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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.
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CONTENT

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Factors determining the direction of the process of physical rehabilitation of men with osteochondrosis of the lumbar spine in remission

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Purpose: *identify relationships based on the results of clinical, biomechanical and functional data to identify the main factors influencing the nature and direction of the process of physical rehabilitation of men with osteochondrosis of the lumbar spine in remission.*

Material & Methods: *analysis of special scientific and methodical literature; content analysis of medical records, results of computer tomograms and radiographs; clinical research methods; pedagogical research methods; biomedical research methods; computer photometry; methods of mathematical statistics. In the analysis of medical records (n=60), data of men of the second adult age were used with a diagnosis of osteochondrosis of the lumbar spine in the stage of incomplete and complete remission.*

Results: *representatives of the studied population constitute a level of pain in visual analogue scale (VAS) below the average, and during periods of exacerbation of the disease, this indicator is above 50%. After testing the musculoskeletal system according to the method of A. V. Vasilenko, a result was obtained that corresponds to a low level. During the Romberg test, a tendency to a decrease in vertical stability was observed, which may be due to the increased angles of the biogeometric posture profile. During the analysis of heart rate variability, the mode amplitude index in the examined population was 78,1±5,5% ($\bar{X}$±S), which indicates the prevalence of moderate sympathicotonia.*

Conclusion: *in the course of factor analysis, four factors were identified that affect the nature and direction of rehabilitation measures and describe 77,33% of the total variance. The most informative and significant indicators for this category of patients, which characterize each factor, were determined.*

Keywords: *physical rehabilitation, spinal osteochondrosis, factors.*

Introduction

Functional disorders and degenerative-dystrophic diseases of the musculoskeletal system (MSS) remain an important social problem and have significant economic consequences (Yu. N. Furman, S. M. Afanasyev, 2017) [2; 9]. According to the World Health Organization (WHO), spinal osteochondrosis suffers from 40% to 80% of the world's inhabitants. The proportion of clinical neurological manifestations of spinal osteochondrosis among diseases of the peripheral nervous system is 67–95% (J. S. Will et al., 2018) [12]. Chronic back pain is one of the most acute medical and social problems, causing enormous economic damage to society. It should be noted that, despite the fact that in about 70% of patients, the pain under the influence of treatment goes away in a relatively short time - from several weeks to a month, in patients of working age, it usually takes on chronic recurrent (C. B. Oliveira et al., 2018) [10].

Extremely high prevalence of vertebral pain syndromes, according to WHO experts, has reached epidemic proportions, in most cases associated with increased information and stress loads on a person, as well as hypokinesia (M. J. Stochkendahl et al., 2018) [11].

Being an interdisciplinary problem, spinal osteochondrosis is at the intersection of the interests of many specialists, and in the last decade has become the source of an almost unlimited amount of scientific research, including in the field of physical rehabilitation (O. B. Lazareva, 2013) [6].

In recent years, non-drug methods are increasingly used in the treatment of dystrophic diseases of the spine and their reflex manifestations [3], but the question of what actions and their combinations are more rational to use depending on the clinical manifestations of osteochondrosis is still debatable. that determines the special significance of psychological factors in eliminating chronic back pain [5].

So, the work of A. Samoshkin, N. Moskalenko (2017) is devoted to the analysis of modern ideas about the effectiveness of physical exercises on the Pilates system in osteochondrosis of the lumbar spine of the spine in women [8]. The study of domestic and foreign literary sources that highlight the results of the scientific evidence-based practice of using Pilates exercises showed, on the one hand, the feasibility of their inclusion in comprehensive programs for the physical rehabilitation of women with osteochondrosis, on the other – the need for further study of their effects not only on pain syndrome, but also on other functions of the musculoskeletal system, the violation of which is characteristic of this pathology.

In the study of B. G. Antonevich, E. Yu. Alekseenko (2017), a study was conducted on the use of stretching in a physical

rehabilitation program for men 40–50 years old with degenerative-dystrophic spinal lesions in the lumbar region at the outpatient stage [1]. The authors, after analyzing the characteristics of stretching exercises in patients with degenerative-dystrophic lesions of the lumbar spine at the outpatient stage, recommended stretching various muscle groups, resulting in patients having less pain, increasing the amplitude of spinal movement, and strengthening the muscular corset and improving the quality of life of patients.

D. V. Popovich et al. (2017) determined the effectiveness of the impact of physical rehabilitation tools, the integrated use of improved methods of therapeutic massage, a complex of therapeutic gymnastics static-dynamic exercises and exercises on the Evminov board on patients with osteochondrosis of the cervicothoracic spine [7]. The authors argue that the integrated use of improved elements of therapeutic massage, exercises on the Evminov board and the complex of therapeutic gymnastics of static-dynamic exercises significantly increased the effectiveness of rehabilitation for both initial and clinically pronounced neurological manifestations of vertebral osteochondrosis..

However, despite the large amount of theoretical and practical work devoted to various aspects of physical rehabilitation of people with osteochondrosis of the lumbar spine, there are currently no data on indicators that will play a key role in the rehabilitation process of the thematic cohort of patients, and determined the relevance of this work.

Purpose: identify relationships based on the results of clinical, biomechanical and functional data to identify the main factors influencing the nature and direction of the process of physical rehabilitation of men with osteochondrosis of the lumbar spine in remission.

Material and Methods of the research

To achieve this goal, the following research methods were used: analysis of special scientific and methodological literature; content analysis of medical records, results of computer tomograms and radiographs; clinical - quality of life assessment; pedagogical – stating and forming pedagogical experiment, observation, testing; biomedical methods – heart rate variability, the method of determining the physical state according to the formula of A. A. Pirogovoi, the method of assessing the adaptive potential of R. M. Baevsky, the method of assessing physical performance; computer photometry; mathematical statistics methods.

In the analysis of medical records (n=60), data of men of the second adult age were used with a diagnosis of osteochondrosis of the lumbar spine in the stage of incomplete and complete remission. The average age of the subjects was 38,6±2,76 years ($\bar{X}$±S).

It should be noted that in the studied groups of men with osteochondrosis of the lumbar spine, patients with different types of posture were detected, in turn, is one of the factors in the development of this pathology, the occurrence of non-optimal load distribution in the intervertebral discs and reflex deformities. In accordance with this, from the general group we distinguished two subgroups of patients: a subgroup with a disorder in the sagittal plane – patients with increased cyphosis and flattened lordosis, and also a subgroup of patients with combined disorders in the frontal plane and sagittal plane. The analysis of patients in the selected subgroups made it possible to clarify the specifics of physical rehabilitation programs, taking into account the nature of violations of the static and dynamic stereotype.

All patients were informed about the goals and methods of the study and provided written consent. In conducting the study, they adhered to the issues of medical ethics and the principles of the Helsinki Declaration, adopted by the General Assembly of the World Medical Association (1964–2000), the Council of Europe Convention on Human Rights and Biomedicine (1997).

Results of the research

As the most typical, the average level of pain on the four-syllable visual analogue pain scale (VAS) patients noted 2,72±0,42 cm ($\bar{X}$±S) with the maximum possible 10 cm, which would correspond to unbearable pain. In the best periods of the disease, patients reported pain at 1,57±0,49 cm ($\bar{X}$±S). During relapses, the level of pain in patients reached 5,8±0,8 cm.

Based on these results, it can be concluded that mainly representatives of the studied population constitute a level of pain below the average, and during periods of exacerbation of the disease, this indicator is above 50%.

After conducting the primary testing of the locomotor apparatus in accordance with the survey method A. V. Vasilenko, the result was 65,7±1,6 points ($\bar{X}$±S), which corresponds to a low level [4]. During the execution of the Romberg test, a tendency towards a decrease in vertical stability was observed, which may be due to increased angles of posture biogeometric profile.

During the analysis of the variability of the heart rate, the amplitude of the mode in the examined contingent was 78,1±5,5% ($\bar{X}$±S), which indicates the prevalence of moderate sympatheticone. These data are confirmed by indicators of the tension index of regulatory systems (TI), which is 541,5±77,7 conv. units, which indicates pronounced sympathicotonia. At the same time, the activity index of the sympathetic nervous system (LF wave) is 70,4±7,9%, the activity index of the parasympathetic part (HF wave) – 20,2±4,9%. The LF/HF ratio is 3,7±1,1%, which indicates a temporary mobilization of the body. The level of physical condition at the beginning of the experiment was 0,599±0,071 conv. unit ($\bar{X}$±S), which corresponds to the average level of the functional state. The indicator of the PWC_{170} test for participants in the experiment was 470,3±30,6 $kgm \cdot min^{-1}$, which corresponds to a low level of functional status. The indicator of adaptive capacity at the beginning of rehabilitation is 2,6±0,1 conv. unit, which corresponds to the state of functional tension.

Based on the analysis of quantitative indices of posture biogeometric profile, two subgroups were formed: faces with combined posture disturbances in the sagittal and frontal plane – 52% (n=31) and persons with disturbances of posture in sagittal plane – 48% (n=29). All studied angles characterizing the posture in the frontal plane in the subgroup with combined pathology exceed the values admissible in norm. The angle β2, which characterizes the position of the shoulder girdle relative to the horizon, has 4,4±0,3°, which is 29%

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higher than the maximum normal value. The angle α4, which characterizes the angle of inclination of the pelvis in the sagittal plane, was 6,24±0,24. Thus, we can confirm the presence of increased lumbar lordosis and scoliotic posture disorders in this subgroup. In the subgroup with impaired posture in the sagittal plane, the angle α2, which characterizes the thoracic spine, is the most informative in the definition of hypercyphosis, 4,86±0,52 at a rate of 2,3°, and the angle α4 is 2,05±0,09 at the norm is 4,5°, which is a sign of a smoothed lumbar lordosis. Thus, in the course of previous studies, a large array of data was obtained that characterize the characteristics of the body of men of second adulthood with vertebral pathology. With the help of factor analysis, the most informative indicators were identified in the future used in the work.

In the course of factor analysis, four factors were identified that affect the nature and direction of rehabilitation measures and describe 77,33% of the total variance (Table). The most informative and significant indicators for this category of patients, which characterize each factor, were determined.

Factor structure of the functional potential of the surveyed (n=60)

Factors that determine the functional potential	Factor contribution, %
Factor I – the quality of life associated with pain	28,85
Factor II – the functional state of the spine	18,91
Factor III – components of physical fitness	15,84
Factor IV – physical state	13,73
Total input factors	77,33
Contribution of other factors	22,67

Conclusions / Discussion

Despite the large amount of theoretical and practical work devoted to various aspects of the physical rehabilitation of persons with osteochondrosis of the lumbar spine, data on indicators that will play a key role in the rehabilitation process of the thematic cohort of patients are currently lacking and has made this work relevant.

In the course of previous studies, a large array of data was obtained that characterize the characteristics of the body of men of second adulthood with vertebral pathology.

During the factor analysis, four factors influencing the nature and direction of rehabilitation measures were identified and describe 77,33% of the total dispersion. The most informative and meaningful indicators for this category of patients are described, characterizing each factor.

It was found that the first factor (28,85% of the total dispersion) is the main one, which characterizes the subjective evaluation of pain sensations (quality of life).

The next factor (the functional state of the spine) has a contribution to the general dispersion of 18,91% and characterizes the deviation of posture in the sagittal plane.

The factor of the components of physical fitness contributes to a general dispersion of 15,84% with factor loadings of indicators characterizing the functional state of the locomotor apparatus.

The fourth factor contributes to the general dispersion of 13,73%, the highest factor loadings in which the indicators characterizing the physical state.

The results of this study, as well as the experience of regenerative treatment, in accordance with the disease and the nature of motor activity, can form the basis for further research, the most characteristic features of the contingent under study, as well as for the development of a progressive rehabilitation program in the remission phase.

The prospect of further research. In the future, it is planned to develop and define the rehabilitation potential of men with osteochondrosis of the lumbar spine, will be based on these factors affecting the rehabilitation process of the thematic cohort.

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Assessment of the level of formation of values of healthy lifestyle of students

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Purpose: *theoretically substantiate, develop and experimentally test a system for assessing the level of formation of the values of a healthy lifestyle of students in the process of physical education.*

Material & Methods: *to achieve this goal, such research methods were used – analysis and synthesis of literature sources and documentary materials, pedagogical observation, pedagogical testing, pedagogical experiment, sociological research methods (questioning), anthropometry method, methods for determining the functional state of the body, methods for assessing the level of physical health (according to G. L. Apanasenko method), methods for determining motor activity, testing theoretical knowledge, methods of mathematical statistics. The study involved 108 students and 120 female students of higher educational institutions in Kyiv.*

Results: *the components of the students' value attitude to a healthy lifestyle are defined and the criteria and indicators of their formation are refined: cognitive (knowledge about health, healthy lifestyle, health values, axiological attitudes to achieve the goal), motivational and value (attitude to one's own health, positive emotions, interest and needs for a healthy lifestyle), activity (actions and behavior, contribute to a healthy lifestyle, compliance with the requirements of a healthy lifestyle in everyday life). On the basis of certain criteria and indicators, the levels of formation of the values of a healthy lifestyle are characterized: high, sufficient, satisfactory and critical. It was revealed that the majority of students have a critical level of formation of values of a healthy lifestyle (boys – 75,93%, girls – 72,5%).*

Conclusion: *the existing developments in assessing the attitude of students towards a healthy lifestyle and the development of their attitude towards recreational activities have been further developed; based on the analysis of empirical research data, a significant discrepancy was noted between the declared value of health, a healthy lifestyle, and behavioral attitudes of students. On the basis of the obtained data, we proposed the directions of modernization of physical education of students, to promote the formation of values of a healthy lifestyle.*

Keywords: *students, health, healthy lifestyle, values, motor activity, assessment system.*

Introduction

The problem of youth health, its social, medical, pedagogical, and psychological aspects have gained national importance and require additional intensification of the search for new effective directions in developing health-forming technologies [11; 21]. Today, the health of the young generation is one of the most important indicators of a healthy potential of the nation, therefore its preservation and strengthening are of priority [2; 7; 18]. This issue is actively discussed not only among scientists [8; 12; 23], but is also an important area of state policy of Ukraine, as evidenced by the development and implementation at the legislative level of relevant programs and projects [14–17]. The program-regulatory documents draw attention to the development of a conscious attitude of young people to their health and the health of others, the formation of the fundamentals and hygienic skills of a healthy lifestyle, the need to preserve and strengthen their physical and mental health, and the promotion of a healthy lifestyle (HLS).

A theoretical analysis of research on the formation of values of a healthy lifestyle of university students has made it possible to determine the high interest of specialists in attracting students to a healthy lifestyle and the degree of study of the scientific problem in modern scientific literature [2; 5; 13]. Scientists see the possibility of solving problems associated with the formation of values of a healthy lifestyle, based on the introduction of models of health formative activities, acquires the character of value orientation, that is, determines the mind, activity and behavior of students in various life situations, in solving personal problems, reflects the process of accumulation and generalization of individual experience of an individual on himself and his health [8; 12]. At the same time, it is noted that due to the imperfect software and methodological support of the educational process on physical education, insufficient information about health, the formative activity and the conditions for its use in the educational process on physical education in the framework of educational and extracurricular activities of educational institutions address the issues of value formation healthy way of life of students has not found an adequate practical solution, identified the need for further research [1; 4; 9; 13; 18].

Purpose: theoretically substantiate, develop and experimentally test a system for assessing the level of formation of the values of a healthy lifestyle of students in the process of physical education.

Material and Methods of the research

The analysis of the scientific and methodological literature

was carried out with the aim of theoretical substantiation of the object of research, as well as the generalization of the scientific approaches to assessing the values of the healthy lifestyles of students in the process of physical education. The theoretical analysis, generalization of modern practical experience made it possible to determine the relevance of the study, clarify and specify the goals, objectives and orientation of the pedagogical experiment, develop the content of a comprehensive program of research of value orientations, motives, interests and needs of students for classes using recreational motor activity, physical condition indicators , morbidity, level of motor activity, theoretical preparedness of students about the formation of health.

One of the main methods of the study was a pedagogical experiment, which was introduced in order to obtain the initial data, became the basis for the development of a system for assessing the values of the healthy lifestyles of students. Evaluated the health status and morbidity structure of students. Anthropometric studies of students were carried out with standard equipment according to generally accepted and unified methods [19]. Studies on morbidity and disease resistance were carried out according to the results of in-depth medical examinations by copying information from primary medical records of educational institutions. Additionally, we took into account the number of student's absences due to illness, the duration of one case of illness. In the study of morbidity processing of the materials carried by classes of diseases in accordance with the "International Statistical Classification of Diseases and Problems" (ICD-10) [20]. In determining the methods of health assessment in the study, they preferred the most adequate, informative, non-invasive and such that they provide an opportunity to cover a group of students in a short period of time, therefore the assessment of the level of health was carried out using the express method of somatic health G. L. Apanasenko [3]. To assess the attitude of students to physical education classes, motivational priorities in the choice of types of motor activity, sociological research methods (questioning) were used. The basis for the development of an assessment of the level of formation of value orientations was a modified research method Yu. S. Boyko [5]. To determine the initial level of formation of attitudes towards a healthy lifestyle among students, the method of M. Rokich "Value Orientations" is used, which allows to investigate the orientation of the individual and determine his attitude to the world, to other people, to himself, the perception of the world, key motives of actions. Material systematization and initial mathematical processing were performed using Microsoft® Excel 2010 tables.

The studies were conducted at the bases of the Kyiv National Linguistic University, National Pedagogical University named after M. P. Dragomanov. The study involved 108 male students and 120 female students. The student contingent was involved in the study voluntarily with the written consent to participate in all stages of the pedagogical experiment, as well as to further analyze and disclose their personal data when considering and reporting on the research results.

Results of the research

Analyzing the results of the study [5] on the formation of a healthy lifestyle of university students, we have identified the following components that characterize it: affective, motivational, informative, projective, activity and procedural. The affective component reflects the peculiarities of students' attitudes towards preserving and strengthening their health by observing the principles of a healthy lifestyle, and the motivational one indicates a desire to expand knowledge in the field of health, interest in the formation and strengthening of planning skills and organizing health saving skills. Note that when evaluating the affective component, we, taking into account the refinements of predecessors [5], drew attention to the location of the category "Health" in the rating of terminal values. If this category was located in the top five, we accounted for 5 points, in case it occupied from 6 to 9 places – 4 points, from 10 to 13 – 4 points, and when it was placed from 14 to 18 positions – 2 points. The substantive component assumes that students have the necessary amount of knowledge on the basics of a healthy lifestyle, while the projective component focuses on the planning skills of individual events. But the activity component is associated with the observance by students of the optimal motor mode. The purpose of the procedural component is the practical application of the principles of a healthy lifestyle in everyday life, as a result of which one can assess the level of physical health of the participants in the experiment. Thus, the general level of formation of a healthy lifestyle of students depends on the level of formation of its individual components. These components were used as the basis for the criteria for the formation of a healthy lifestyle for university students.

We carried out the assessment of the formation of a healthy lifestyle of students of higher educational institutions on the basis of the criteria developed, taking into account the indicators characterizing it. These indicators included the awareness of the need to comply with the fundamentals of a healthy lifestyle, an understanding of the primary value of health, knowledge and skills in matters of a healthy lifestyle, as well as the implementation of appropriate steps aimed at maintaining a healthy lifestyle.

The results of a study aimed at determining the level of theoretical knowledge of students convincingly indicate that the majority of students have fragmentary knowledge concerning health, a healthy lifestyle, and its components. The lack of fundamental knowledge among students has been noted by us in matters relating to the rational mode of the day, hardening, nutrition, etc. The main reason for the students' lack of awareness in matters relating to the health of formative activities is, first of all, the lack of effectiveness of the physical education process as an integral part general structure of education of student youth.

In the future, the criteria served us to establish the levels of formation of a healthy lifestyle of students, including high, sufficient, satisfactory and critical. Thus, on the basis of the selected components, in the course of the study, we developed an integrated assessment of the formation of a healthy lifestyle for students of higher educational institutions (Table 1).

On the basis of the proposed approach, we identified the following levels of the formation of a healthy lifestyles of university students (Table 2).

So, with the development of a healthy lifestyle of students in further research, we considered this gradation:

– "high" level provided for a high dominance of health in the system of terminal values, high motivation for a healthy life-

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Table 1

Integral assessment of the development of a healthy lifestyle of university students

Criterion	Component	Quantitative score, points	Score on scale	Points
Value-motivational	***affectionate:*** attitude to health	14–18	health is highly dominant	5
		10–13	sufficient dominance	4
		6–9	average dominance	3
		1–5	low dominance	2
	motivational: motivation for healthy lifestyles	5	sustainable motivation	5
		4	sufficient	4
		3	established	3
		2	missing	2
Cognitive	***informative:*** volume of knowledge on healthy lifestyles	12–10	high level of knowledge	5
		9–7	sufficient	4
		6–4	average	3
		3–1	elementary	2
	projective: individual event planning skills	5	high level of skills	5
		4	sufficient level of skills	4
		3	average	3
		2	elementary	2
Activity-procedural	***activity:*** daily energy consumption	40 and more	high level of MA	5
		37–40	average	4
		33–37	low	3
		less 33	very low	2
	procedural: level of physical health	more 16	high level	5
		12–16	above the average	
		7–12	average	4
		4–7	below the average	3
		less 4	low	2

style at the level of belief, in-depth knowledge of the fundamentals of a healthy lifestyle, and planning skills for health measures, adherence to optimal motor regimen and proper behavioral stereotypes;

– "sufficient" level – accountable realize the value of health, the necessary knowledge of the basics of a healthy lifestyle and the ability to plan activities zdorovyaformuvannya, steady motivation to comply with the principles of a healthy lifestyle, the average level of physical activity and responsible attitude to health;

– "satisfactory" level of development of a healthy lifestyle indicates an insufficient value attitude to health and the presence of motivation to observe certain principles of a healthy lifestyle, the presence of a certain amount of knowledge in the field of healthy lifestyle and the ability to plan individual health activities of the formation, a low level of physical activity and irregular adherence to basic components of a healthy lifestyle;

– "critical" level indicates a low dominance of the category "health" in the system of life values, the lack of positive motivation for a healthy lifestyle, lack of knowledge and skills to plan health measures, a low level of physical activity and noncompliance with the principles of a healthy lifestyle.

The components that make up the formation of a healthy lifestyle of students were studied. The study showed that the average value was equal to (5; 3; 9,5; 3,97 points) for the affective component of the value-motivational criterion for young men, and (3; 3; 4; 0,77 points) for the motivational component. According to the informative component of the cognitive criterion, the indicator was (4; 3; 5; 1,81 points), and by the

Table 2

Scale of the level of formation of a healthy lifestyle of students

Level	Quantitative score	Points
High	30–27	5
Sufficient	26–23	4
Satisfactory	22–19	3
Critical	18–16	2

projective component – (3; 2; 3; 0,7 points). According to the activity component of the activity-procedural criterion – (33,9; 32,26; 34,76; 1,98 c.u.); and according to procedural – (4,52; 0; 7; 3,54 c.u.) (Table 3).

The girls had the following average indicators: affective component – (4; 2; 5,5; 2,7 points), for motivational – (4; 3; 4; 0,93 points), for informative – (5; 4; 6; 5; 2,07 points), by projectives – (3; 3; 4; 0,77 points), for activities – (31; 29; 33; 2,79 c.u.), and by procedural – (4; 0; 7; 3,48 c.u.).

The distribution of participants in the experiment according to the level of formation of healthy lifespan showed that among young men, 3,7% (n=4) had a sufficient level, 20,37% (n=22) were satisfactory and 75,93% were critical (n=82) (Figure 1).

At the same time, girls were characterized by such a distribution by levels of formation of healthy lifestyles: a sufficient level of 2,5% (n=3), satisfactory 25% (n=30), critical 72,5% (n=87). As we can see, among boys there is a 1,2% decrease in the proportion sufficient and 3,43% less with a critical level, but a 4,86% increase in the proportion with an average level of the formation of healthy lifestyles than girls. However, it

Table 3

Indicators of the formation of a healthy lifestyle of university students, n=228

Components, score	Boys, n=108				Girl, n=120			
	Me	25%	75%	S	Me	25%	75%	S
Affective	5,00	3,00	9,50	3,97	4,00	2,00	5,50	2,70
Motivational	3,00	3,00	4,00	0,77	4,00	3,00	4,00	0,93
Informative	4,00	3,00	5,00	1,81	5,00	4,00	6,50	2,07
Projective	3,00	2,00	3,00	0,70	3,00	3,00	4,00	0,77
Activity	33,90	32,26	34,76	1,98	31,00	29,00	33,00	2,79
Procedural	4,52	0,00	7,00	3,54	4,00	0,00	7,00	3,48

should be noted that there were no statistically significant differences in the distribution of subjects by gender (p>0,05). As a result of the study, no students with a high level of formation of values of a healthy lifestyle were established. This requires the development of measures aimed at improving the level of formation of the values of healthy lifestyles of students in the process of physical education.

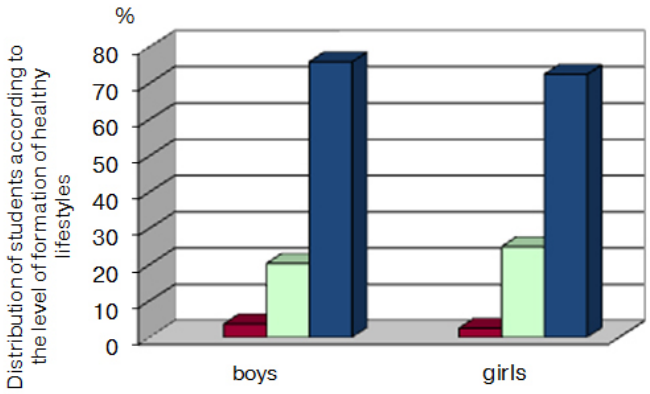

Figure 1. Assessment of the level of formation of values of a healthy lifestyle of university students, (boys n=108; girls n=120):
– sufficient; – satisfactory; – critical

Conclusions / Discussion

We have confirmed the data of researchers [5; 8; 12; 13; etc.] that the process of formation of values of a healthy lifestyle of students in higher education institutions is due to the current system of physical education, which today requires substantial reorganization and improvement. These problems in the organization of physical education of students of higher educational institutions naturally lead to a deterioration in the level of involvement of young people in regular physical activity classes, a decrease in their physical health and physical preparedness indicators [2; 6; 7; 10; 23]. Training sessions do not provide the volume of physical activity necessary for students [4]. 61,1% of respondents consider their knowledge and skills to use physical culture aids to implement measures to preserve their own health insufficient. Similar research results were obtained by us. In the physical education of students, a problematic situation has arisen, which is the contradiction between the level of social requirements and the effectiveness of the system of physical education. Thus, the majority of surveyed students of higher educational institutions do not consider themselves competent in matters of health protection, 5% could not answer this question and only 30% admit their competence. The results of a study aimed at determining the level of theoretical knowledge of students convincingly indicate that the majority of students have fragmentary knowledge concerning health, healthy lifestyles and its components [9; 12]. The lack of fundamental knowledge among students has been noted by us in matters relating to the rational mode of the day, hardening, nutrition, etc. The main reason for the students' lack of awareness in matters relating to health-forming activities is, first of all, the lack of effectiveness of the physical education process as an integral part of the general structure of education student youth. The data we have obtained confirms the existing scientific developments and determines the need to substantiate approaches to improving the level of theoretical preparedness of students in health preservation as part of the formation of healthy benefits.

Scientific findings confirm the results of our study [7; 11; 18; 23 etc.] on the practical absence of students with a safe level of health. The criteria for assessing the levels of formation of values of a healthy lifestyle of students have been improved, a qualitative and quantitative characteristic of the levels of formation of values of healthy lifestyle of students (high, sufficient, satisfactory, critical) has been submitted. The components of the students' value attitude to a healthy lifestyle are defined and the criteria and indicators of their formation are refined: cognitive (knowledge about health, healthy lifestyle, health values, axiological goals for achieving the goal), motivational and value (attitude to one's own health, positive emotions, interest and needs for a healthy lifestyle), activity (actions and behavior, contribute to a healthy lifestyle, compliance with the requirements of a healthy lifestyle in everyday life). On the basis of certain criteria and indicators, the levels of formation of the values of a healthy lifestyle are characterized: high, sufficient, satisfactory and critical. It was found that most students have a critical level of formation of healthy lifestyle values (boys 75,93%, girls 72,5%).

Prospects for further research and this direction will be the possibility of applying the developed approaches to assessing the values of a healthy lifestyle for students of general secondary education institutions.

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Informative significance of indicators of physical preparedness and morphofunctional state in the structure of the motor system of 9–10 years old pupils

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The article presents the results of the factor analysis of the indicators of physical preparedness, functional status and physical development of pupils of primary school age. Identified leading factors affecting the state of the motor system of children 9–10 years old, which allows to determine the direction of pedagogical influences that will improve the efficiency of the process of physical education in primary school.

Purpose: *to determine the presence and informative significance of the interrelations of indicators of physical preparedness, functional status and physical development of primary school pupils.*

Material & Methods: *the study was conducted in the secondary school No. 2 in Pereyaslav-Khmelnitsky, 115 pupils of 3–4 classes at the age of 9–10 years took part in the study. The following methods were used: theoretical analysis and synthesis of scientific and methodological literature data; pedagogical methods (observation, experiment, testing); anthropometry; physiological research methods (pulsometry, spirometry, Shtange and Gencha tests, Rufie test) methods of mathematical statistics (correlation and factor analysis).*

Results: *the informative significance of the main components in the general structure of the motor system of boys and girls 9–10 years old has been established.*

Conclusion: *revealed significant relationships between the components of physical preparedness, functional state and physical development, which have certain gender and age differences, but despite these differences in the factor structure of the motor activity of children 9 and 10 years old, it can be noted that there are general tendencies, which consist in the dynamic, heterochrony of development and the relationship of its main content components.*

Keywords: *factor analysis, physical condition, leading factors, primary school age.*

Introduction

The younger school age is a very crucial period in the development of a child. It is at this age that the foundation for further state of health and physical fitness is laid, interests and habits are actively developed, character and motivational priorities are being formed [1; 10]. It has been established that in preschool and school age, in the period of active growth and development, the effectiveness of physical training can be achieved under the condition of physical exertion, which should correspond to the peculiarities of the age development of physical abilities [2; 8; 9]. In the current socio-economic conditions of Ukraine, a significant number of schoolchildren have a low level of health and physical fitness, which is largely due to the insufficient level of physical activity, the optimization of which is one of the main tasks of the modern school physical education system [3; 7].

In the early school years, significant morphological and functional changes occur in the child's body [3; 10]. It is important that during this age period motor activity is especially necessary, it contributes to: the optimal course of the restructuring processes of the body's functional systems; physical development and the formation of physical qualities necessary in the process of adult activity [1; 11]. Until recently, there was a physical education program for students in grades 1–4, in which all physical exercises were classified by "schools". One of these "schools" is the "ball school", in which exercises with balls of various sizes and different ways of performing them are presented [6]. Since 2017, an updated program for physical culture has been in effect, in which the exercises are classified by type of activity, but this is of no fundamental importance. Some of the exercises presented in this section are elements of basketball. Such exercises cause positive emotions in children, give the opportunity to develop physical abilities in a comprehensive manner, and it is precisely in the younger school age that assimilation of elements of the game is actively taking place, but the lack of time allocated to the lesson does not allow to effectively solve educational and health problems (development of physical abilities), therefore the development of a methodology for the complex development of physical abilities of pupils of 3–4 classes in the process of teaching the techniques of basketball elements is an urgent task. Leading Ukrainian scientists T. Yu. Krutsevich, N. Ye. Pangelova, A. D. Krivchikova et al. [4] consider physical fitness more broadly, not limited to the level of development of motor skills, but understanding it as a form of manifestation of the functional capacity of the body involved in motor activity and determine its effectiveness. Consequently, the level of development of physical qualities in a certain way testifies to the psycho-physiological potential of the organism, which makes it expedient to study the interrelationships of the components

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of the human motor system. The study of the relationship of the components of the functioning of the body of students as an integrated system using the methods of mathematical analysis (correlation and factor) allows the development of a ratio of the components of pedagogical actions.

Purpose: to determine the presence and informative significance of the interrelations of indicators of physical preparedness, functional status and physical development of primary school pupils.

Material and Methods of the research

The study was conducted in secondary school number 2 of Pereyaslav-Khmelnitsky, the study was attended by 115 students of 3–4 classes at the age of 9–10 years. In the process of research, the following methods were used: theoretical analysis and synthesis of data from scientific and methodological literature; pedagogical methods (observation, experiment, testing); anthropometry; physiological research methods (pulsometry, spirometry, Shtange and Gencha tests, Rufie test) methods of mathematical statistics (correlation and factor analysis). The comprehensive study program included 21 indicators. The interrelation of all components of the motor system of the students was analyzed on three correlation levels: high – r=0,7–0,99; average – r=0,31–0,69; low – r<0,3. A factor analysis was used to reduce the number of variables and to identify the structure of interrelationships between variables, which allows us to determine the directions of pedagogical measurements.

Results of the research

The conducted factor analysis of the structure of the motor system of boys for 9 years has made it possible to establish that it is determined by 8 orthogonal factors in which the sum of load variables varies from 3,72 to 1,32 and the dispersion contribution is 99,8% (Table 1). The first factor was the anthropometric indicators with the highest values (body weight – 0,94, body length – 0,76, CC – 0,61). Also in this factor included indicators of vital capacity of the lungs (0.75), which also determined the name of this factor – "morpho-functional state". It should be noted that the first factor has the greatest weight coefficient of significance (21%). In the second factor, the sum of the load variables is 2,64 and in it the most significant are the indicators of dynamometry (left – 0,90, right – 0,88), arm muscle strength (0,65). The data obtained give us reason to consider this factor as a factor of "strength abilities", and its contribution to the total variance is 15,0%. In the third factor, where the sum of the coefficients is equal to 2,52, and the weight coefficient of significance is 14,4%, the most significant are the indicators of the functional state of the respiratory system (the Shange test is – –0.92, the Gencha test is 0,86) and the coordination ability (vestibular stability – 0,57), which determined the name of the factor – "functional state of the respiratory system and vestibular stability", and there is feedback, which suggests that a low level of functional state is the limiting factor torus of physical condition. When analyzing the content of the fourth factor (13,1%), the effect of indicators of endurance (running 1,000 m – 0,86) and coordinating abilities (the ability to estimate the spatial and temporal parameters of movements – 0,73, the reaction rate – –0,60, vestibular stability – 0,41). The fourth factor has a sum of loading variables of 2,30 and received the name "endurance, coordination and speed capabilities". The fifth factor included indicators of heart rate (relative rest – 0,96, absolute rest – 0,94). The sum of loading variables is equal to 2,28,

Table 1

Factor analysis of the main components of physical development, functional status and physical fitness of boys, 9 years old, n=28

Indicators	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Body mass	**0,94**	0,04	0,16	0,11	0,07	0,03	0,14	–0,02
Body length	**0,76**	0,37	–0,19	–0,09	–0,11	–0,13	–0,03	–0,09
Chest circumference	**0,61**	0,10	0,33	0,30	–0,24	0,21	0,28	–0,33
Quetelet index	**0,87**	–0,08	0,26	0,16	0,12	0,07	0,17	0,01
HR relative rest	0,03	0,03	0,19	0,09	**0,94**	0,12	–0,01	–0,12
HR absolute rest	–0,03	0,05	0,17	0,02	**0,96**	–0,18	–0,01	–0,05
HR difference	–0,17	0,05	–0,06	–0,19	0,04	**–0,84**	0,02	0,18
VC	**0,75**	0,10	–0,22	–0,12	–0,05	0,04	–0,18	0,11
Stange's test	0,04	0,03	**–0,92**	0,01	–0,15	–0,09	–0,08	0,18
Gencha test	–0,07	–0,17	**–0,86**	0,06	–0,34	0,06	0,19	0,03
Rufie test	–0,02	–0,05	–0,08	–0,07	–0,13	–0,06	–0,10	**0,82**
Dynamometry, rights	0,12	**0,88**	0,19	0,07	0,20	0,08	–0,13	0,03
Dynamometer, left	0,14	**0,90**	0,04	0,03	–0,01	0,02	–0,08	–0,13
Standing long jump	–0,11	0,10	0,01	–0,08	0,01	0,06	**–0,92**	0,11
Flamingo test	0,26	0,09	**0,57**	**0,41**	–0,09	–0,02	0,16	0,38
Pulling up	–0,11	**0,65**	–0,36	–0,15	–0,07	0,08	0,41	0,29
Tilt the body forward from a standing position	–0,33	–0,46	–0,13	–0,30	0,31	0,32	–0,05	0,26
Grip a gymnastic stick that falls	0,49	0,02	0,19	**–0,60**	0,05	–0,07	0,02	–0,10
Running 30 m	0,17	–0,30	0,04	**0,42**	0,03	**–0,64**	0,07	–0,19
"Shuttle run" 4x9 m	0,11	0,33	0,16	**0,73**	–0,13	–0,07	0,28	–0,23
Running 1000 m	0,08	–0,07	0,03	**0,86**	0,23	0,05	–0,05	–0,02
Sum of loading variables	3,72	2,64	2,52	2,30	2,28	1,37	1,37	1,32
Contribution of the factor to the total variance, %	21,2	17,52	14,4	13,1	13,0	7,9	7,9	7,5

Table 2

Factor analysis of the main components of physical development, functional status and physical fitness of girls, 9 years old, n=22

Indicators	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Body mass	**0,95**	0,05	0,11	–0,15	0,09	0,01	0,08
Body length	**0,75**	0,43	0,12	–0,16	–0,01	–0,11	0,01
Chest circumference	**0,80**	–0,03	–0,13	0,22	0,12	–0,34	–0,06
Quetelet index	**0,94**	–0,04	0,11	–0,13	0,11	0,04	0,09
HR relative rest	0,24	**0,85**	0,19	–0,01	–0,04	0,14	0,24
HR absolute rest	–0,09	**0,92**	–0,09	0,05	0,12	–0,20	0,06
HR difference	–0,37	0,31	**–0,56**	0,05	0,34	–0,45	–0,19
VC	**0,52**	0,41	**0,52**	0,19	–0,12	–0,18	–0,28
Stange's test	–0,28	–0,06	–0,05	**0,87**	0,00	0,13	–0,08
Gencha test	0,01	0,10	0,00	**0,96**	0,06	0,04	0,04
Rufie test	–0,22	–0,09	–0,01	0,30	0,19	0,32	**–0,66**
Dynamometry, rights	0,35	0,37	0,48	0,38	0,36–	0,18	–0,19
Dynamometer, left	0,19	**0,60**	–0,18	**0,53**	0,05	0,40	–0,01
Standing long jump	–0,03	–0,27	**–0,55**	–0,21	**–0,56**	0,40	–0,03
Flamingo test	–0,24	0,01	–0,16	–0,01	–0,18	**0,87**	0,04
Pulling up	–0,05	–0,26	**–0,81**	0,06	0,01	–0,02	0,00
Tilt the body forward from a standing position	**–0,54**	–0,18	0,09	–0,29	0,37	0,18	–0,02
Grip a gymnastic stick that falls	0,00	0,18	0,13	0,27	0,12	0,18	**0,87**
Running 30 m	0,10	–0,24	**0,80**	–0,10	0,34	–0,18	0,14
"Shuttle run" 4x9 m	0,24	0,08	0,03	–0,18	**0,74**	–0,13	0,35
Running 1000 m	0,06	0,01	0,05	0,12	**0,96**	–0,09	0,05
Sum of loading variables	4,18	2,80	2,60	2,59	2,45	1,79	1,59
Contribution of the factor to the total variance, %	23,2	15,5	14,4	14,4	13,6	9,9	8,8

which determined the name of this factor – "functional state of the cardiovascular system". The contribution of this factor to the total variance is 13%. The sum of the coefficients of the variables in the sixth factor is 1,37, and the contribution of the factors to the total variance is 7,9%. Here the indicators of the functional state of the cardiovascular system (–0,84) and speed (–0,64). The content of this factor allows to define it as "functional state of the cardiovascular system and speed". The seventh factor has the sum of the coefficients – 1,37, the contribution to the total variance – 7,9%. The most significant is the indicator of the test "standing long jump" (–0,92), which determined the name of the seventh factor – "speed-strength abilities". In the eighth factor, where the sum of the coefficients is equal to 1,32, and the weighting factor is 7,5%, the indicator of the Rufie test is the most significant (–0,82). Thus, this factor is interpreted as a factor of "physical working capacity". The conducted analysis of the factor structure gives us the opportunity to consider that the development of physical fitness, functional state and physical development of boys of 9 years of age is complex and is ensured by the following factors: morphofunctional state, strength abilities, functional state of the respiratory system and vestibular stability, endurance, coordination and speed abilities, functional state of the cardiovascular system, functional state of the heart cerebrovascular system and speed, speed-strength abilities, physical working capacity.

The analysis of the motor system of girls 9 years old, in contrast to boys, is determined by 7 orthogonal factors, where the sum of load variables ranges from 4,18 to 1,59, and the total dispersion contribution is 99,8% (Table 2). The first factor has the largest amount of loading variables – 4,18 and the contribution of the factor to the total variance (23,2%). It includes indicators of body mass (0,95), Quetelet index (0,94), CC (0,80), body length (0,75), which enabled us to define this factor as "physical development". The second factor contributes to the general dispersion of 15,5% and the sum of the coefficients 2,80. The largest here are indicators that characterize the functional state of the cardiovascular system (0,85 and 0,92), as well as the indicators of left hand dynamometry (0,60). Thus, the interconnection of the components gives the right to interpret this factor as "the functional state of the cardiovascular system and the strength of the muscles of the brush". The most significant indicators of the third factor (14,4%) are the strength (–0,80), speed (0,80), functional state of the respiratory system (difference of heart rate – 0,56), indicators of lung capacity (0,52) and high-power (–0,55) abilities. The sum of the coefficients of the third factor is 2,60 and is called the "physical abilities and functional status of the respiratory system." In the fourth factor, where the sum of the coefficients is equal to 2,59, and the weight coefficient of significance is 14,4%, the indicators of the Genche test (0,96) and the Stange test (0,87) are the most significant, which determined its name – "functional state respiratory system. When analyzing the fifth factor, where the sum of the coefficients is 2,45, and the dispersion contribution is 13,6%, the mutual influence of endurance (0,96), coordination (0,74) and speed-strength (–0,56) abilities is clearly seen. This made it possible to identify this factor as a factor of "physical abilities". In the analysis of the sixth factor, where the sum of the coefficients is 1,59, and the dispersion contribution is 8.8%, the most significant are the indicators of coordination abilities (0,87) and the Rufie index (–0,66). This made it possible to determine this factor as a factor of "coordination abilities and physical performance". In the seventh factor, where the sum of the coefficients is 1,79, and the weight coefficient of significance is 9,9%, the Flamingo test indicator (0,87) is the most significant, which caused its name – "vestibular stabil-

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Table 3

Factor analysis of the main components of physical development, functional state and physical fitness of boys 10 years, n=41

Indicators	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Body mass	0,21	**0,60**	**0,58**	–0,12	0,15	–0,21	–0,02
Body length	–0,08	0,30	**0,84**	–0,09	–0,08	0,01	–0,13
Chest circumference	0,10	**0,88**	0,13	0,00	–0,08	–0,09	0,07
Quetelet index	0,41	**0,54**	0,14	0,11	0,05	–0,32	–0,17
HR relative rest	–0,21	0,06	–0,15	**0,89**	–0,06	0,01	0,12
HR absolute rest	–0,12	0,07	0,06	**0,89**	0,12	–0,09	–0,22
HR difference	0,22	0,03	0,45	0,08	0,34	–0,14	**–0,69**
VC	–0,23	0,32	0,47	–0,09	–0,48	0,15	0,17
Stange's test	0,11	0,15	**0,67**	0,28	0,11	0,03	0,26
Gencha test	0,11	0,21	**0,44**	**0,60**	–0,11	0,22	0,01
Rufie test	–0,23	0,15	0,31	0,32	–0,13	**–0,55**	–0,17
Dynamometry, rights	–0,17	**0,87**	0,15	0,12	0,03	0,13	–0,07
Dynamometer, left	–0,12	**0,82**	0,05	0,18	–0,11	0,00	–0,17
Standing long jump	–0,29	0,01	0,11	0,15	–0,03	**0,83**	–0,19
Flamingo test	–0,36	0,31	**–0,47**	0,00	0,10	0,18	0,05
Pulling up	**–0,90**	0,02	–0,04	–0,04	0,13	0,03	0,03
Tilt the body forward from a standing position	0,09	–0,01	0,03	–0,02	**0,92**	0,06	0,06
Grip a gymnastic stick that falls	0,12	–0,19	0,28	–0,04	0,19	–0,19	**0,76**
Running 30 m	**0,91**	0,04	0,04	–0,,17	0,18	0,00	0,10
"Shuttle run" 4x9 m	**0,90**	–0,18	0,10	–0,07	0,12	0,04	–0,01
Running 1000 m	**0,76**	0,19	–0,04	–0,21	0,18	–0,30	–0,03
Sum of loading variables	3,78	3,34	2,62	2,32	1,44	1,42	1,38
Contribution of the factor to the total variance, %	23,1	20,5	16,0	14,2	8,8	8,7	8,5

ity". The analysis of the factor structure allows us to consider that the development of physical fitness, functional state and physical development of girls of 9 years is ensured by the following factors: physical development, functional state of the cardiovascular system and the strength of the muscle of the brush, physical abilities and functional state of the respiratory system, functional state respiratory system, physical abilities, coordination abilities and physical working capacity, vestibular stability .

Summarizing the results of factor analysis of the motor system of boys and girls of 9 years of age, one can state that reliable relationships have been identified between the components of physical fitness, physical development and functional state of children. Boys have identified 8 orthogonal factors, and girls have 7, which is due to the fact that boys of this age are experiencing intense growth (this is the so-called period of "second extraction"). According to A. A. Markosyan's theory, the greater the number of factors determines the functioning system, the less stable it is. Such trends are observed in such periods of age development, which are called "critical" (intensive growth, quantitative and qualitative changes occur in the body.)

In boys of 10 years, the structure of motor activity is determined by 7 orthogonal factors with a sum of variables from 5,34 to 1,38 and a total dispersion contribution of 99,8% (Table 3). The first factor (23,1%) included indicators of physical abilities (speed – 0,91; coordination abilities – 0,90; endurance – 0,76; strength of the arm muscles – 0,66). The sum of indicators of this factor is 3,78 and it is defined by us as "physical abilities". In the second factor, which has a coefficient of significance (20,5%) and a sum of coefficients of 3,34, the indicators of dynamometry (right – 0,87, left – 0,82) and physical development (CC – 0,88, body weight – 0,60, Quetelet index – 0,54), which makes it possible to determine this factor as a factor of "physical development and muscle strength of the hands". When analyzing the third factor (16,0%), it was revealed that the functional state of the respiratory system (the Shange test – 0,67 and the Gencha test – 0,44) and the Flamingo test (–0,47) have the highest values. The sum of the coefficients of the third factor is 2,62 and is called the "functional state of the respiratory system and coordination abilities". The most significant in the fourth factor are the indicators of the functional state of the cardiovascular system (0,89 and 0,89) and the Gencha test (0,60). The contribution of the factor to the general dispersion is 14,2%, and the sum of the coefficients is 2,32. The fourth factor is interpreted as a "functional state of the cardiorespiratory system". In the fifth factor, where the sum of the coefficients is 1,44, and the weight coefficient of significance is 8,8%, the most significant is the index of the "torso inclination forward in the standing position" (0,92), which was determined by its name – "flexibility". In the analysis of the sixth factor, where the sum of the coefficients is 1,42, and the dispersion contribution is 8,7%, the most significant are indicators of speed-strength abilities (0,83) and the Rufie index (–0,55). This made it possible to determine this factor as a factor of "speed-strength abilities and physical performance". In the seventh factor, where the sum of the coefficients is equal to 1.38, and the weight coefficient of significance is 8,5%, the most significant are the indicators of the reaction rate (0,76) and the functional state of the cardiovascular system (–0,69), which determined the name the seventh factor "the functional state of the cardiovascular system and the reaction rate". The conducted analysis of the factor structure of boys for 10 years allows us to as-

Table 4

Factor analysis of the main components of physical development, functional status and physical fitness of girls, 10 years old, n=24

Indicators	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Body mass	0,19	0,17	**0,68**	**–0,56**	0,16	0,22	–0,07
Body length	0,13	0,14	**0,81**	–0,08	0,07	0,25	–0,21
Chest circumference	**0,62**	0,13	0,01	–0,24	–0,17	**0,55**	0,15
Quetelet index	0,19	0,17	**0,52**	**–0,62**	0,29	–0,10	0,02
HR relative rest	**–0,85**	–0,26	–0,16	0,03	0,13	–0,05	0,02
HR absolute rest	**–0,79**	–0,06	–0,24	–0,04	0,15	0,22	–0,07
HR difference	0,23	0,27	0,07	0,45	**0,67**	0,02	–0,09
VC	0,08	–0,21	**0,91**	0,04	–0,01	–0,06	–0,02
Stange's test	0,00	0,26	0,03	0,23	0,00	–0,20	**0,83**
Gencha test	0,14	0,31	**0,72**	0,07	–0,26	0,11	0,39
Rufie test	**–0,83**	0,26	–0,11	–0,12	–0,21	–0,12	0,19
Dynamometry, rights	0,00	–0,30	–0,03	**–0,79**	–0,06	0,36	–0,19
Dynamometer, left	0,08	–0,07	0,01	**–0,85**	–0,05	–0,20	–0,15
Standing long jump	0,09	–0,40	–0,18	0,08	0,21	0,28	**0,71**
Flamingo test	–0,15	**–0,52**	–0,10	0,08	**0,52**	0,03	–0,07
Pulling up	–0,18	–0,09	0,24	0,08	0,07	**0,87**	–0,05
Tilt the body forward from a standing position	**–0,75**	–0,07	0,03	0,21	–0,04	0,15	–0,11
Grip a gymnastic stick that falls	–0,14	0,00	0,04	–0,21	**0,81**	0,01	0,18
Running 30 m	0,08	**0,92**	–0,11	0,07	0,09	0,06	0,04
"Shuttle run" 4x9 m	–0,06	**0,87**	0,22	0,04	0,01	0,08	0,05
Running 1000 m	0,13	**0,74**	0,00	0,11	0,00	–0,22	–0,04
Sum of loading variables	3,27	3,20	3,00	2,51	1,74	1,63	1,57
Contribution of the factor to the total variance, %	19,4	18,9	17,8	14,9	10,0	9,7	9,3

sert that the functioning of the motor system is ensured by the following factors: physical abilities, physical working capacity and muscle strength, functional state of the respiratory system and coordination abilities, functional state of the cardiorespiratory system, flexibility, physical working capacity and speed-strength abilities, functional state of the cardiovascular system and the reaction rate.

The factor structure of the motor system of girls 10 years is also determined by 7 orthogonal factors, where the sum of load variables varies from 3,27 to 1,57. The total dispersion fee is 100% (Table 4). In the analysis of the first factor, where the sum of the coefficients is 3,27, and the dispersion contribution is 19,4%, the interaction of the components of the functional state of the cardiovascular system (–0,85; –0,79) and physical working capacity (–0,83) is clearly traced. This makes it possible to determine this factor as a factor of the "functional state of the cardiovascular system and physical performance". The second factor contributes to the total variance of 18,9% and the sum of the coefficients is 3,20. The largest here are indicators of physical qualities (speed – 0,92; coordination abilities – –0,52 and 0,87; endurance – 0,74; speed-strength abilities – –0,40). Thus, the interrelation of these components gives the right to interpret this factor as "physical abilities". The third factor has the sum of variables – 3,0, the contribution to the total variance – 17,8%. It contains the highest lung capacity (0.91) and Gencha samples (0,72) with the highest values. Also, this factor included anthropometric indicators (body length – 0,81, body weight – 0,68, Quetelet index – 0,52), which determined the name of this factor – "morphofunctional state". The most significant indicators of the fourth factor (14,.9%) are indicators of the strength of the hand muscles (–0,79 and –0,85), Quetelet index (–0,62), body mass (–0,56). The sum of the coefficients of the fourth factor 2,51 and received the name "physical development". In the fifth factor, where the sum of the coefficients is 1,74, and the weight coefficient of significance is 10,0%, the most significant are the indicators of the reaction rate (0,81) and the Flamingo test (0,52), which determined the name of this factor – "speed and coordination abilities". The sum of the coefficients of the variables in the sixth factor is 1,63, and the contribution of the factor to the total variance is 9,7%. Here, the highest value is given to the strength index (0,87) and CC (0,55), which makes it possible to determine the name of this factor – "power abilities". In the seventh factor, where the sum of the coefficients is 1,57, and the weight coefficient of significance is 9,3%, the most significant is the indicator of the Stange test (0,83) and speed-strength abilities (0,71) which led to his name – "functional state of the respiratory system and speed-power abilities". The analysis of the factor structure of girls for 10 years is provided by the following factors: functional state of the cardiovascular system and physical fitness, physical abilities, morphofunctional state, physical development, speed and coordination abilities, strength abilities, functional state of the respiratory system and speed-strength abilities.

So, the factor analysis of the main components of the motor activity of boys and girls of 10 years of age indicates the presence of interconnections between physical abilities and morphofunctional state. Interpretation of these data in the pedagogical aspect suggests that in primary school age it is advisable to carry out the integrated development of physical abilities.

Conclusions / Discussion

The use of factor analysis in research allowed us to establish

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the information significance of factors in the overall structure of the motor system of children of primary school age, and also to identify their main components. In girls of 9 years of age, 7 orthogonal factors are determined, and in boys, 8, and in boys and girls of 10 years of age, 7 orthogonal factors.

Summarizing the results of factor analysis of motor activity of junior schoolboys (boys and girls), it can be stated that reliable relationships have been identified between the components of physical fitness, functional state and physical development, which have certain gender-age differences. But despite certain differences in the factor structure of the motor activity of children 9 and 10 years, one can note the existence of general tendencies that consist in the dynamics, heterochronous development and interconnection of its main content components. Thus, it was established that the anthropometric and functional indicators in all sex and age groups are located in the most influential factors - I and II, in combination with the indicators of motor tests, allows us to realize the ratio of physical exercises of different orientations in the process of teaching and non-teaching physical training.

Our data confirm the results of studies by other scientists on the structure of the motor system of junior schoolchildren [5; 6]. In particular, in children of 9 years of age, there is a difference between the number of orthogonal factors in girls and boys (7 and 8 respectively), which is explained by the different rates of sex and age development during this period, and already at 10 years of age, the number of orthogonal factors is the same, both boys and girls.

Prospects for further research are to substantiate and develop methods for the integrated development of physical abilities of students in grades 3–4 in the process of teaching basketball elements.

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Improving the technical training of female athletes 10–11 years in rhythmic gymnastics in exercises with clubs

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Purpose: *to prove the expediency of using training combinations to increase the level of knowledge of young athletes with basic skills in exercises with clubs.*

Material & Methods*: study was attended by nine athletes of 10–11 years old who train at the Children's and Youth Sports School of Rhythmic Gymnastics in the training group of the 2nd year of study. Using the method of expert evaluation and video analysis, the level of technical preparedness of athletes in the exercises with clubs and discounts for the technique of the subject in competitions was determined.*

Results: *training combinations with clubs were developed, which consisted of exercises involving the combination of various technical work with the subject and body work with difficulty, as well as elements and connections from competitive programs.*

Conclusion: *as a result of the introduction of training combinations, the discounts on the components of the equipment used by the object at competitions decreased: for performing "mills" – from 1,7 to 1,0 points; when making small throws and catching clubs – from 3,8 points to 2,7 points; in non-fundamental (non-specific) work – from 2,5 points to 1,7 points.*

Keywords: *gymnastics, clubs, exercise combinations, discounts, competitions.*

Introduction

Currently, in rhythmic gymnastics, the complications of competitive compositions of athletes [14] continue, which is largely due to the expansion of the gymnast's interaction with the subject and emphasizes the specifics of the sport [8]. Specialists in rhythmic gymnastics point to the original combination of work with an item with elements, dance tracks, at transitions from one element to another [3; 13].

Modern technology of training athletes in rhythmic gymnastics is based on the results of scientific research and has a scientific and methodological rationale [1; 6; 10, 16]. Specialists have developed a technique for consistent training of gymnasts with complex coordination actions with objects [2; 9]. The work of N. A. Andreev [3] is devoted to the study of the specifics of athletes performing exercises with objects; V. V. Bayer [4]; N. V. Bochkarnikova, A. V. Gaskova, E. I. Ovchinnikova [5]; A. Ya. Mullagildina [12]

The high complexity of competitive exercises in rhythmic gymnastics determines the search for effective pedagogical approaches to the process of improving the technical training of athletes in exercises with objects [3; 7]. The traditional way of successive mastery of a number of elements, accelerated in which movements are combined without a subject and with a subject, cannot provide the necessary basis for the creation of modern programs [8; 11].

The essence of the proposed method is programming the improvement of the basic elements, using the most appropriate number of connection options, creating the necessary stock of technical readiness and conditions ensuring the reliability of the performance of competitive compositions.

Purpose: to prove the expediency of using training combinations to increase the level of knowledge of young athletes with basic skills in exercises with clubs.

Objectives of the study: 1) to develop training combinations to increase the level of basic skills in exercises with gymnasts 10–11 years old; 2) determine the effect of the use of training combinations with clubs on the competitive outcome of young athletes.

Material and Methods of the research

The study was attended by nine athletes of 10–11 years old who train at the Children's and Youth Sports School of Rhythmic Gymnastics in the training group of the 2nd year of study. Using the method of expert evaluation and video analysis, the level of technical preparedness of athletes in exercises with clubs and discounts for the technique of the subject at competitions was determined.

Results of the research

According to the generally accepted scheme of building lessons with clubs and the results of an earlier analysis [13] of an analysis of the level of fitness of gymnasts, a set of exercises with clubs 40 minutes in duration was developed. The exercises were aimed at the correct formulation of the hand and the differentiation of muscular efforts with successive small shots, at the correct formulation of the hand on the issues of the clubs, at consolidating the experience of working with a brush in different planes when performing "mills". The ability to differentiate muscular effort without visual control, the static dynamical stability of gymnasts, and the coordination of work of the body and the subject, and the combination of

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asymmetric work with maces are improved. The following exercises with clubs were developed (Table 1).

It should be noted that when performing consecutive small throws of both clubs per 1 turn at an increasing pace, the correct formulation of the hand, the differentiation of muscular efforts, and the preservation of the rhythm of the ejection of the clubs were worked out. Four counts were thrown at the same speed, then backing up with an increase in the rotation speed of the mace. When making small throws right and left hands for 2 turns practiced the skill of a slight increase in muscle effort without an increase in the rate of movement. The correct setting of the hand on the issues of the maces was also worked out: a throw with a straight hand with a fixation on the release.

When performing "mills" in different planes and with a change in direction, the skill of working the brush in different planes was improved (also the rotation of the mace through the thumb). "Mills" was accompanied by a preparatory exercise: "interfere with the porridge", in which the ball of the clubs should rotate freely in the closed palm. When performing throws of one mace over the shoulder with his right and left hand, the skill of differentiating muscular efforts was improved without visual control. When making throws of both clubs from the shoulder with rotation in the horizontal plane, the right and left hands worked out the skill of making the throw by straightening the hand and rotating the object with the help of a hand. When performing "mills" in the rotation of 180° by stepping in different planes and in different directions, the combination of working with a brush in different planes was practiced.

With the content of one club over the other right and left hand with a rotation of 360° in both directions, the static-dynamic stability of the gymnast's body was improved. In side flips on one hand with the content of one mace over the other, the static-dynamic stability of the body was improved when exposed to the vestibular apparatus and the coordination of the body and the object. When performing various circles in different planes, skills of complex asymmetric movements of the body and the subject were acquired. When "juggling" athletes acquired the skills of rhythmic movements during the ejection of clubs, acquired the ability to quickly respond to a moving object.

When performing large shots, gymnasts perfected the accuracy of muscular effort and spatial coordination when releasing the object up and forward. When performing large shots of one club with the right hand, with the transfer of another club from the left hand to the right, followed by the fishing mace left arm behind him, the gymnasts trained a combination of different work with the right and left hand.

At each training session, gymnasts, as instructed by the trainer, conducted a warm-up at an intense, fast pace, thereby reducing it. Thanks to this, 15 minutes were released for additional work with clubs. Systematic performance of exercises with clubs allowed to adjust the technique and increase the reliability of performing basic exercises with clubs. A weighty advantage in conducting lessons on subjects was the regulated number of repetitions with a high intensity of work of the whole group. Depending on the period of preparation, the duration of the lesson varied from 15 to 45 minutes. Movement was performed in both directions, with the right and left hand. The number of repetitions was multiple or even with a predominance of elements for non-dominant hands. In some cases, the exercise began with the left hand. In the beginning, exercises were performed with an object with minimal body movement, then a combination of body and object movements took place.

Considering that gymnasts train at the stage of preliminary basic training, special attention was paid to mastering training combinations. The basic principle of developing such combinations was to concentrate the basic elements and the main components of the technical actions necessary for the successful mastering of more and more complex exercises of the main structural groups. Training combinations were the foundation for individual competition programs, which is especially important for rhythmic gymnastics, since athletes must demonstrate in their programs not individual elements, but the so-called "blocks" of difficulty elements. Such "blocks"

Table 1
Training exercises with clubs

Exercises	Dosage
1. Alternate small flips of both clubs (1 turn). Pace - increasing	30 times
2. Small throws with the right hand (2 turns). Same left	20 times
3. "Mill" in the horizontal plane to the right and left; "Mill" in the frontal plane (behind the head) to the right and left; "Mill" in the vertical plane back and forth	1 min for every "mill"
4. Throwing one club over the shoulder with the right and left hand	20 times
5. Throw both clubs from the shoulder with rotation in the horizontal plane with the right and left hand	10 times
6. "Mills": a mill in a vertical plane with the rotation of the clubs on themselves; mill in the frontal plane (behind the head) mill in a vertical plane with the rotation of the clubs forward and overturning to the semi-toes by 180°	10 times
7. Hold one club over the other right and left hand with a 360° rotation by stepping.	5 times in both directions
8. Coupling sideways on one hand with the content of one club over the other	10 times
9. S.P. – left hand forward, right to the side: small circles with the clubs forward in the lateral plane, small circles in the horizontal plane above the arm and under the arm	1 min with a change in the position of the hands
10. "Juggling": sequential release of both clubs with one hand	1 min right and left hand
11. Big throws of clubs from right and left hands	20 times
12. Large throw of one club with the right hand, transfer of the other mace from the left hand to the right, followed by catching the mace with the left hand behind the back	10 times each hand

were developed in order to form skills for combining elements of the same or different structural groups of exercises without an object and with objects. The "blocks" of such elements of difficulty were combined into training combinations.

Three training combinations with clubs were developed, which consisted of exercises involving the combination of various technical work with the subject and the work of the body, as well as elements and communication with the competition programs. The training combinations included the implementation of an unstable balance, the contents of one mace of another. Combined elements of the body's difficulty with the work of the subject. Included were elements of the difficulty of the item worth 0,3 points, where such criteria were combined without hands, visual control and rotation. Included elements of the difficulty of the item in value of 0,4 points, where the object was trapped under the above conditions from medium and high throws [4; 5, 9; 15]. The training combinations included from four to six consecutive exercises. Each of the following combinations was distinguished by an increase in the technical complexity of the exercises (Table 2).

Training combinations were applied at each training session, with dosage as it was learned 10–15 times. In the future, 2–3 times in each training session. The combinations were made in accordance with the requirements for the indivisibility and dynamic implementation of the elements in the competition have the right. The end of the previous exercise served as the starting position for the next one. The movements were selected in a logical sequence, the dynamism of which consisted in increasing the amplitude of movements of the gymnast's body, changing the angles, levels, amplitude of movements on the platform, increasing the speed of movements of the links of the gymnast's body and the subject.

When comparing the average test results at the beginning and at the end of the pedagogical experiment, it was determined that for all nine tests in exercises with clubs there were positive changes: from 0,8 points to 1,2 points (Table 3).

The most significant improvements occurred when performing the unstable balance of the subject (by 1,2 points) and asymmetric motions in the maces on the dance track, with the domination of the right-handed hand (by 1,1 points), with the execution of "mills" in turn by 180 degrees (by 1,1 point). The results in juggling with the right and left hand (by 0,8 points) have not improved sufficiently. Under the influence of the experimental technique, there were positive shifts in the technique of performing small transfers and "risks", but these improvements are not sufficient.

The objective indicator of the quality of educational work is the competition. An analysis of videotapes of gymnasts' performances in exercises with maces in competitions was conducted to detect errors in the technique of work by the subject. Figure 1 shows the comparative results of the discounts for the technique of work by the subject at the beginning and at the end of the academic year after the application of the experimental method. It should be noted that the sum of all discounts at competitions at the end of the school year was 15,4 points, which is considerably less than at the beginning of the year – 24 points (Figure 1) [13].

It was determined that all components of the technique of work on the subject were positive changes. The highest number of discounts, as before, was observed when performing "skill" (4,3 points) and "risks" (4,1 points). The athletes confirmed sufficient basic skills in the execution of small circles of maces (0,5 points), significantly improved the quality of the "mills", the discounts for which decreased from 1,7 points to 1,0 points. Athletes had problems when performing small throws and catching bulls, discounts decreased from 3,8 points to 2,7 points. In non-fundamental (nonspecific) work discounts have decreased from 2,5 points to 1,7 points (Figure 1).

In the context of the study, the assessment of the brigade E (max – 10,0 points) was considered, namely, discounts for the technique of work by the subject [14]. The assessment

Table 2
Training combinations with clubs

Combination No.	Content
1 combination – 20 s	small unlike circles with clubs in two small jumps on the right and left foot; asymmetrical movement of the clubs in the balance in the "pass" of the right: right hand to the side - small circles above the hand, at hand in the horizontal plane; left hand down – small circles back; rotate in a 360° "ring" with the contents of one mace on the inside of the hand; a high parallel throw of both clubs, two "Shens", catching in both hands.
2 combination – 35 s	360° rotation in "attitude" with tapping with maces over the head on the jump, "touching, bending with the push of two", a throw from the shoulder of both clubs in a horizontal plane, catching in both hands 360° rotation in "attitude" with tapping with maces over the head 2 jump touching the "ring", big circles of maces in the side plane back; semicircular mill; big throw of one club, "goat" on 360° with transfer of mace, catching behind.
3 combination – 40 s	equilibrium in the front twine with a twist was one turn in different sides; reverse wave with "ingot"; side swing on one hand with the contents of one club over another release of the right clubs on the side step in the jump, catching the mace on the jump "Jett Anthurnan" touching; going backwards in half-toes with opposite circles (in front of a large facial circle, behind the head – medium) – 4 steps; throwing the clubs with the right hand under the shoulders, catching on the floor with a mace (pressing the clubs to the floor with another clubs).

Mullagildina, A. & Krasova, I. "Improving the technical training of female athletes 10–11 years in rhythmic gymnastics in exercises with clubs", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 1(69), pp. 19-24, doi: 10.5281/zenodo 2589939

Table 3

Changes in test results when performing basic cubs exercises

Test	Results, scores (max –10 points)		
	Initial ($\bar{X}1$)	Repeat ($\bar{X}2$)	Difference ($\bar{X}_1 - \bar{X}_2$)
1. Small opposite circles with two clubs in the lateral plane (right hand back)	7,2	8,2	1,0
2. Small opposite circles with two clubs in the lateral plane (right hand forward)	7,0	7,9	0,9
3. The content of two clubs on the neck and shoulders in horizontal equilibrium on the half-toes	6,1	7,3	1,2
4. Right hand big circle back, left – small circles in the horizontal plane above the hand and at hand, moving forward in a dance step	6,7	7,8	1,1
5. With the left hand a large circle back, with the right hand - small circles in the horizontal plane above the arm and under the arm moving along a dance step forward	6,2	7,2	1,0
6. "Mills" in 180° turnaround	6,3	7,4	1,1
7. "Juggling": alternately throwing both clubs with the right hand four times with catching in both hands	5,3	6,1	0,8
8. "Juggling": alternately throwing two clubs with his left hand four times with catching in both hands	3,5	4,3	0,8
9. Big throw of both clubs, two spins with advancement (shene), catching in both hands	4,6	5,6	1,0

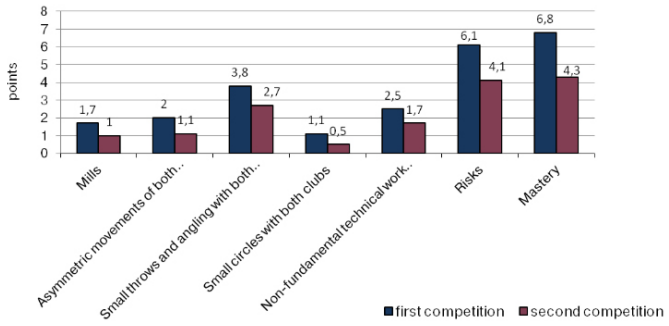

Figure 1. Dynamics of discounts in the subject matter technique at competitions at the beginning and at the end of the school year

of the competitive exercise with the maces was calculated by both teams of judges and entered into the protocol of the competitions (Table 4).

According to the results of the analysis performed, it is safe to say that the individual results of gymnasts in a competitive exercise with clubs are inversely proportional to the amount of discounts received for the technique of the subject. So, the best result for a gymnast under the number 2 is 10,75 points, and in her the same amount of discounts for the technique of working with the subject is 0,6 points. The greatest amount of discounts for the technique of work with the subject is – 3,8 points for a gymnast at number 7, and in her the last result is 6,65 points and the same relationship in other athletes (Table 4).

Thus, the essential role of the number of discounts for the technique of the subject in the final assessments of gymnasts in competitions was determined. A comparative analysis of the performances of gymnasts in competitions at the beginning and at the end of the school year can be concluded that after applying the experimental methodology in gymnasts the technique of performing basic exercises with clubs has significantly improved.

Conclusions / Discussion

The results of the studies completed are supplemented by the theoretical positions formulated in the papers by I. A. Wiener [6] and L. A. Karpenko [10], who note that the important precondition for technical training in exercises with subjects is the development of specific coordination abilities of gymnasiums [7; 12], the means of development of which experts include competitive and special training exercises [4].

We also agree with the statement of specialists [2; 10] that transfer of difficult coordination from one exercise to another is very slight. In connection with this, training combinations were developed with clubs to connect various technical work with the subject and with difficulty of body work, as well as with elements and connections from the competitive programs of gymnasts.

The conclusions of A. Sumenkov, I. Nakonechnaya, A. Rudenko [15], A. Ya. Mullagildina, I. V. Krasova [13] and other scientists are confirmed, the insufficient level of relatively simple, but basic actions with objects is one of the reasons many technical mistakes made by gymnasts in competitions.

Thus, the results of the study showed the effectiveness of the use of training combinations to increase the level of basic skills of young athletes in exercises with clubs. The data we have cited is confirmed by a decrease in discounts for components of the equipment used as a subject at competitions: for performing "mills" from 1,7 points to 1,0 points; when making small throws and catching clubs – from 3,8 points to 2,7 points; in non-fundamental (non-specific) work – from 2,5 points to 1,7 points. Gymnasts have confirmed sufficient ba-

Table 4

Results of gymnasts in the exercise with clubs in competitions

Components of competitive exercise evaluation	Discounts, points								∑ discounts
Female athletes:	1	2	3	4	5	6	7	8	
Mills	0,1	0	0	0,4	0	0,1	0,3	0,1	1
Asymmetric movements of both clubs	0,1	0	0	0,2	0	0,1	0,4	0,1	1,1
Small throws and angling with both clubs	0,1	0,3	0,3	0,2	0,4	0,4	0,6	0,1	2,7
Small circles with both clubs	0	0	0	0	0	0	0,3	0	0,5
Non-fundamental technical work subject	0,1	0	0,2	0,2	0,2	0,3	0,4	0,1	1,7
Risks	0,3	0	0,3	0,8	0,5	0,5	1,0	0,3	4,1
Mastery	0,3	0,3	0,5	0,6	0,7	0,6	0,8	0,3	4,3
The amount of discounts for the technique of the subject	1	0,6	1,3	2,4	1,8	2	3,8	2,5	15,4
Score from competitive exercise with clubs, points (max – 15 points)	9,75	10,8	9,15	8,2	8,95	8,85	6,65	9,75	8,79

sic skills in performing small circles with clubs and asymmetric movements of clubs, but the athletes still have problems in performing elements of risk and skill.

Prospects for further research. It is planned to determine the main directions of improving the technical training of athletes in other forms of all-around.

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Choice of playing roles of the central defenders on the basis of the analysis of the structure of the special preparedness of qualified female water polo players

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Purpose: *to develop and experimentally substantiate the method of choosing the game role of the central defenders on the basis of the analysis of the indicators of the structure of the special preparedness of qualified female water polo players.*

Material & Methods: *analysis and generalization of literary sources, pedagogical observation, anthropometric and physiological measurements, testing, analysis of the game activities of water polo players using test game protocols, methods of mathematical statistics. The contingent of the surveyed were members of the team of the Kharkiv region on the female water floor.*

Results: *the authors determined the features of the structure of special preparedness of qualified female water polo players who perform functions as central defenders, investigated the relationship between physical development indicators, technical and special swimming training of representatives of this role, developed model characteristics of the most significant parameters of the structure of special preparedness of qualified female water polo players to determine the playing role of the central defenders*.

Conclusion: *the definition of playing roles in women's water polo should be based on a comprehensive analysis of indicators that reflect all aspects of preparedness of qualified female athletes.*

Keywords: *women's water polo, central defenders, structure of special preparedness, interconnection, model characteristics.*

Introduction

Water polo refers to situational sports that differ in terms of playing activity due to the aquatic environment (V. Yu. Davydov, 2007; Yu. V. Kolosov, 2003; V. N. Platonov, 2004; V. M. Chernov, 2006). Therefore, the requirements for representatives of this specialization are quite multifaceted.

Choosing a game role is one of the most important moments in a water polo player's sports career. The achievement of the heights of sportsmanship largely depends on the right choice of a narrow specialization of an athlete (I. F. Zemtsov, 2008; A. A. Pilipko, A. V. Poproshayev, 2007; A. V. Poproshayev, A. V. Chumakov, 2014, A. A. Shinkaruk, 2011).

An analysis of modern literature led to the conclusion that today the issues relating to the determination of factors affecting the effectiveness and efficiency of competitive activity in water polo have been thoroughly studied (N. Yevpak, 2015; I. F. Zemtsov, 1988; D. Karangozashvily, 1990; N. Rebitska, 2002).

At the same time, the conducted studies are mainly related to the problems of training male athletes. However, women's water polo still remains deprived of the attention of specialists.

Purpose: to develop and experimentally substantiate the method of choosing the game role of the central defenders on the basis of the analysis of the indicators of the structure of the special preparedness of qualified female water polo players.

Objectives of the study:

1. Identify the features of the structure of special preparedness of qualified female water polo players who serve as central defenders.

2. Investigate the relationship between indicators of physical development, technical and special swimming readiness in qualified female water polo players selected roles.

3. To develop model characteristics of indicators of the structure of special preparedness of qualified female water polo players to determine the playing role of the central defenders.

Material and Methods of the research

To solve the tasks, the following methods were used in the work: analysis and generalization of literary sources, pedagogical observation, anthropometric and physiological measurements, testing, and analysis of the game activities of water polo players using special protocols of control games, methods of mathematical statistics.

The experimental study was conducted on the basis of the NSC NTU "KPI" in the period from October 2017 to November 2018.

The surveyed group consisted of water polo players who had the level of sports qualification of master of sport and were members of the team of the Kharkiv region.

Pilipko, O. & Pilipko, A. (2019), "Choice of playing roles of the central defenders on the basis of the analysis of the structure of the special preparedness of qualified female water polo players", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 1(69), pp. 25-29, doi: 10.5281/zenodo.2590013

Results of the research

The main components of the structure of the special preparedness of qualified female water polo players are physical, technical and special swimming preparedness.

Features of physical development of athletes performing the functions of central defenders were determined by 11 most informative morpho-functional indicators, namely: length and body mass, length of arm, leg, hand and foot, chest excursion, wrist strength (right and left hand), shoulder and thigh girth.

On the basis of the obtained digital material, we constructed an average morpho-functional profile of the representatives of this gaming role (Figure 1).

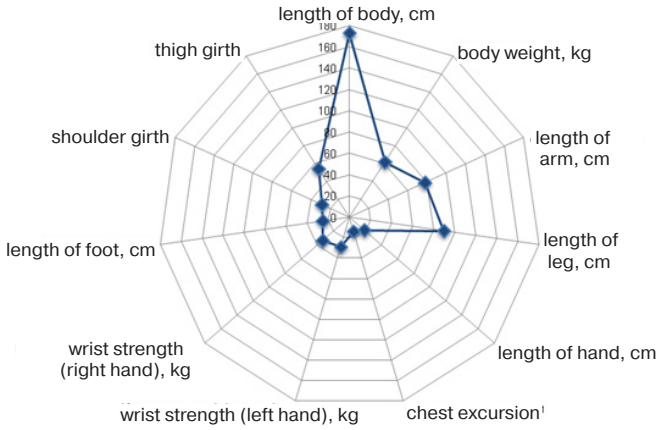


Figure 1. Averaged morpho-functional profile of qualified female water polo players who serve as central defenders

As can be seen from Figure 1, significant values of the linear and girth dimensions of the lower limbs and their segments, chest excursions, average values of height and body weight, length of the upper limbs and their segments, carpal strength are inherent in central defenders.

As the main parameters of technical readiness, we identified the following: "15 m dribble", "throw for distance", "main throw technique from the place" (MTTP), "ball handling time at the main throw from the place" (than. MTP), "main throw technique on the move" (MTTM), "ball handling time at the main throw on the move" (than. MTM), "lob shot w technique from the place" (LTTP), "lob throw technique on the move" (LTTM) and "modernized 7-minute special tests".

Conducting relevant tests and summarizing the data allowed us to form an averaged profile of technical readiness of qualified female water polo players, who have the role of central defenders (Figure 2).

Among the leading criteria for special training in swimming, which were to be measured, were: "5x3 m in the gateway", "15 m front crawl", "10 m front crawl", "2x10 m front crawl", "10 m back crawl", "2x10 m trudgen on the back", "30 m front crawl", "10 jumping", "7-minute special tests".

The obtained values became the basis for constructing the profile of special swimming preparation of central defenders (Figure 3).

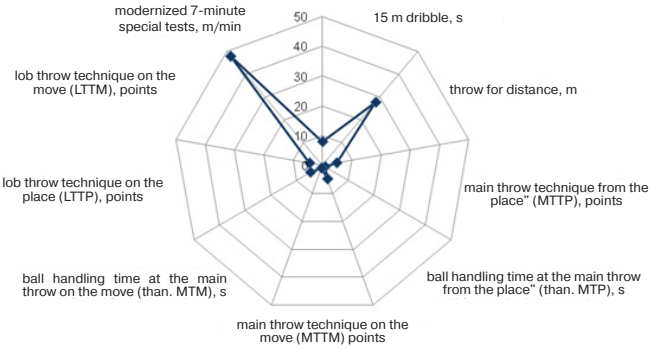


Figure 2. Averaged profile of technical readiness of qualified female water polo players who serve as central defenders

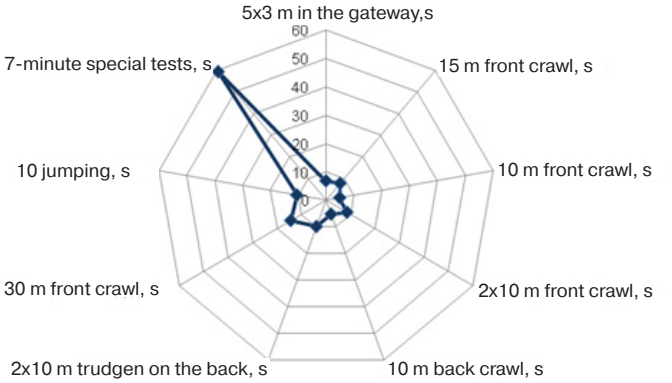
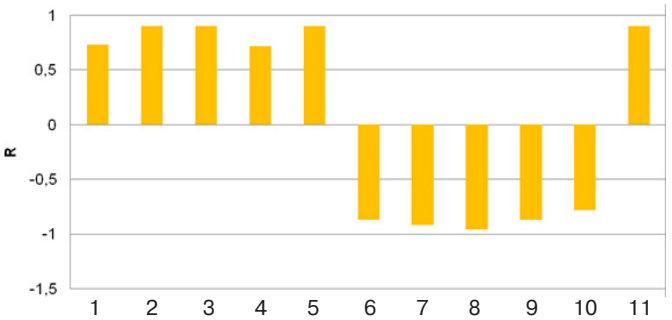


Figure 3. Average profile of the special swimming preparedness of qualified female water polo players who serve as central defenders

It is well known that the effectiveness of actions of female water polo players of various roles is determined by the specifics of the technical methods they perform in the game.

To evaluate the effectiveness of the game actions of the central defenders, the most important are quantitative indicators of seizures from the field, goals scored, shots on goal, net ball picks, failed ball throws and time spent in the game.

Having considered how the main components of the effectiveness of game actions are interconnected with the indicators



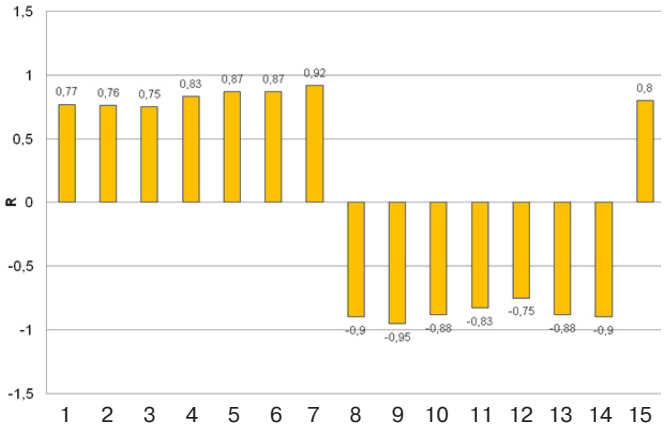
1 – MTTP;
2 – MTTM;
3 – LTTP;
4 – LTTM;
5 – modernized special tests;
6 – 10 m front crawl;
7 – 2x10 m front crawl;
8 – 10 m back crawl;
9 – 2x10 m trudgen on the back;
10 – 30 m front crawl;
11 – 5-minute special tests

Figure 4. Degree of correlation of the most influential indicators of the structure of the special preparedness of the central defenders with the number of goals scored from under the defender

of the structure of the special preparedness of female water polo players of this role, it became possible to determine the most significant parameters in terms of their impact (Figure 4–7).

As can be seen from Figure 4, the number of goals scored from under the defender is under the considerable influence of indicators reflecting the technique of possession of the ball, and also indicate the level of sprinting capabilities and preparedness of the athletes.

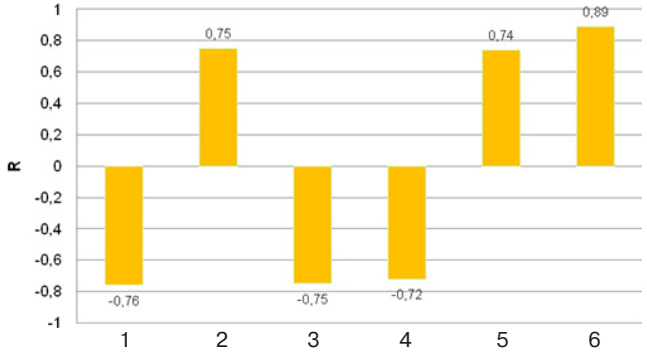
The indicator of the number of throws on the gate is largely determined by the accuracy of the performance of the lob throw technique on the move LTTM, as well as the effectiveness of performing tasks reflecting the level of development of velocity qualities of water polo players of this game role (Fig. 5).



1 – leg of leg;
2 – leg of hand;
3 – wrist strength (right and left hand);
4 – leg of foot;
5 – MTTM;
6 – LTTP;
7 – LTTM;
8 – 5x3 m in the gateway;
9 – 15 m front crawl;
10 – 10 m front crawl;
11 – 2x18 m front crawl;
12 – 10 m back crawl;
13 – 2x10 m trudgen on the back;
14 – 30 m front crawl;
15 – 5-minute special tests

Figure 5. Degree of correlation of the most influential indicators of the structure of the special preparedness of the central defenders with the number of shots on goal

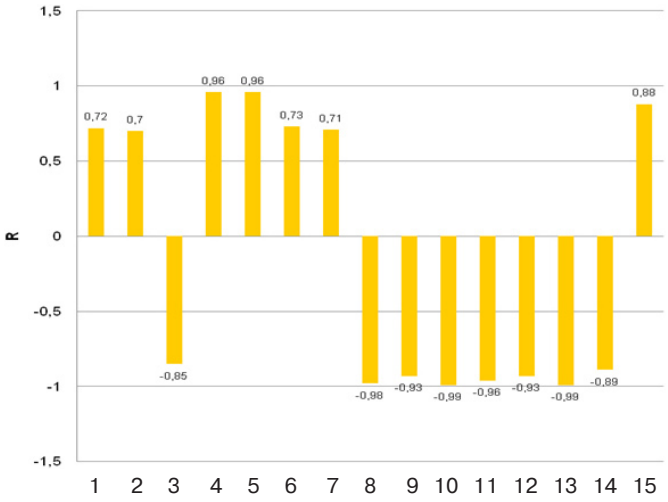
This parameter of the effectiveness of game actions, such as the number of goals scored, is mainly determined by the level of swimming performance in conjunction with the technique of ball possession (Fig. 6).



1 – than. MTP;
2 – modernized special tests;
3 – 5x3 m in the gateway;
4 – 15 m front crawl;
5 – 2x10 m trudgen on the back;
6 – 5-minute special tests

Figure 6. Degree of correlation of the most influential indicators of the structure of the special preparedness of the central defenders with the number of goals scored

The high level of swimming preparedness, as well as the accuracy of performing the main throw on the move and the accuracy of the performance of the lob throw from the place allow the athletes to be effective when performing the selection of the ball from rivals (Figure 7).



1 – chest excursion,;
2 – length of foot;
3 – than. MTM;
4 – MTTM;
5 – LTTP;
6 – LTTM;
7 – modernized special tests;
8 – 5x3 m in the gateway;
9 – 15 m front crawl;
10 – 10 m front crawl;
11 – 2x10 m front crawl;
12 – 10 m back crawl;
13 – 2x10 m trudgen on the back;
14 – 30 m front crawl;
15 – 5-minute special tests

Figure 7. Degree of correlation of the most influential indicators of the structure of the special preparedness of the central defenders with the ball selection

Based on the original digital material, the model characteristics of the structure of special training were developed, in which I should take part in competitions, including in the country (Table 1).

As can be seen from Table 1, among the most significant parameters that can be used as reference points when choosing the playing role of the central defender are: MTTM, LTTP, LTTM, performance of modernized special tests, swimming intervals of "10 m front crawl", "15 m front crawl", "30 m front crawl","2x10 m front crawl","10 m back crawl" "2x10 m trud-

Table 1

Model indicators of the most significant parameters of the structure of the special preparedness of the central defenders

Indicators	Model indicators	Standard deviation
Main throw technique on the move (MTTM) points	4,88	0,08
Lob throw technique on the place (LTTP), points	4,68	0,10
Lob throw technique on the move (LTTM), points	4,43	0,13
Modernized 7-minute special tests, m·min^{-1}	47,98	1,56
5x3 m in the gateway, s	6,85	0,25
15 m front crawl, s	7,78	0,26
10 m front crawl, s	4,95	0,26
2x10 m front crawl, s	8,60	0,56
10 m back crawl, s	5,28	0,33
2x10 m trudgen on the back, s	9,95	0,26
30 m front crawl, s	14,40	0,29

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gen on the back" and "5x3 m in the gateway".

To test the developed methodology for determining the game role, we took the most important parameters of the structure of the special preparedness of the leader of the group being examined – S-ko, which serves as a central defender, and compared them with the model value (Fig. 8–10).

As can be seen from the figures, the female athlete almost completely corresponds to the profile of the players of this role. This is confirmed by the high performance of the water gun during the games.

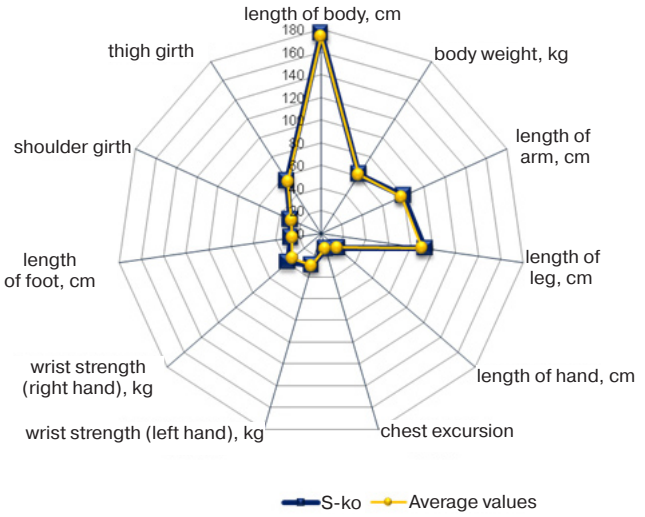

Figure 8. Comparison of individual indicators of physical development of the S-ko athlete with the model parameters of qualified female water polo players, which serve as central defenders

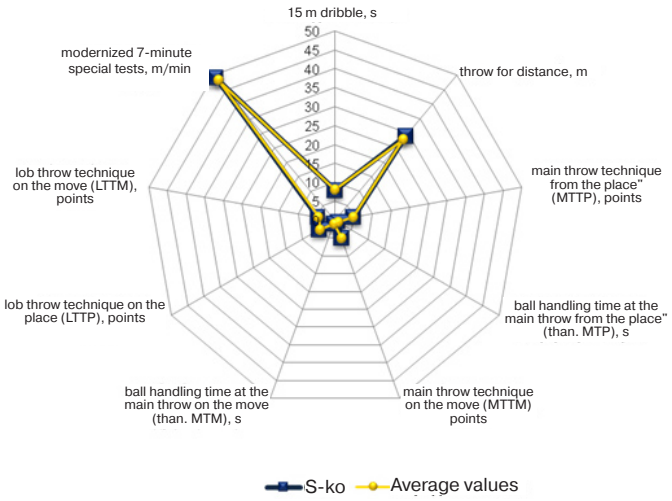

Figure 9. Comparison of individual indicators of technical preparedness of S-ko athlete with model parameters of qualified female waterpolo players who serve as central defenders

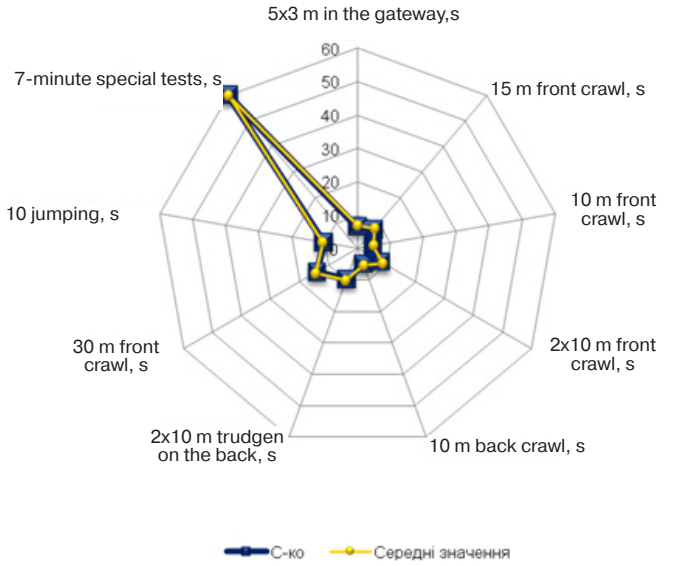

Figure 10. Comparison of individual indicators of the special swimming readiness of the S-ko athlete with the model parameters of qualified female water polo players who serve as central defenders

Thus, the definition of a game role should be based on a comprehensive analysis of indicators reflecting the level of physical development, technical and special swimming preparedness of athletes.

Conclusions / Discussion

The results of this study confirm the usual opinion that the main components of the structure of special training of qualified female water polo players that affect the effectiveness of their game activities is physical, technical and special training. At the same time, we have proved that the effectiveness of the acting actions of the central defenders is mainly due to the indicators of special swimming preparation, the average role is given to the parameters of the level of physical development and the less important is the technical component.

The results obtained allowed us to confirm the assumption that individual indicators of the structure of the special preparedness of water polo players have a different degree of influence on the effectiveness of game actions, depending on the role. We have shown that for the central defenders, the most significant are parameters indicating the level of splaying the opportunities and fitness of athletes, and also reflect the technique of possession of the ball (R is in the range of 0,90–0,99). So the definitions of the game's role should be based on a comprehensive analysis of indicators that reflect all aspects of preparedness.

Prospect of further research is to develop the model characteristics of the parameters of the structure of the special preparedness of qualified water polo players to determine the playing role of the central forwards, midfielders and moving forwards.

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Use and impact of a comprehensive program of physical therapy in the treatment of patients with deforming coxarthrosis of 2–3 degrees

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Purpose: *to study the effectiveness of physical therapy in the complex treatment of patients with deforming coxarthrosis of 2–3 degrees.*

Material & Methods: *a comparative analysis of the use of traditional basic drug therapy and complex drug and physical therapy for 2 months in 30 patients (main and control group) with coxarthrosis of 2–3 degrees, functional insufficiency (FI) of 2 degrees using goniometry, visual analogue pain scale (VAS), Leiken index.*

Results: *results of the analysis of goniometry indices, VAS and Leiken indices showed with statistical certainty the advantage of using physical therapy in the complex rehabilitation treatment of patients with coxarthrosis of 2–3 degrees, which was expressed in improving the dynamic function of the hip joint.*

Conclusion*: a program of physical therapy for patients with coxarthrosis of grade 2–3 was developed and put into practice, including a set of ideomotor exercises, post-isometric muscle relaxation, gymnastic exercises with projectiles and objects, movement coordination exercises, breathing exercises with gravitational weights, exercises on block simulators and an exercise bike , as well as self-study at home.*

Keywords: *coxarthrosis, physical therapy, post-isometric relaxation of muscles, pain syndrome, VAS and Leiken scales.*

Introduction

The number of patients with orthopedic pathology is increasing every year and has a negative impact on the health of the population. Among the diseases of the musculoskeletal system, osteoarthritis is the most common pathology of the joints (V. A. Koryak, V. A. Sorokovikova, V. V. Svistunov, T. V. Sharova, 2013). Osteoarthritis is characterized by chronic inflammation and involvement of all components of the joint in the pathological process (A. D. Woolf, J. Ervin, L. March, 2012). According to averaged estimates, the prevalence of osteoarthrosis among the population of most developed countries of the world ranges from 8–12% (W. Y. Kwok, V. Kloppenburg, F. R. Rosendaal et al., 2011). In Ukraine, in 2015, the incidence of osteoarthritis was 431 per 100 thousand population, the prevalence was 2995 per 100 thousand (about 3%) (O. B. Yaremenko, A. M. Mykytenko, 2016).

Coxarthrosis – arthrosis of the hip joints – occupy 2nd place after lesion of the knee joints in terms of frequency of occurrence and 1st place in terms of temporary disability and persistent disability (V. A. Koryak, V. A. Sorokovikova, V. V. Svistunov, T. V. Sharov, 2013). Coxarthrosis is characterized by progressive damage to the articular cartilage and subchondral bone associated with inflammation, osteophyte formation and joint deformity. Primary osteoarthritis, which develops in healthy cartilage under the influence of various factors, and secondary, characterized by the destruction of already previously modified cartilage, are distinguished. One or both hip joints may be affected. At the age of 50 years, the disease occurs mainly in men. With increasing age, osteoarthritis affects mainly women. The increase in the frequency of the disease is due to an increase in the number of obese people, poor physical condition due to physical inactivity, progressive aging of the population.

Research into the causes of osteoarthritis is carried out for a long time. However, there is still no consensus about the nature of this disease. The majority of scientists agree that it has a complex multifactorial origin: metabolic disorders, hereditary causes, harmful habits and working conditions, changes in the biomechanics of joints of various genesis (E. F. Turovskaya, L. I. Alekseeva, E. G. Filatova, 2014).

Most often in clinical practice, the classification of arthrosis by Kellgren-Lawrence on the basis of radiographic evidence (P. G. Conagan, D. J. Hunter, J. F. Maillefert et al., 2011):

Stage 0 – signs of arthrosis are not visualized;

Stage 1 – minor marginal osteophytes are determined without changing the height of the joint space;

Stage 2 – significant marginal osteophytes are determined without changing the height of the joint space;

Stage 3 – significant marginal osteophytes are determined with a moderate decrease in the height of the joint space;

Stage 4 – significant marginal osteophytes, subchondral sclerosis, significant narrowing of the height of the joint space are determined.

It is also advisable to determine the functional insufficiency

(FI) of the joints (T. E. McAlindon, R. R. Bannuru, M. C. Sulivan et al., 2014).

1st degree (moderate) – a small limitation of the range of motion in the joints (the amplitude of movements in the hip joints is reduced by 30–20° from the volume of movements in a healthy hip joint);

2nd degree (expressed) – significant limitation of range of motion (range of motion in the hip joint does not exceed 50°; subluxation of joints with severe deformation due to periarticular scarring, as well as muscle atrophy, a significant stiffness throughout the day);

3rd degree (pronounced) – significant difficulty in walking (the patient can take several steps around the room) or the patient cannot get out of bed due to pain and deformities in the hip and knee joints (range of motion does not exceed 15° or is completely absent); almost impossible self service.

The main clinical manifestation of coxarthrosis is pain, the nature, intensity, duration and location of which depend on the severity of changes in the joint. Then FI joins. First of all, internal rotation and abduction are limited – flexion-adduction contracture is formed, lameness occurs (N. A. Shostak, 2012).

Treatment of coxarthrosis can be conservative and operative. The choice of treatment depends on the severity of clinical manifestations. The goal of conservative treatment is to stabilize the process, improve the patient's well-being. Conservative treatment consists of pharmacological and non-drug methods. Drug therapy consists of non-steroidal anti-inflammatory drugs, muscle relaxants, vascular drugs, chondroprotectors (L. Fernandes, K. B. Hagen, J. W. Bijlsma et al. (2013). Non-drug therapy includes therapeutic exercise and joint unloading - wearing shoes with a well-cushioned sole, the use of additional support when walking, orthotics (S. V. Kolesnikov, E. S. Kolesnikova, 2012).

The main efforts of doctors should be aimed at preserving the biomechanics and the function of the affected joint (V. V. Povoroznyuk, 2009, "Vredenovskie readings", 2013). This can help physical therapy, without the use of which it is difficult to achieve a real improvement in the condition of patients. Because of the pain, many people reduce physical activity and this aggravates the process, as muscular atrophy joins, blood circulation worsens.

Purpose: to study the effectiveness of physical therapy in the complex treatment of patients with deforming coxarthrosis of grade 2–3, FI grade 2.

Objectives of the study: 1. To analyze the etiology, pathogenesis, clinical characteristics and current approaches to restorative conservative treatment of patients with coxarthrosis of 2–3 degrees. 2. Develop a program of physical therapy with its subsequent application and evaluation of its effectiveness.

Material and Methods of the research

The study included 30 people with deforming coxarthrosis of grade 2–3, FI grade 2, aged 40 to 65 years (mean age 55±5,2 years), who were treated at the medical health center "Fortis" (clinical base HSAPC). Among the surveyed were 19 women (63.3%, average age 52,7±2,4 years) and 11 men (36,7% average age 57,1±1,5 years). With deforming coxarthrosis grade 2, FI grade 2 was 7 people (23,3%), with grade 3 coxarthrosis, FI grade 2 – 23 people (76,7%). The disease was bilateral in 8 people (26,6%), unilateral in 22 (73,4%) people. FI of the hip joints of grade 2 was in 24 people (80%), grade 3 – in 6 people (20%).

Criteria for inclusion of patients in the survey:

– patients aged 40 to 65 years;
– patients moving independently (use of aids for support is possible: cane, crutches, etc.);
– verified radiographic coxarthrosis of grade 2–3;
– functional disorders of the hip joints 2 degrees;
– the absence of severe somatic diseases;
– absence of injuries (fractures, dislocations) of different localization;
– absence of ankylosis of other joints;
– absence of severe spinal pathology;
– absence of pronounced pain syndrome (less than 6 cm according to VAS).

Exclusion criteria from the survey:

– acute infectious diseases;
– pronounced pain syndrome (from 6 cm according to VAS);
– ankylosis of the joints;
– pronounced impairment of the lower extremity support ability;
– the presence of fresh injuries of the limbs, spine, skull.

According to the criteria for inclusion in the examination, patients were divided into two groups: 20 patients of the main group (MG) in addition to the course of drug therapy, underwent a program of physical therapy. The control group (CG) consisted of 10 patients who received only drug therapy.

The clinical efficacy of physical therapy was determined according to the results of the pain syndrome assessment by VAS, the Leiken index and the study of the amplitude of movements in the joints.

VAS pain serves as a general assessment of the intensity of pain by the patient and is a horizontal scale with marks from 0 to 10 cm, the beginning of which corresponds to the absence of pain, and the end – the most pronounced pain. The patient independently notes on the scale the degree of pain.

The Leiken index for coxarthrosis reflects the severity of the disease and is a questionnaire in the form of a table. The Leiken index is calculated based on the sum of points obtained when answering groups of questions focused on the assessment of pain and discomfort, according to the maximum distance traveled without pain and the presence of difficulties in everyday life.

The amount of movement in the joints was measured using a goniometer by the "zero-passing" method of V. O. Marx.

The obtained data were processed statistically, the methods of descriptive statistics were used: mean (M) and standard deviation (SD). Comparison between groups was performed using a T-test for independent samples and a T-test for

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paired samples.

The program of physical therapy developed and applied in the study was designed for 8 weeks (classes were held 2 times a week, the duration of classes was 60 min±15 minutes) and included therapeutic exercises in the form of:

– gymnastic exercises (including with projectiles and objects) – active, passive, active-passive, exercises for the coordination of movements, breathing, exercises with a gravitational burden;

– exercises on block simulators, stationary bike. The average number of repetitions of exercises was 15 times in 2 sets. Since coxarthrosis especially suffers from internal rotation and abduction in the hip joint, exercises that help restore these movements were performed at the beginning and end of the session. Excluded exercises with axial load on the hip joint;

– ideomotor exercises, postisometric muscle relaxation.

MG patients were carried out at home, developed a program of gymnastic exercises, which was performed daily (duration 45±10 minutes).

Drug therapy (for patients of both groups) included non-steroidal anti-inflammatory drugs (oxicam – rheumatic, meloxicam, Celebrex) for 14 days; vascular therapy; muscle relaxants; chondroprotectors.
In accordance with the requirements of bioethics (the Helsinki Declaration), all patients signed an informational consent to participate in the study.

Results of the research

The initial condition of the patients in both groups did not differ in intensity of pain syndrome and the degree of FI (Table 1).

The use of physical therapy in the complex treatment of patients with coxarthrosis contributed to the reduction of pain in patients in the MG and CG by 35–40% for VAS and a decrease in the Leiken index by 20–25% in both CG and CG, which can be explained by the use of the same drug therapy (Table 2).

After the study, a repeated analysis of the motor function of the lower limb in the hip joint was carried out (Table 3).

Table 1

Pain and functional parameters in patients with coxarthrosis of grade 2–3, FI grade 2 before treatment

No.	Indicators	MG (n=20) Before treatment	CG (n=10) After treatment
1.	VAS, cm	5,2±0,8	5,6±0,4
2.	Leiken index, score	6,8±1,2	6,4±0,8
3.	Range of motion (degrees): – flexion-extension; – lead-cast; – internal-external rotation.	 65±15/0/5±3 20±7/0/10±5 10±5/0/20±7	 65±10/0/5±4 22±6/0/10±6 10±6/0/21±6

There is a statistically significant increase in the range of motion in the hip joint in all planes in patients with MG. The best results on the restoration of movements in the hip joint were observed in patients of the MG:

– in the sagittal plane, due to an increase in flexion by 19,5%;
– in the frontal plane, by increasing the lead by 10%;
– rotational movements (internal rotation increased by 38%, external rotation – by 39%).

In patients from CG, the range of motion in the hip joints did not change statistically significantly.

Conclusions / Discussion

A program of physical therapy for patients with coxarthrosis of grade 2–3 was developed and put into practice, including a set of ideomotor exercises, post-isometric relaxation of muscles, gymnastic exercises with shells and objects, exercises for motor coordination, breathing exercises with gravitational weights, exercises for block simulators and exercise bike and self-study at home.

Analysis of goniometry indices, VAS and Leiken indices demonstrated the advantage of using physical therapy in the complex rehabilitation treatment of patients with coxarthrosis of grade 2–3, which was expressed in improving the dynamic function of the hip joint.

Prospects for further research in this direction imply consideration of issues related to the use of modern techniques of hardware mechanotherapy as an integral part of the physical therapy of patients with coxarthrosis.

Table 2

Dynamics of indicators of VAS and Leiken index before and after the study

Parameter	Groups		MG (n=20) M±SD	CG (n=10) M±SD	Statistical significance of differences between groups (T-test for independent samples)
VAS, cm	Before treatment		5,3±0,5	5,8±0,3	t=–3,499; p=0,002
	After treatment		3,1±0,6	4,1±0,4	t=–4,419; p=0,001
	Statistical significance of the difference between the observation periods (T-test for paired samples)	M±SD T p	2,1±0,6 t=15,075 p=0,001	1,8±0,4 t=13,809 p=0,001	
Leiken index, score	Before treatment		6.8±1,3	5,9±0,6	t=5,389; p=0,001
	After treatment		4,9±0,5	5,3±0,3	t=–2,463; p=0,020
	Statistical significance of the difference between the observation periods (T-test for paired samples)	M±SD T p	2,2±0,8 t=12,623 p=0,001	0,6±0,8 t=2,442 p=0,037	

Table 3

Comparative table of movement parameters in the hip joint before and after rehabilitation treatment (independent sample test)

Parameter	Groups	Before treatment			After treatment		
		MG	CG	T-test (independent samples)	MG	CG	T-test (independent samples)
Flexion / extension	Flexion	65±10	65±9	t=–0,076; p=0,940	78±7	71±6	t=2,839; **p=0,008**
	Extension	6±2	5±2	t=1,142; p=0,263	8±3	8±2	t=0,899; p=0,376
	Range of motion	71±10	70±9	t=0,129; p=0,899	87±7	79±7	t=2,914; **p=0,007**
Leading / adductiont	Leading	18±7	20±4	t=–0,575; p=0,570	30±6	23±3	t=4,273; **p=0,001**
	Adductiont	10±3	10±4	t=–0,073; p=0,942	15±2	13±4	t=1.750; p=0.091
	Range of motion	28±8	30±6	t=–0,498; p=0,622	45±6	36±6	t=3,739; **p=0,001**
Rotation	Internal	9±2	10±5	t=–0,568; p=0,574	17±4	13±2	t=3,344; **p=0,002**
	External	20±7	20±4	t=–0,248; p=0,806	28±3	22±2	t=5,112; **p=0,001**
	Range of motion	29±7	30±6	t=–0,440; p=0,663	45±6	35±2	t=6,604; **p=0,001**

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Physical development and functional status of women 20–35 years old, involved in swimming

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Purpose: *determining changes in physical development and functional state of women 20–35 years old, engaged in swimming.*

Material & Methods: *20 women aged 20–35 years old took part in the study, which consisted of two groups: the main group (MG) and the control group (CG). The MG included women swimming in the fitness and fitness groups of the author's swimming school of Yu. V. Bliznyuk and Pioneer pool (water sports school named after Yana Klochkova); in the CG – women who lead active lifestyles, but in health groups are not engaged, swimming only on weekends. The tested people had the same swimming preparedness. Applied: survey, testing, instrumental methods for studying the cardiovascular system. Lung capacity and dynamometry were determined. To study the functional reserves of the respiratory and cardiovascular systems, the Skibinsky index was used. The obtained quantitative data were processed by the methods of mathematical statistics.*

Results: *the study suggests that in women of 20–35 years old swimming lessons cause changes in physical development and functional state. According to the parameters of the physical development of women of MG and CG swimming during the year has a positive effect on the body. First of all, swimming helps to improve the state of the cardio-respiratory system and the strength abilities of women.*

Conclusions: *the positive effect of swimming on the physical development and functional status of women aged 20–35 years engaged in recreational swimming is substantiated and proved.*

Keywords: *swimming, women, indicators, physical development, functional state.*

Introduction

At present, the preservation and strengthening of health, the prevention of various kinds of diseases in the population are of particular social importance (N. N. Cardamonov, 2001; V. V. Ponomareva, 2001; Brian J. Sharkey, Steven E. Gaskill, 2006). The increasing value of life, health, active longevity and the realization of human individuality are increasingly viewed as criteria for the social progress of society [6; 8; 17].

According to a number of authors (I. V. Amosov, E. A. Zemskov, 2000; L. Sh. Aptsiauri, 1990; L. V. Sheiko, 2014), an increase in interest in issues related to the content and location of physical culture in women's lives are caused by poor health, declining childbirth and physical development rates. This leads to the search for new ways to increase women's mobility in order to improve their health, improve their cultural and educational levels, and unlock their personal potential [1; 2; 12].

It is known that the aquatic environment and swimming have a powerful effect on the body involved. However, the use of swimming for recreational purposes requires a specially organized pedagogical approach taking into account the specifics of the aquatic environment [3; 5; 13].

Swimming lessons, depending on the tasks, can be divided into sports, conditioning, recreational. Recreational swimming is of great importance for the implementation of the program for the development of physical culture and the formation of a healthy lifestyle of the population of Ukraine. It combines therapeutic effects in a specific training process: general (health promotion, hardening, acquisition of skills of correct movements, volitional qualities), and special (restoration of impaired body functions). The main objectives of recreational swimming are to achieve and further maintain the desired state of health, improve the quality of life, prevent diseases (age, labor, from the harmful effects of the environment). The optimal load is determined by many factors: the need to improve the functional performance or maintain them at the level achieved; mode of habitual motor activity; lifestyle and things like that [10; 11]. The pedagogical process is to educate people involved in recreational swimming with a conscious attitude to the use of physical exercises, teach them rational movements in the water, accustom them to body hygiene, inculcate skills for optimal planning of the daily routine, etc. Healthy swimming is recommended 3–4 times a week for 45–60 min [4]. Recreational swimming is aimed at improving the psycho-emotional and physical state of the body through active rest. Usually it is used on its own, irregular classes (swimming and swimming at weekends) and occur once or twice a week. Thus, it can be argued that both recreational swimming activities contribute to maintaining a certain level of health and hardening [12; 16].

In the work "Like a fish in water. Effective swimming techniques available to everyone" T. Laughlin (2012) argues that in modern economic conditions, to attract women to recreational swimming, you need a comprehensive study of traditional and non-traditional means adequate to the state of health, fitness level, needs and individual characteristics of those engaged. All this requires a comprehensive scientific substantiation of the impact of swimming lessons on women of different ages, the development and validation of new means and methods of conducting classes, the dissemination of physical culture knowledge among the population, the improvement of their educational and cultural level, as well as the training of spe-

cialists in this field of knowledge [7; 14; 15]. During its development, recreational swimming as an integral part of the discipline "Swimming" has undergone qualitative changes in technology, teaching methods, training, but so far the scientific and methodological foundations of conducting recreational swimming with people of different ages and levels of preparedness have not been formed. All this determines the relevance of the chosen research direction.

Purpose: determining changes in physical development and functional state of women 20–35 years old, engaged in swimming.

Objectives of the study:

1. To determine the level of physical development of women 20–35 years old, engaged in swimming.
2. Evaluate the features of the functional state of the subjects.
3. To carry out a comparative analysis of changes in the indices of the physical development and functional state of women aged 20–35 who are engaged in swimming.

Material and Methods of the research

In order to accomplish the tasks, 20 women aged 20–35 years were examined, which consisted of two groups: the main group (MG) and the control group (CG). The MG included 10 women who regularly (throughout the year) go swimming in fitness and recreation groups of the author's swimming school of Yu. V. Bliznyuk and the Pioneer swimming pool (water sports school named after Yana Klochkova); in the CG – 10 women who lead an active lifestyle, but do not engage in recreational groups: they do not swim regularly, only on weekends. MG women engaged in recreational swimming 2–3 times a week for 45 or 60 minutes; CG subjects swam 1–2 times a week, i.e., they did recreational swimming. The subjects had the same swimming preparedness.

Studies were conducted in the period from October 2017 to June 2018; determined the level of physical development and functional status of women 20–35 years old, who are engaged in recreational swimming. In the course of the study, the state of physical development and functional state of the subjects was tested at the beginning of the experiment and after 9 months (in October 2017, initial indicators were recorded; in June 2018, indicators were recorded after a year of swimming). At the final stage of the study, a comparative analysis of changes in the physical development and functional state of the studied population was conducted.

During data collection, the following methods were used: survey, testing, instrumental methods for studying the cardiovascular system. Vital capacity of the lungs (VC) and dynamometry were determined. To study the functional reserves of the respiratory and cardiovascular systems, the Skibinsky index was used [9]. The obtained quantitative data were processed by the methods of mathematical statistics.

Results of the research

Taking into account the above, the features of the physical condition of these groups of women were determined. Namely, the parameters of physical development and functional reserves of the respiratory and cardiovascular systems at the beginning of the study and after a year of training.

The survey included a set of body measurements (body length, body weight, circumference and chest excursion, shoulder and thigh girth); determined: heart rate (HR), blood pressure (BP), lung capacity (VC) and dynamometry. Taking into account most indicators of physical development, the vital and strength index, body mass index was calculated. To study the functional reserves of the respiratory and cardiovascular systems, the Skibinsky index was used. The data of

Table 1

Measurement data of body parameters, cardiovascular system and calculation indexes of women's MG at the beginning of the study and after a year of classes

No. i/o	Measurement indicators	MG, n=10		t	P(t)
		Initial data	After a year of training		
1.	Body length, cm	169,64±1,33	169,89±1,48	1,28	>0,05
2.	Body weight, kg	68,57±1,45	62,21±1,17	3,63	<0,001
3.	Chest circumference (pause), cm	86,97±1,86	82,29±2,58	1,48	>0,05
4.	Chest circumference (inhale), cm	90,9±1,9	87,51±1,7	1,52	>0,05
5.	Chest circumference (exhalation), cm	83,64±2,1	80,34±0,97	1,43	>0,05
6.	Excursion, cm	7,27±0,2	7,17±0,73	1,42	>0,05
7.	Shoulder girth (relaxed), cm	27,9±0,7	26,1±0,61	2,0	>0,05
8.	Shoulder girth (tense), cm	30,8±0,51	28,5±0,8	2.55	<0,01
9.	Hip girth, cm	56,57±1,51	51,4±1,4	2,56	<0,01
10.	HR, beats min^{-1}	81,14±2,75	72,58±1,70	2,67	<0,01
11.	BP systolic, mm Hg	119,29±2,07	110,21±1,97	2,59	<0,01
12.	BP diastolic, mm Hg	82,14±1,88	71,72±3,96	2,42	<0,01
13.	BP pulse, mm Hg.	37,15±0,19	38,49±1,99	0,71	>0,05
14.	VC, l	3115±25,6	3218±21,7	3,07	<0,001
15.	Dynamometer right, kg	22,9±0,18	26,1±1,3	2,66	<0,01
16.	Dynamometer left, kg	21,2±0,8	23,95±1,1	2,03	<0,01
17.	Body mass index, $kg \cdot m^{-2}$	23,72±1,3	21,5±0,6	1,55	>0,05
18.	Life Index, $ml \cdot kg^{-1}$	45,42±1,7	51,72±1,8	2,62	<0,01
19.	Power index, %	32,1±3,3	40,2±1,2	2,32	<0,01
20.	Skibinsky index	1987,5±189,1	2228,3±193,2	0,38	>0,05

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women of CG obtained at the beginning of the study and after a year of swimming, are shown in Table 1. In Table 2 the data of women of the CG were entered.

As can be seen from the Table 1, the parameters of the physical development of CG in women at the beginning of the study and after a year of swimming are significantly different in many respects.

First of all, you should pay attention to the fact that after a year of classes, the indicators of the body weight of women in the MG have significantly decreased. At the beginning of the study, this indicator was 68,57±1,45 kg, after a year of training it dropped to 62,21±1,17 kg (the difference – 6,36 kg, P(t)<0,001). According to all coverage measurements, except for indicators of shoulder circumference in a relaxed state (P(t)>0,05), women of MG significantly improved indicators (P(t)<0,01). Thus, the girth of the hip decreased by 5,17 cm, and the girth of the shoulder (tense) by 2,30 cm, which, of course, is associated with a decrease in body weight of the studied CG. First of all, attention should be paid to the fact that at rest there are significant differences in HR and BP (with the exception of pulse BP, (P(t)>0,05), which indicate a more economical and efficient cardiovascular system after year of swimming (P(t)<0,01). The greatest differences are observed in terms of VC (P(t)<0,001) and brush strength parameters (P(t)<0,01), they are significantly better compared to the original data. The most pronounced differences are also noted in the indices of the power and life indices, the indices of which have significantly improved in comparison with the initial data (P(t)<0,01).

Analysis Table 1 showed that in almost all of the parameters studied there were positive changes in the indicators, i.e., their improvement. However, some indicators of physical development, such as the circumference (pause, inspiration, exhalation) and chest excursions, as well as vital index indicators indicate unreliable differences (P(t)>0,05). For example, the indicators of the excursion of the chest of women MG at the beginning of the study were 7,27±0,2 cm, and at the end of the year – 7,17±0,73 cm. Separately, it should be added that unexpressed differences are also noted in the Skibinsky index (P(t)>0,05), which characterizes the state of the cardiorespiratory system. The values of this index in the CG have improved after swimming for a year of classes (from 1987,5±189,1 to 2228,3±193,2), however, they are still within the limits of "good".

If women of MG were engaged in recreational swimming organized and regularly, at least three times a week, then women of CG were engaged in swimming independently and only on weekends. However, it should be noted that positive changes in the indices of the parameters studied were also recorded from recreational swimming (only on weekends) (Table 2).

Data analysis Table 2, showed that the indicators of the physical development and functional status of women in the CG also underwent positive changes. Parameters such as the girth of a stressed shoulder (from 31,96±0,83 to 28,95±1,1 cm) have significantly improved; HR (decreased from 85,14±2,23 to 79,01±1,23 beats·min^{-1}); BP pulse (decreased from 44,97±1,13 to 42,56±0,04 mm Hg) (P(t)<0,01). Positive differences are observed in the performance of the VC (P(t)<0,001) and the power parameters of the brush (P(t)<0,01, P(t)<0,001). The most pronounced differences are also noted in the indices of the power and life indices, the indices of which have significantly improved in comparison with the initial data. (P(t)<0,01).

All other indicators of female CG are not significantly better compared with the baseline data obtained at the beginning of the study (P(t)>0,05). The most significant indicators, which did not increase significantly, are indicators of the Skibinskaya index. At the beginning of the study, the indicators were at the

Table 2

Measurement data of body parameters, cardiovascular system and calculation of indices of women's in the CG at the beginning of the study and after a year of swimming

No. i/o	Measurement indicators	CG, n=10		t	P(t)
		Initial data	After a year of training		
1.	Body length, cm	170,43±2,37	170,83±2,63	1,14	>0,05
2.	Body weight, kg	72,57±1,95	69,57±2,59	0,92	>0,05
3.	Chest circumference (pause), cm	94,53±1,58	92,28±2,76	0,71	>0,05
4.	Chest circumference (inhale), cm	97,91±2,0	95,10±0,95	1,33	>0,05
5.	Chest circumference (exhalation), cm	91,17±1,9	89,8±2,0	0,51	>0,05
6.	Excursion, cm	6,74±0,1	5,3±1,05	1,37	>0,05
7.	Shoulder girth (relaxed), cm	29,6±1,1	27,5±1,2	1,75	>0,05
8.	Shoulder girth (tense), cm	31,96±0,83	28,95±1,1	2,31	<0,01
9.	Hip girth, cm	59,32±2,00	56,7±1,4	1,08	>0,05
10.	HR, beats min^{-1}	85,14±2,23	79,01±1,23	2,45	<0,01
11.	BP systolic, mm Hg	130,43±2,25	123,57±2,8	1,91	>0,05
12.	BP diastolic, mm Hg	85,46±1,12	81,01±2,04	1,93	>0,05
13.	BP pulse, mm Hg.	44,97±1,13	42,56±0,04	2,13	<0,01
14.	VC, l	3013±25,1	3112±23,2	2,90	<0,001
15.	Dynamometer right, kg	23,5±0,9	27,2±1,4	2,31	<0,01
16.	Dynamometer left, kg	20,9±0,7	25,8±1,2	3,76	<0,001
17.	Body mass index, kg·m^{-2}	25,19±1,1	24,15±0,9	0,73	>0,05
18.	Life Index, ml·kg^{-1}	41,51±1,2	44,73±0,9	2,17	<0,01
19.	Power index, %	30,5±2,02	38,0±0,5	3,60	<0,01
20.	Skibinsky index	1798,6±201,4	1995,7±171,8	0,74	>0,05

level of 1798,6±201,4, which characterized the state of the cardiorespiratory system of women in the CG within the limits of "satisfactory". After a year of recreational swimming, the index of this index came very close to the "good" mark and became at the level of 1995,7±171,8 (P(t)>0,05).

Thus, it can be stated that, according to the dynamics of the physical development parameters of women of MG and CG, swimming during the year has a positive effect on the body. First of all, it contributes to the improvement of the cardiorespiratory system and the strength abilities of women. It should also be noted that the most significant differences in indicators are observed in the MG of women. The percentage of indicators of this group, which significantly improved after a year of classes, was 55% (11 indicators out of 20), whereas in the CG this indicator was only 40% (8 indicators out of 20).

Conclusions / Discussion

Studies of 20–35-year-old women engaged in recreational swimming throughout the year made it possible to establish differences in the physical development and functional status of women in the MG who were engaged in recreational swimming 2–3 times a week for 45 or 60 minutes, and CG who swam 1–2 times a week, i.e., we were engaged in recreational swimming. Thus, the most pronounced significant differences are observed in the indices of the power and life indices (P(t)<0,01), as well as in the indicators of the VC (P(t)<0,001) and the force parameters of the brush (P(t)<0,01), which significantly improved in both groups, compared with baseline data.

According to a study of the state of the cardiorespiratory system, after a year of swimming in both groups of women, more economical activities were established at rest (P(t)>0,05). The greatest significant differences in performance are observed in the MG of women. The percentage of indicators of this group, which significantly improved after a year of classes, was 55%, while in the CG – 40%.

Dissemination of experience of such work meets the requirements of practice, and the proposed information can be taken into account in the further planning of the training process in order to optimize the physical condition of women involved in swimming; will help teachers, instructors, methodologists of physical culture, doctors and people engaged in their own, more effectively use the means of recreational swimming to improve health and improve physical fitness

Prospects for further research. Further research is supposed to be carried out in the direction of studying the physiological mechanisms of adaptation processes to physical loads during classes of recreational swimming.

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Changes in the level of technical-tactical readiness indicators of tennis players at the stage of preliminary basic training

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Purpose: *investigate changes in the level of technical-tactical readiness indicators of tennis players at the stage of preliminary basic preparation of the preparatory period of the macrocycle.*

Material & Methods: *the study involved 8 tennis players aged 11–13 years who were training in the basic training group of the Park Tennis Club in Kharkiv. The following methods were used: analysis of scientific and methodological literature, pedagogical testing, methods of mathematical statistics.*

Results: *reliable changes in the indicators of the level of technical-tactical readiness in the exercises "shot through the net" by 19,6% were obtained; "shot from rebound through the net" by 2,2%; "shot after the ball bounces off the wall" by 10,4%; "serve through the net to the target" by 1,8%.*

Conclusion: *young tennis players of the basic training group improved the level of technical-tactical readiness indicators in the preparatory period of the macrocycle in the execution of an accurate directional serve, active and stable back line shot and one timer shot at the net.*

Keywords: *tennis players, technical and tactical readiness, indicators.*

Introduction

Technical and tactical training is one of the most important types of training in tennis. Many tennis experts have been involved in the research of technical and tactical preparedness of tennis players. The works of M. Crespo (2013), N. Bollettieri, (2003), N. V. Ibraimova, A. V. Khanyukova (2013), and others determine that technical and tactical training when working with tennis players occupies one of the most important places because it means learning to play. The basis of the game in tennis is the ability to own a racket, that is, the technique, and the ability to dispose of it is nothing more than a tactic. As defined by S. P. Belitsa-Gayman (2003), Yu. Chunhuan, V. L. Bochkovskaya, S. S. Aganov (2018), L. Crognier, Y. Fery (2005), C. Triolet, N. Benguigui, C. Runigo, A. M. Williams (2013) and many other authors in tennis need to choose the way, place and time of action, react quickly and correctly to the ball and the actions of the opponent, be able to and consciously direct the ball to the court to win in the drawings and in general matches.

Thus, the problem of raising the level of technical and tactical preparedness in the training process of young athletes is one of the urgent tasks in the preparation of tennis players.

Purpose: investigate changes in the level of technical-tactical readiness indicators of tennis players at the stage of preliminary basic preparation of the preparatory period of the macrocycle.

Objectives of the study:

1. Analysis of the scientific and methodological literature on the improvement of technical and tactical preparedness of tennis players in the training process.
2. Investigate changes in the level of technical-tactical readiness indicators at the stage of preliminary basic training for tennis players in the preparatory period of the macrocycle.

Material and Methods of the research

The study involved 8 tennis players aged 11–13 years, practicing in the basic training group of the tennis club "Park", Kharkiv.

Research methods: analysis of scientific and methodological literature, pedagogical testing, methods of mathematical statistics.

Testing indicators of technical and tactical preparedness was conducted with exercises:

"Shot after the ball bounces off the wall" – it was proposed to perform without stopping the maximum number of blows from the rebound against the wall. At a distance of 1,2 m from the floor, a "net line" was drawn. Only those shots ranked above the "net line" were counted. To perform the exercise was given 2 attempts. Counted the best attempt.

"Shot the ball out of the rebound through the net with the basket" – it is necessary to perform 16 shocks to the right and left from the rebound diagonally (along the line) by a comfortable thrown trainer to the ball in the specified "corridor" (1,5x1,5 m), the pace of ball hits – 16 times in 1 minute. 2 exercises were performed for the exercise. Counted the best attempt.

"Serve through the net to the target" – it was necessary to complete 10 serve – 5 hits in the first feed after serve and 5 hits – in the second field feed after serve without interruptions. 1 attempt was given for execution.

"Volley shot through the net into the corridor". The subject must perform 10 take-off strikes on the ball conveniently thrown over by the trainer diagonally into the indicated "corridor" (1,5x1,5 m). There were 2 attempts at execution Counted the best attempt.

In the selection of exercises for testing, the authors' studies were guided (S. P. Belitsa-Geymn, 2001; M. V. Ibraimova, 2012).

Pedagogical testing took place in three stages: in November 2017 and January and April 2018, which allowed determining and evaluating the indicators of the level of technical and tactical readiness of young tennis players in the training process. The testing was conducted for the purpose of operational monitoring of the indicators.

Results of the research

The analysis of the research shows that a number of specialists were involved in determining the closure between the indicators of physical and technical fitness of tennis players (C. Pereira and others, 2017), others showed the effectiveness of technical and tactical actions in competitive activities (M. Crespo, 2013; V. I. Muzhichuk, A. A. Shevchenko, 2017; Yu. Chunhuan, V. L. Bochkovskaya, S. S. Aganov, 2018; L. Crognier, Y. A. Fery, 2005), Estimation of Tennis Indicators (A. Ahmadi, D. Rowlands, D. A. James, 2009). This study revealed changes in the indicators of technical and tactical preparedness of tennis players in the preparatory period of the macrocycle.

At the primary tests in November 2017, no athlete received a high score. The following test assessments of the exercise were determined: "Volley shot through the net" – 25% of tennis players received a grade of 4, 25% rated a score of 3, 50% of athletes received a score of 3; "Shot after the ball bounces off the wall" – 50% of tennis players each received marks "3" and "2"; " Shot the ball out of the rebound through the net" – "3" – 12,5%, "2" – 25%, "1" – 62,5%; "Serve through the net to the target" – rating "3" – 12,5%, "2" – 75%, "1" – 12,5% of athletes. These results can be attributed to the end of the sports season and the decrease in fitness.

Analyzing changes in the results of technical and tactical readiness for the period from November 2017 to January 2018, it can be noted that the results have slightly increased, but did not have a significant difference. On the second control test, which took place in January 2018, young tennis players slightly improved the average number of hits in the "volley shot through the net" exercise – by 1,13 times, which is 0,9%; in the "shot after the ball bounces off the wall" the average number of hits increased by 0,13 times, which is 0,13%; in the " shot the ball out of the rebound through the net" the average number of hits increased by 0,5 times, which is 0,47%; In the "serve through the net to the target" the number of hits increased by 0,88 times, which is 0,7%.

Considering the results obtained in April 2018, it can be noted that the indicators of control tests have improved significantly, compared with January 2018 (Table 1).

Thus, in the "volley shot through the net", the average number of hits increased by 2,3 times, which is 1,7%; in "shot after the ball bounces off the wall", they added 15,1 times the average number of hits, which is 10,4%; in the "shot the ball out of the rebound through the net", the average number of hits increased by 2,35 times, which is 1,9%; in the "serve through the net to the target", the average number of hits increased by 2,92 times, which is 1,8%.

Analysis of the research results obtained in November 2017, with indicators of results that were obtained in April 2018, revealed significant changes (Table 1).

The indicators in the exercise "volley shot through the net" increased by 3,35 times, which is 19,6% (t=4,4; P<0,01);

In terms of "shot after the ball bounces off the wall", the average number of hits increased by 15,15 times, which is 10,4% (t=3,3; P<0,05).

The average number of hits in the "shot the ball out of the rebound through the net" exercise increased by 2,85 times, which is 2,2% (t=3,3; P<0,05).

In terms of "serve through the net to the target", the average number of hits increased by 3,8 times, which was 1,8% (t=6.8; P<0,001).

Analysis of the estimates obtained in the tests showed positive changes in the results at the end of the preparatory period of the macrocycle. In testing in April 2018, a high score of "5" received for the exercise "volley shot through the net" – 3 ath-

Table 1

Changes in indicators of technical and tactical readiness during the study (November 2017 – April 2018), (n=8)

Test	Number of hits, X±m			Reliability of changes		
	November, 2017	January, 2018	April, 2018	November – January t P	November – April t P	January – April t P
Volley shot through the net	4,75±0,56	5,88±0,52	8,1±0,52	1,5 >0,05	**4,4** **<0,01**	**3** **<0,05**
Shot after the ball bounces off the wall	33,25±2,2	33,38±1,88	48,4±3,97	0,05 >0,05	**3,3** **<0,05**	**3,4** **<0,05**
Shot the ball out of the rebound through the net	8,25±0,59	8,75±0,65	11,1±0,52	0,57 >0,05	**3,6** **<0,05**	**2,8** **<0,05**
Serve through the net to the target	3,5±0,33	4,38±0,42	7,3±0,45	1,6 >0,05	**6,8** **<0,001**	**4,7** **<0,01**

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Table 2

Results of the evaluation of technical and tactical preparedness of tennis players, n=8

Ratings	volley shot through the net						shot after the ball bounces off the wall						shot the ball out of the rebound through the net						Serve through the net to the target					
	November		January		April		November		January		April		November		January		April		November		January		April	
	Q-ty ratings	%	Q-ty ratings	%	Q-ty ratings	%	Q-ty ratings	%	Q-ty ratings	%	Q-ty ratings	%	Q-ty ratings	%	Q-ty ratings	%	Q-ty ratings	%	Q-ty ratings	%	Q-ty ratings	%	Q-ty ratings	%
1													5	62,5	4	50			1	12,5				
2	4	50	1	12,5			4	50	2	25			2	25	2	25	3	37,5	6	75	5	62,5		
3	2	25	5	62,5	1	12,5	4	50	6	75	6	75	1	12,5	2	25	3	37,5	1	12,5	1	12,5	3	37,5
4	2	25	2	25	4	50					2	25					2	25			2	25	3	37,5
5					3	37,5																	2	25

letes and in the exercise "serve through the net to the target" – 3 athletes. The score "4" in the exercise "volley shot through the net", was obtained by 50% of tennis players, the grade "3" – 12,5%. In the exercise "shot after the ball bounces off the wall", the score "4" received 25%, the score "3" – 75%, in the impact on the shot the ball out of the rebound through the net, the rating "4" received 25% of tennis players, the score "3" – 37,5 %, estimate "2" – 37,5%. In the exercise "serve through the net to the target" the score "4" was 37,5%, the score "3" – 37,5% of tennis players (Table 2).

Conclusions / Discussion

Analysis of the scientific and methodological literature has shown that the successful use of the basics of technical and tactical training will allow athletes to win the match and lays a solid foundation in preparing young tennis players to participate in professional tours.

Primary pedagogical testing of indicators revealed a low level of technical-tactical readiness indicators. No athlete has received high test scores.

Reliable changes of the indicators of the level of technical and tactical readiness in the exercises "volley shot through the net" were received – by 19,6%; "shot the ball out of the rebound through the net" – by 2,2%; "shot after the ball bounces off the wall" – by 10,4%; "serve through the net to the target" – by 1,8%.

In the final testing of a high score of "5", 3 athletes received 37,5% of the exercises, "volley shot through the net", and 2 athletes in the exercise "serve through the net to the target", which is 25%. The "4" rating was determined in the "volley shot through the net" exercises – 50% of tennis players, "shot after the ball bounces off the wall" – 25%, "shot the ball out of the rebound through the net" – in 25% of tennis players, "serve through the net to the target" – in 37,5%.

Thus, it can be argued that the young tennis players of the basic training group have improved the level of technical and tactical readiness in the preparatory period of the macrocycle in the execution of the precise directional serve, active and stable strikes on the back line and the impact of volley shot through the net.

The results obtained confirm the results of studies by other authors (Crespo, M., 2013; Triolet, C., Benguigui, N., Le Runigo, C., & Williams, A. M. 2013, Bollettieri, N., 2003; Beliza-Gayman, S. P. (2001), supplemented by works by Ibraimov, M. V. & Hanyukova, O. V., 2013, Crognier, L., & Fery, Y. A., 2005.

The analysis of the obtained indicators shows that in the training process, the direction was made to improve the attacking shots in the attack with accurate aiming, active and stable play on the back line and exits to the net for the game of. Further training process should be directed to the effective application of techniques in educational games and competitions.

Prospects for further research. Based on the above, further research is planned to be carried out in the direction of increasing the efficiency of technical and tactical readiness in the competitive activities of tennis players of the basic training group.

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