibrium and the shuttle run 3x10 m are better done by the guys. An exception is the shuttle run data of 3x10 m 6-year-old boys, who have worse results than girls. At the same time, the significance of differences is observed in terms of forward bending of the trunk, flexion of the foot and shuttle running 3x10 m in five-year-old children (p<0,001). In children of 6 years old, the significance of differences is observed between the indices of exercises, flexion of the foot, a long jump from a place and a shuttle run of 3x10 m (p<0,01–0,001).

Comparison of the data of physical qualities with the presented norms revealed that the indicators of children 5-6 years correspond to the "average" level (3 points).

The results of the conducted research allow to recommend to instructors on physical education of preschool institutions to spend more time on exercises directed on development of coordination and speed-power abilities.

Prospects for further research may be to determine the dynamics of the level of development of motor skills under the influence of innovative means of physical education.

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Model characteristics of special physical preparedness of Juvenile category athletes in acrobatic rock'n'roll

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Purpose: *develop model characteristics of special physical readiness of Juvenile category athletes in acrobatic rock'n'roll.*

Material & Methods: *theoretical analysis and synthesis of data of special scientific and methodical literature, pedagogical observation, pedagogical testing, pedagogical experiment, methods of mathematical statistics. The study involved 40 athletes (20 sports pairs of the category Juvenile).*

Results: *model characteristics and evaluation standards of the level of special physical readiness of athletes of the Juvenal category from acrobatic rock'n'roll are determined.*

Conclusion: *a system for assessing the level of special physical readiness of athletes can be used to optimize the training process in acrobatic rock'n'roll.*

Keyword: *acrobatic rock'n'roll, special physical readiness, model characteristics.*

Introduction

Conducting research in various sports is closely related to the study of the model characteristics of the strongest athletes.

The need to use the model characteristics of the strongest athletes in the selection and orientation process is emphasized by O. A. Shinkaruk [10] in his works, and notes that the development of model characteristics of competitive activities of various parties in the athletes' preparedness allows them to be properly trained with due regard to the propensity to work with a specific orientation. create conditions for successful training and performances in competitions so that athletes can reach the planned parameters P. N. Kizim [3] developed model characteristics and evaluation standards for the level of special physical fitness of highly qualified athletes in acrobatic rock'n'roll. At present, we have not found any publications on the construction of model characteristics of special physical preparedness of athletes of the Juvenal category in acrobatic rock'n'roll. The actual problem of this sport is the lack of a scientifically based method of training athletes of the Juvenal category from acrobatic rock'n'roll, as well as the lack of methods for assessing the level of special physical preparedness of the rock ruling in this category from the training sections.

Purpose of the study: to develop the model characteristics of the special physical fitness of athletes of the category Juvenile in acrobatic rock'n'roll.

Material and Methods of the research

With the aim of a comprehensive study of the level of special physical preparedness of athletes of the studied group in the Juvenals category from acrobatic rock'n'roll, a set of tests was used to assess the athletes' preparedness in acrobatic rock and roll [5]. This complex answered a more complete and comprehensive assessment of the level of special physical preparedness in accordance with the requirements of acrobatic rock'n'roll. In the process of research, tests T1, T2, T5 were used to determine the level of development of speed-strength components; test T6 was used to determine the level of development of the power components; to determine the level of development of special endurance, we used tests: T3, T4, T7 [5].

Results of the research

The results of testing the special physical preparedness of athletes of the Juvenal category in acrobatic rock'n'roll are presented in Figures 1 and 2.

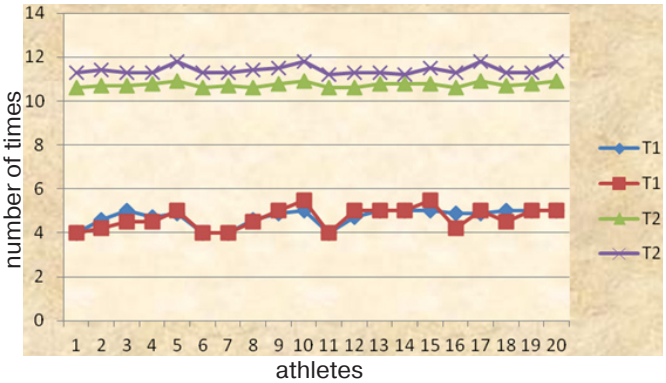

Figure 1. Results of individual testing of special physical preparedness of Juvenal category athletes in acrobatic rock'n'roll

The results of **T1** "2 somersaults forward, 1 somersault back," tour "for 30 s (number of times)", as an indicator of speed-strength training, for partners averaged 4,71 times for the group 39 times), with partners – on average 4,67 times for a group (the range of indicators was±0,49 times);

The average **T2** indicator "Perfoming the main course in 20 s (number of times)", as an indicator of speed-strength training, for partners made up for the group 10,74 times (the range of indicators was ±0,11 times), for partners it averaged for a group of 11,42 times (the range of indicators was ±0,21 times).

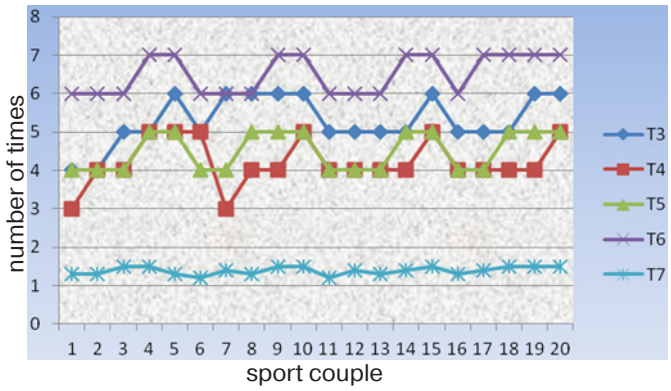

Figure 2. Results of the general (joint) performance of the tests in a sport couple of special physical preparedness of Juvenal category in acrobatic rock'n'roll

The **T3** indicator "Lower change with a partner's turn by 540° (number of times)", as an indicator of special endurance, averaged 5,3 times for a group (the range of indicators was ±0,66 times).

The **T4** test "Upper change with the partner's turn by 720° in American spin (number of times)", as an indicator of special endurance, showed average results for the group – 4,2 times (the range of indicators was ±0,62 times);

Indicator **T5** "Lower, upper change, tour anler (in air) by 360° (number of times)", as an indicator of speed-strength training, averaged 4,5 times for a group (variation of indicators was ±0,51 times);

Test **T6** "Lower, upper change, partner's leap upward based on the partner's arms, (number of times)", as an indicator of strength training – on average, 6,5 times for a group (the range of indicators was ±0,51 times);

Test 7 "Performing a non-stop competitive program (number of times)", as an indicator of special endurance, averaged 1,4 times for a group (the range of indicators was ±0,11 times).

As a result of processing the obtained test data, we determined the model characteristics and assessment standards for the level of special physical fitness of the Juvenile category athletes from acrobatic rock'n'roll (Table 1).
The results are shown at the level of average values, we evaluate as "good", by the magnitude of the standard deviation for the better as "excellent", to the worse by the same value – "satisfactory"

Conclusions / Discussion

This study complements the theoretical foundations of building sports training in acrobatic rock'n'roll, as described in the works of the authors [1; 2; 4; 5; 10]. At the same time, in our study, for the first time, model characteristics and assessment standards of the level of special physical preparedness of athletes of the Juvenal category were determined by acrobatic rock'n'roll. The development of model characteristics and assessment standards for the level of special physical fitness of athletes of the Juvenal category in acrobatic rock'n'roll fully confirms our vision of solving the problem of improving the special physical preparedness of athletes in the Juvenal category in acrobatic rock'n'roll.

This research has developed a practical system for assessing the level of special physical preparedness for the athletes in the Juvenal category for acrobatic rock'n'roll. The model characteristics and assessment norms of the level of special physical preparedness of the athletes of the category Juvenal on acrobatic rock'n'roll are determined.

Separate characteristics and a system for assessing the level of special physical preparedness can be used to control the course of the training process.

Prospects for further research should be in the search for ways to solve the problem of improving the training process of athletes of the Juvenile category in acrobatic rock'n'roll.

Table 1

Model characteristics of the level of special physical preparedness of athletes of the Juvenal category in acrobatic rock'n'roll

Test	Test SPP	Athletes	Assessment		
			excellent	good	satisfactory
T 1	2 somersaults forward, 1 somersault back," tour "for 30 s (number of times)	male partner	5	4	3
T 1	2 somersaults forward, 1 somersault back," tour "for 30 s (number of times)	female partner	5	4	3
T 2	Perfoming the main course in 20 s (number of times)	male partners, female partners	12	11	10
T 3	Lower change with a partner's turn by 540° (number of times)	in couple	6	5	4
T 4	Upper change with the partner's turn by 720° in American spin (number of times)	in couple	5	4	3
T 5	Lower, upper change, tour anler (in air) by 360° (number of times)	in couple	5	4	3
T 6	Lower, upper change, partner's leap upward based on the partner's arms, (number of times)	in couple	7	6	5
T 7	Performing a non-stop competitive program (number of times)	in couple	1,5	1,4	1,3

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Influence of musical-rhythmic means education on the level of development of artistic athletes 6–8 years in rhythmic gymnastics

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Purpose: *investigate the impact of musical rhythmic education on the development of artistic abilities of gymnasts 6–8 years.*

Material & Methods: *study involved 20 gymnasts aged 6–8 years who are trained at the initial training stage in the Youth Sport School of rhythmic gymnastics. During the study, the following methods were used: theoretical analysis and synthesis of scientific and methodical literature; pedagogical observation; pedagogical testing; pedagogical experiment and methods of mathematical statistics.*

Results: *analysis of the development of artistry showed that by all criteria the average scores in the group corresponded to the average level: plasticity – 3,3 points; expressiveness – 3,2 points; rhythm – 3,0 points; dancing – 3,4 points.*

Conclusion: *as a result of the introduction of various methods and means of musical rhythmic education, the improvement of indicators was established, namely, the plasticity of movements increased by 1,0 points, expressiveness – by 1,4 points, rhythm – 1,5 points, by dancing – 1,1 points.*

Keywords: *artistry, music, rhythm, rhythmic gymnastics.*

Introduction

The trends in the development of modern rhythmic gymnastics place high demands on all types of training for female athletes. Performing competitive compositions in this kind of sport requires a high level of technical readiness from female athletes, manifestation of the harmonious development of physical qualities, motor expressiveness and artistry [13]. Analysis of the results of international competitions in rhythmic gymnastics suggests that the level of performance skills of female athletes is growing rapidly. Modern competitive compositions of gymnasts have become very complex, many different compounds and elements have appeared, but according to many experts [4; 5; 11; 14], such a factor as artistry acquires a share in performing skills [8]. The leaders are those gymnasts who, against the background of immaculate possession of their bodies and objects, demonstrate the artistry of performing competitive programs [9].

In the latest changes in the rules of rhythmic gymnastics competition, the number of obligatory elements has been reduced, and the implementation of combinations of dance steps has been included. According to experts, these changes provide for the enhancement of entertainment competitive compositions, as well as increase the requirements for artistic skills of female athletes [11; 15].

Rhythmic gymnastics is one of those sports that are characterized by an increase in the volume and intensity of physical activity, early specialization and "rejuvenation". Therefore, knowledge and skills acquired by gymnasts in the process of initial training, affecting the success of further competitive activity [6]. General trends in the development of rhythmic gymnastics make it necessary to clarify the content of the training, the constant correction of its components, aimed at achieving maximum sporting results [5].

In connection with the importance of the musical component in the evaluation of the competitive compositions of athletes, experts [2; 12; 15] consider it necessary to work with musical material, to improve the process of musical and rhythmic training of athletes. Musicality and expressiveness of the exercises performed affect the assessment for artistry. In the process of musical and rhythmic training athletes develop these artistic abilities. According to experts [4; 5], the issues of formation and evaluation of artistic skill of gymnasts remains extremely difficult because of its subjectivity. Therefore, today the question of raising artistry in rhythmic gymnastics remains insufficiently studied. Based on this, in the training process it is necessary to apply various techniques and means of musical rhythmic education, the use of which will further contribute to the improvement of the artistic potential of young female athletes [3].

Purpose of the study: investigate the influence of musical rhythmic education on the development of artistic abilities of gymnasts 6–8 years.

Material and Methods of the research

The study involved 20 gymnasts aged 6–8 years who are trained at the initial training stage in the youth sport school of rhythmic gymnastics. During the study, the following methods were used: theoretical analysis and synthesis of scientific and methodical literature; pedagogical observation; pedagogical testing according to the following criteria: plasticity, expres-

siveness, rhythm, danceliness (maximum 5 points); pedagogical experiment and methods of mathematical statistics.

Results of the research

At the beginning of the training year, a study was conducted on the level of development of artistry of young gymnasts. According to the criterion of plasticity, namely when assessing the types of waves, the athletes showed results from 3,2 points to 3,3 points. Best of all, the girls coped with the reverse wave. When performing the wave ahead, the gymnasts made gross mistakes. Errors in the technique of performing the basic element of the "wave", a necessary condition for which is the coordination of movements with links of the body, indicate significant shortcomings in gymnasts in the overall coordination of movements, namely in the harmonious integrity of movements.

According to the criterion of expressiveness, gymnasts performed the most expressive dance steps at a fast pace with musical accompaniment 2/4, than the types of running and jumping. When performing exercises for musical accompaniment at a moderate (average) pace with a musical size of 3/4 (waltz and polonaise steps), the results of the tasks were lower. So, at the polonaise step, some girls showed inconsistency of the main phase of the step (first step) with the metric music accent (strong beat). In this regard, the unity of the pace of execution of the steps was broken, the pace of movement was accelerated, which negatively affected the expressiveness of the execution of movements.

In the task of rhythm after listening to two bars of music with a simple rhythm, the girls had to replay the rhythmic pattern by clapping. The average results of this task were lower than expected (3,0 points), which indicated an insufficient level of development of a sense of rhythm in young gymnasts (Table 1).

Table 1

Average results of indicators by some criteria of artistry (max – 5 points)

General criteria	Points	Components	Points
Plastic	3,3	Forward wave	3,2
		Backward wave	3,3
		Side wave	3,2
Expressiveness	3,2	Performing of movements at a rapid pace	3,3
		Performing of movements at a moderate pace	3,1
Rhythm	3,0	Displaying the rhythm pattern	3,0
		Exercise "jug band"	2,9
Dance	3,3	Compliance with the nature of the music	3,5
		Creative abilities using choreographic vocabulary	3,3

The content of the exercise "jug band" consisted of the following task: 1) after listening to a children's song, which has a simple two-part musical form (the song's verse consisted of singing and chorus), the children first played back with rhythmic drawing and singing the chorus with musical accompaniment; 2) after this, the children performed the same task, only without musical accompaniment. In assessing this task into account the rhythm and timing performance were taken into account.

Dance, the level of choreographic preparation of girls was determined consistently in the performance of two creative tasks. In the first assignment gymnasts were invited to dance for musical accompaniment of Ukrainian folklore. The group of athletes satisfactorily demonstrated the conformity of dance moves with the character of music (3,5 points). This fact is quite explained by the fact that the gymnasts prepared an exemplary performance from the elements of the Ukrainian dance.

The task of displaying creative abilities was the following: after listening to two diverse musical works of P. I. Tchaikovsky: "Baba Yaga" and "Old French Song" – young athletes had to demonstrate improvisation on given topics (they were not familiar with the name of the works). When performing the creative task, the children showed interest, imaginative thinking, artistry, but some sportswomen could not create an artistic image in movement to the lyric play "Old French Song", therefore the average result was 3,3 points.

Thus, the analysis of the test results showed that, according to the criteria of artistry, female athletes showed insufficiently high results.

The gymnasts practiced the musical-rhythmic preparation within the meaning of the training process at the initial preparation stage, approved by the youth sport school program. Training gymnasts at the stage of initial training is 1,5–2 hours, the frequency of training – 3 times a week. For three months, at each training session with young athletes, various techniques and means of musical rhythmic education were used.

The main means of musical rhythmic education were specially-developed motor actions that were performed in accordance with the peculiarities of music. These funds consisted of the following groups:

– fundamentals of music theory, included some concepts about the means of musical expressiveness (melody, tempo, dynamic shades, metro-rhythm, etc.);

– exercises on a combination of movements with music, which allowed a deeper understanding of the musical-moving image, developed the ability to perform exercises at a certain pace and rhythm according to the content and structure of the musical work;

– musical games were used to consolidate acquired skills in the relationship of movements with music. Unforeseen situations arising in the course of the game required quick orientation, initiative, ingenuity;

– dance element – were built on music, which determines the characteristics of dance movements of different nations and contributed to the education of emotionality, expressiveness, artistry.

After the introduction of various techniques and means of musical rhythmic education, retesting of young female athletes was conducted (Figure 1).

The girls improved their results when performing various

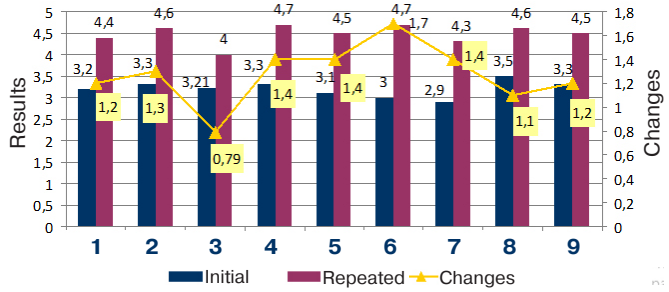

Figure 1. Changes in average results by criteria of artistry:
1 – forward wave; 2 – backward wave; 3 – side wave; 4 – Performing of movements at a rapid pace; 5 – Performing of movements at a moderate pace; 6 – Displaying the rhythm pattern; 7 – exercise "jug band; 8 – Compliance with the nature of the music; 9 – Creative abilities using choreographic vocabulary.

waves, the improvement of results occurred on average from 0,8 points to 1,3 points. According to the criteria of expressiveness of movements, improvements occurred by 1,4 points. According to the criteria of rhythm, positive changes averaged 1,4 points and 1,7 points. The dance performance on average changed by 1,1 points – 1,2 points. The greatest positive changes occurred in the criteria for rhythm.

In the group, according to general criteria, an increase in indicators of test results was established, namely, the plasticity of movements increased by 1,0 points, the expressiveness of movements – by 1,4 points, rhythm – 1,5 points, dance performance – 1,1 points (Figure 2).

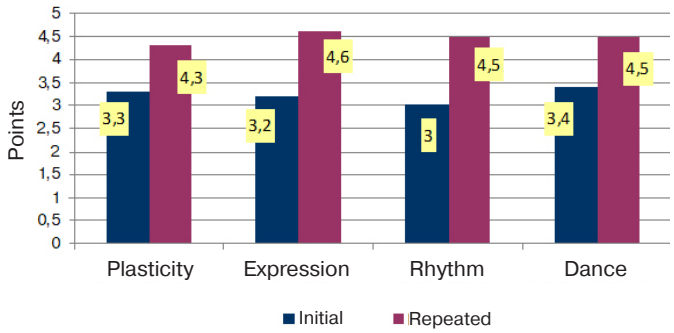

Figure 2. Dynamics of indicators on the general criteria of artistry

This training program has contributed to a significant improvement in the plasticity, expressiveness, rhythm and dance of athletes. Thus, the use of musical rhythmic education has provided a significant improvement in the indicators characterizing the level of artistry among young gymnasts.

Conclusions / Discussion

The results of the studies carried out complement the theoretical propositions formulated in the works of I. A. Viner [5], L. A. Karpenko, A. G. Rumba [8], A. Ya. Mullagildina [10], that rhythmic gymnastics is to those sports where an important role is played by the aesthetic sense of the compositions and the display of the artistic abilities of female athletes when performing competitive exercises.

We also agree with the statement of specialists [6; 7] that due to the early specialization, shortening of training periods and the increasing complexity of sports equipment, young gymnasts have high demands on all types of training. The basic components of mastery in rhythmic gymnastics are laid at an early age, therefore, it is necessary to educate the artistry of performing movements from the initial preparation stage.

The conducted analysis of the level of development of artistic performance has shown that, according to all criteria, the average grades in the group correspond to the average level: plasticity – 3,3 points; expressiveness – 3,2 points; rhythmicity – 3,0 points; dance – 3,4 points.

The conclusions of G. P. Artemyeva, T. V. Moshenskaya [1], I. G. Belenkaya [2], A. Ya. Mullagildina [11] and other scientists were confirmed; it is advisable to improve the artistic abilities of female athletes in rhythmic gymnastics in choreography classes with the use of musical rhythmic education. The results of the study complement the data of scientific works, in the process of developing the artistry of young athletes it is advisable to use specially selected musical rhythmic exercises and games that correspond to the main psycho-functional characteristics of children of this age [3; 6; 7].

The data presented by us is confirmed by the results of the conducted research, namely, after the introduction of various methods and means of musical-rhythmic upbringing, an improvement was observed: the plasticity of movements increased by 1,0 points, expressiveness – by 1,4 points, rhythmicity – 1,5 points, dance – 1,1 points, which testifies to the positive dynamics of the level of artistic activity of young athletes.

Prospects for further research. Due to the fact that the use of various methods and means of musical rhythmic education has provided a positive result in the development of artistic abilities of young female athletes, we plan to consider the influence of the level of musical rhythmic fitness of gymnasts on the competitive result.

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