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CONTENT

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Improving the special physical training of gymnasts in sports aerobics at the initial training stage

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Competition is intensifying on the world platform, competitive activity is becoming more complex, requirements for the performing skills of athletes are being raised, special requirements are being placed on the level of special physical fitness of gymnasts, and it is becoming increasingly difficult to win. There are new problems that leading experts associate with the process of many years of sports training. Now in sports aerobics (aerobic gymnastics) there is the problem of developing special physical qualities of athletes, starting from the initial training stage. Also, the issues of selecting adequate means and methods have not been sufficiently resolved, their rational combination in the training process, taking into account the specificity of the competitive activity of this sport, modern refereeing and tasks of this stage.

Purpose: *theoretically develop and experimentally substantiate the methodology for improving the special physical training of gymnasts in sports aerobics at the initial training stage.*

Material & Methods: *a complex of scientific research methods (pedagogical research methods and methods of mathematical statistics) was used. 32 athletes (7–8 years old, girls) took part in the experimental part. Two groups were formed (control – 16 girls, and the main – 16 girls).*

Results: *through the use of an experimental technique, selection of funds and the optimal combination of loads, taking into account the age characteristics of young athletes, an increase in physical performance was obtained, the physical and functional preparedness of the gymnasts of the main group increased.*

Conclusions: *the developed methodology for improving the special physical training of gymnasts 7–8 years old, who are engaged in sports aerobics (aerobic gymnastics), ensures the growth of physical capabilities of athletes, solves the main tasks of the training stage, based on the specifics of motor activity, sensitive periods of development of physical qualities in this form sports, contributes to comprehensive physical development, integrated physical preparedness, the laying of a specific functional base for effective of learning technology.*

Keywords: *sports aerobics (aerobic gymnastics), special physical training, physical qualities, initial training stage.*

Introduction

Sports aerobics (aerobic gymnastics) is a spectacular, highly coordinated sport in which athletes perform a set of continuous movements of high intensity to the music at a fairly high pace [8; 9; 21].

Sports aerobics is developing and improving in accordance with the laws and trends of world sports [1; 3; 20]. However, in this sport, the issues of building a multi-year sports training remain insufficiently resolved.

Competition intensifies on the world platform, competitive activity is complicated, and it becomes more and more difficult to win. Athletes need to perform complex elements at a high technical level, quickly, easily, gracefully and artistically [5; 7]. The highest sports achievements in sports aerobics are the performance of a composition to music with the maximum manifestation of coordination abilities, flexibility, strength, vestibular stability, virtuoso body possession in all components of the competition program [2; 19]. These abilities are shown by the winning athletes. Due to the constant complication of competitive programs and increasing requirements for the performing skills of athletes, special requirements are imposed on the level of special physical preparedness of gymnasts [16]. New problems arise, leading experts associate with the process of many years of sports training, since at the moment the main contingent of athletes is provided by an influx from other sports (sports and rhythmic gymnastics, acrobatics, etc.).

Together with the coverage of issues related to building a training session with qualified athletes, the methodological issues of preparing a sports reserve in sports aerobics are not considered enough [19].

The problem of improving the process of special physical training is devoted to a large number of basic research in sports [7; 10; 11]. However, in sports aerobics, such studies are fragmented. Therefore, the development of methods for improving the special physical training of young gymnasts for use in the educational process in sports aerobics is relevant.

Purpose of the study: to theoretically develop and experimentally substantiate a methodology for improving the special physical training of gymnasts in sports aerobics at the initial training stage in annual macrocycles.

Objectives of the study. 1. To study the current state of the training process in sports aerobics. 2. To develop and ex-

perimentally substantiate a methodology for improving the special physical training of gymnasts in sports aerobics at the initial training stage.

Material and Methods of the research

32 athletes (7–8 years old) participated in the experiment. There were formed two groups of gymnasts (control – 16 girls, and the main – 16 girls) of a certain physical development and level of readiness. The study was conducted on the basis of the communal institution of the children's youth sports school No. 13 in Kharkiv.

Results of the research

A pedagogical experiment was conducted in elementary training groups throughout the year. Classes were held three times a week for a duration of 120 minutes. The control group was engaged in a curriculum for youth sports schools [12], and the main group introduced the author's method of special physical training, which in volume and intensity corresponded to work in the control group, but included more effective means and methods of special exercises and techniques, which allow you to purposefully increase the level of physical preparedness of young athletes.

The methodology is based on the specifics of the motor activity of this sport [8; 12], the sensitive periods of the development of physical qualities and contributes to comprehensive physical development, comprehensive physical preparedness, laying a specific functional base for effective training in movement technique and further improvement of athletes.

We have completed blocks of special tools for the development of such qualities as: general endurance, aerobic performance, flexibility, strength, speed, speed and strength qualities and coordination of young gymnasts. The content of the blocks was formed from exercises described in the scientific and methodological literature and used in the practice of sports training in gymnastic and dance sports. In the training process the following methods were used: interval training method, game method, combined method, repeated method, holistic method of training exercises and in parts [17; 18; 22].

The main methodological rule for using the methodology developed by us was the regular use of special breathing exercises in the training process in different parts of the training session (in the warm-up, in the main part and after the training session).

The content of the methodology consisted of three functional blocks. The first block was used before starting the workout during the warm-up, it contained exercises with alternating calming and invigorating breathing. The second block of breathing exercises was performed in the main part of the training session, between the main physical activities. This block is mainly composed of breathing exercises aimed at increasing the vital capacity of the lungs, developing the strength and endurance of the respiratory muscles and the ability to maintain maximum ventilation. The third block was applied after training. The breathing exercises of this block are soothing in nature and are aimed at accelerating recovery processes. The time spent on a complex of breathing exercises was 20% of the total training session time. At the same time, the complex of breathing exercises was designed so that their complexity and dosage progressively increase.

Before and after the experimental training sessions, young gymnasts of both groups were examined according to a single method. The methodology for examining the participants in the experiment provided for determining the level of special physical preparedness and basic physical qualities that determine the effectiveness of the special sports activities of gymnasts in sports aerobics.

When assessing the special physical preparedness of athletes, we focused on generally accepted tests [7; 13], and for tests [1; 5; 16], the choice of which was carried out on the basis of the analysis of the dominant motor mode of the competitive exercise and the specifics of aerobic gymnastics, as well as the age characteristics of the athletes, the requirements of the competition rules, data from previously conducted studies in complex coordination sports (sports and rhythmic gymnastics, acrobatics, figure skating, etc.). Given this, test tasks were proposed to evaluate special physical preparedness. In addition, as an indicator of the level of development of the body of athletes, physical development was determined: 1) age (years); 2) height (cm); 3) weight (kg); 4) heart rate (beats·min^{-1}); 5) VC (ml). The results were processed using mathematical statistics methods [14].

At the end of the pedagogical experiment, the results of repeated testing of the level of development of special physical preparedness of young athletes by comparing the results of the study before and after the experiment checked the effectiveness of the author's methodology.

As a result of the application of the experimental technique, more substantial gains of the studied parameters were obtained.

The results of special physical preparedness of young athletes registered in the process of control examinations before and after the experiment are presented in the table.

In general, the research results confirmed the effectiveness of using the developed author's methodology for improving the special physical training of young gymnasts specializing in sports aerobics.

Indicators of physical preparedness increased in both groups. However, the improvement in motor tests in athletes of the main group after the experiment was much greater.

During the experiment, the gymnasts of the MG increased the vital capacity of the lungs by 5,37% ($p<0,01$), this indicator is closely interrelated and largely determines the overall physical performance (according to HSTI), which increased by 5,39% ($p<0,01$) and can serve as a confirmation of the increased endurance of young athletes. The index of the cardiovascular system (HR) at rest decreased by 2,96% ($p<0,05$), which indicates an increase in the efficiency and efficiency of the circulatory system.

It should be noted that in the main group there was an increase in the indices of coordination abilities by 3,57%, 6,42% ($p<0,01$), 6,71% ($p<0,05$), and 12,18%, ($p<0,01$). The strength abilities also show an increase in results by 30,67% ($p<0,01$), 12,65% ($p<0.01$), 5,86% ($p<0,01$). Performance

Artemieva, G., Bodrenkova, I. & Moshenska, T. (2019), "Improving the special physical training of gymnasts in sports aerobics at the initial training stage", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 5(73), pp. 4-7, doi: 10.5281/zenodo.3595056.

Comparative analysis of indicators of special physical preparedness of gymnasts at the stage of initial training during

No. i/o	Indicators	Main group (n=16)				Control group (n=16)			
		OD ($\bar{X} \pm \sigma$)*	FD ($\bar{X} \pm \sigma$)	%	t; p	OD ($\bar{X} \pm \sigma$)	FD ($\bar{X} \pm \sigma$)	%	t; p
	Physical development								
1.	Age (years)	7,26±0,5	7,44±0,2	0,14	0,2>0,05	7,42±2,2	7,68±2,1	0,13	0,2>0,05
2.	Height (cm)*	122,4±0,6	122,8±0,5	0,07	0,1>0,05	121,7±1,9	122,1±1,7	0,06	0,1>0,05
3.	Body weight (kg)*	23,4±2,0	22,23±1,9	0,29	0,4>0,05	22,5±2,5	22,41±2,2	0,27	0,2>0,05
4.	Heart rate (beats· min^{-1})*	81,04±2,4	78,56±2,3	2,96	2,8<0,05	81,0±2,5	80,46±2,3	0,61	1,2>0,05
5.	VC (ml)*	1775±2,1	1873±2,0	5,37	3,6<0,01	1794±2,5	1831±2,1	2,33	2,7<0,05
	Coordination abilities								
6.	Shuttle 3x10 (s)*	11,66±2,5	11,28±2,2	3,57	1,2>0,05	11,62±2,1	11,45±1,9	1,75	0,8>0,05
7.	Flamingo (s)	87,43±1,5	93,46±1,4	6,42	4,7<0,01	87,25±1,7	90,24±1,6	2,22	2,6<0,05
8.	2 forward somersaults, jump with 360° rotation (points)	8,25±1,9	8,95±1,7	6,71	2,3<0,05	8,0±2,0	8,2±1,8	2,40	1,1>0,05
9.	Aerobic track connection (points)	8,65±2,2	9,85±2,1	12,18	3,2<0,01	8,30±2,1	8,90±1,9	6,74	2,5<0,05
	Strength abilities								
10.	Flexion and extension of the arms in an emphasis lying down (number of times)*	12,25±1,9	17,67±1,8	30,67	3,3<0,01	12,63±1,9	13,88±1,9	9,0	2,2<0,05
11.	Raising the torso in a sedan from a prone position (number of times)	22,91±1,7	26,23±1,5	12,65	4,8<0,01	22,05±1,9	24,23±1,7	8,99	2,4<0,05
12.	Hold the position of "high chair" against the wall (s)	77,21±1,5	82,02±1,3	5,86	4,4<0,01	75,56±1,5	78,13±1,5	3,28	2,5<0,05
	Speed abilities								
13.	Running on the spot 5 s (quantity)	18,27±1,5	19,06±1,3	4,14	2,4<0,05	17,76±1,5	17,96±1,2	1,12	1,1>0,05
14.	Raising and lowering straight arms from the position of the main stand, arms below 10s (number of times)	12,15±1,9	14,83±1,8	18,07	3,7<0,01	12,23±2,0	13,28±1,9	7,90	2,2<0,05
15.	10 bends forward from the position of the main stand, arms up (s)	11,93±1,8	14,65±1,7	18,56	2,9<0,01	12,07±2,0	13,15±1,9	8,21	2,1<0,05
	Speed-strength abilities								
16.	Jumping up from a deep squat in 20 s (number of times)	26,18±1,9	29,26±1,7	10,52	2,6<0,05	26,21±1,5	27,42±1,4	4,41	1,9>0,05
17.	Alternate swing legs 90° forward for 20 s (number of times)	22,75±1,8	25,05±1,5	9,18	2,4<0,05	23,15±1,5	24,35±1,5	4,90	1,9>0,05
	Flexibility								
18.	Bridge (points)	8,98±0,7	9,0±0,5	1,0	0,4>0,05	9,05±0,5	9,13±0,5	0,88	0,9>0,05
	Twine to the right (points)	9,76±0,9	9,96±0,8	0,2	0,8>0,05	9,82±0,7	9,86±0,6	0,2	0,9>0,05
19.	Twine to the left (points)	9,64±0,4	9,86±0,3	0,2	0,8>0,05	9,83±0,5	9,85±0,3	0,2	0,8>0,05
	Twine transverse (points)	10,00±0,2	10,00±0,2	0	0>0,05	10±0,2	10±0,2	0	0>0,05
	Functionality								
20.	HSTI (c. u.)*	79,32±1,5	82,43±1,2	5,39	3,2<0,01	78,55±1,7	80,39±1,5	1,08	1,2>0,05

***Remark.** OD – output data (before the start of the experiment); FD – final data (after the experiment); HR – heart rate; HSTI – Harvard step test index.*

abilities increased by 4,14% (p<0,05), 18,07%, (p<0,01), and 18,56%, (p<0,01). In terms of speed and strength abilities, the increase is: 10,52% (p<0,05), 9,18% (p<0,05). Flexibility indicators increased, but unreliably from 0,2% to 1,0%. This result can be explained by the fact that already in the initial testing the gymnasts showed very high results.

Thus, the use of the methodology developed by us creates a functional basis for the growth of special technical preparedness at the stages of in-depth sports specialization, sports improvement and sports longevity in long-term training of gymnasts.

Conclusions / Discussion

The proposed methodology provided a high level of aerobic capabilities and increased the energy supply efficiency when using various exercises with a wide range of actions, as well as additional means, in particular breathing exercises, which have a positive complex effect on the functions of the central nervous system, acting as a factor that optimizes the psycho-functional and sensorimotor capabilities of the body.

The fact of an increase in the overall physical performance of gymnasts as a result of the use of special exercises coincides with the research results of A. Dobryak and A. Deineko, I. Krasova in rhythmic gymnastics [4; 5].

The work supplemented special requirements and clarified the training process of young gymnasts in sports aerobics.

Among the motor abilities that provide the necessary level of mastering of technical actions, an important role is played by those in which the coordination of movements is of paramount importance, and the results of our experiment were confirmed by the authors' studies [3; 6; 15] that technical mastery in sports aerobics as well as in many gymnastic and dance sports is more determined by coordination abilities.

Theoretically developed and experimentally substantiated, the technique of special physical training of gymnasts in sports aerobics at the initial training stage improves physical qualities, comprehensively affects the body of athletes, providing

a more significant increase in the functional capabilities of the cardiovascular and respiratory systems, and, as a result, increased aerobic and anaerobic performance and physical performance compared to the program that is currently used in sports other schools of the country.

In the future, further research is expected to develop the theoretical and methodological foundations for building the training process in sports aerobics at various stages of preparation.

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References

1. Artemieva, H.P. (2017), "Improvement of Special Physical Training of Gymnasts in Sports Aerobics at the Preliminary Basic Training", *Slobozans`kij naukovo-sportivnij visnik*, No. 6(62), pp. 21-22. (in Ukr.)
2. Artem'ieva, H.P., Avramenko, O.V. & Humeniuk, S.V. (2016), "Improvement of the level of physical development and physical fitness of athletes in sports dances at the stage of specialized basic training by means of step aerobics", *Slobozans`kij naukovo-sportivnij visnik*, No. 6(56), pp. 12-16. (in Ukr.)
3. Boliak, A.A. (2007), "Analysis of the technique of basic movements of young athletes in sports aerobics", *Teoriia ta praktyka fizychnoho vykhovannia*, No. 4, pp. 16-18. (in Ukr.)
4. Dobriak, O. (2017), "Motor Problems for the Development of Special Endurance of Qualified Gymnasts in Group Exercises of Artistic Gymnastics", *Teoriia i metodyka fizychnoho vykhovannia i sportu*, No. 4, pp. 13-18. (in Ukr.)
5. Deineko, A. & Krasova, I. (2018), "Improvement of special physical training of female gymnastics athletes 9-10 years old", *Slobozans`kij naukovo-sportivnij visnik*, No. 1, pp. 27-30. (in Ukr.)
6. Kovalenko, Ya. (2017), "Sensomotor coordination of athletes engaged in rhythmic gymnastics at the stage of specialized basic training", *Teoriia i metodyka fizychnoho vykhovannia i sportu*, No. 4, pp. 27-34. (in Ukr.)
7. Lyakh, V.I. (2010), "Improving Specific Coordination Abilities", *Fizicheskaya kultura v shkole*, No. 2, pp. 7-14. (in Russ.)
8. FIG (2019), Official site, available at: http://www.fig-gymnastics.com/site.
9. Moshenskaya, T.V. (2013), "Compatibility of athletes in the formation of a team for sports aerobics, taking into account their technical and special physical fitness", *Slobozans`kij naukovo-sportivnij visnik*, No. 5, pp. 52-55. (in Russ.)
10. Ozolin, N.G. (2004), *Nastolnaya kniga trenera* [Trainer's Handbook], Astrel, Moscow. (in Russ.)
11. Platonov, V.N. (2004), *Sistema podgotovki sportsmenov v olimpiyskom sporte. Obshchaya teoriya i ee prakticheskie polozheniya* [The system of training athletes in Olympic sports. General theory and its practical provisions], Olimpiyskaya literatura, Kiev. (in Russ.)
12. Ministry of Youth and Sports of Ukraine, Ukrainian Gymnastics Federation, Technical Committee on Sports Aerobics (2014), Sports Aerobics: Curriculum for Junior Sports School, Kyiv, 67 p. (in Ukr.)
13. Serhiienko, L.P. (2001), *Kompleksne testuvannia rukhovykh zdibnostei liudyny: navchalnyi posibnyk* [Comprehensive testing of human motor abilities: a textbook], Mykolaiv. (in Ukr.)
14. Shestakov, M.P. (2002), *Statistika. Obrabotka sportivnykh dannykh na kompyutere6 uchebnoe posobie* [Statistics. Processing sports data on a computer6 study guide], SportAkademPress, Moscow. (in Russ.)
15. Tereshchenko, I.A. (2015), "Coordination training of specializing in sports gymnastics", *Fizicheskoe vospitanie studentov*, No. 3, pp. 52-65. (in Russ.)
16. Moshenska, T.V. (2017), "Improvement of the special physical training of gymnasts in sports aerobics at the stage of preliminary basic training", *Slobozhanskyi herald of science and sport*, No. 6, pp. 17-20.
17. Beliak, Yu.I., & Zinchenko, N.M. (2014), "Dosing method of physical activity in aerobics classes for students", *Physical Education Of Students*, No. 18(5), pp. 8-13, doi:10.15561/20755279.2014.0502.
18. Bryukhanova, N.A., Bulgakova, O.V., Mokrova, T.I., & Bogashchenko, Y.A. (2013), "Determination of possibilities of the use of high-intensive trainings facilities on lessons health aerobics", *Physical Education Of Student*, No. 17(2), pp. 25-29, doi:10.6084/m9.figshare.156376.
19. Shepelenko, T.V., Kozina, Zh.L., Cieślicka, M., Prusik, K., Muszkieta, R., Sobko, I.N., Ryepko, O.A., Bazilyuk, T.A., Osiptsov, A.V. & Kostiukevych, V.M. (2017), "Factorial structure of aerobics athletes' fitness", *Pedagogics, psychology, medical-biological problems of physical training and sports*, No. 21*(6)*, pp. *291-300,* doi: 10.15561/18189172.2017.0606.
20. Wang, M. & Zhang, H. (2016), "Discussion of the Relationship between Core Power Training and Physical Control of Aerobics Athletes", *Sports and Social Sciences : 6th Ese International Conference*, Vol. 59, pp. 153-155.
21. Yan, F.F. (2016), "Artistic Arrangement of Complete Sets of Competitive Aerobics Taking the Three – Person Aerobics as an Example", In G. Lee (Ed.), *The 6th International Conference on Information, Communication and Education Application*, No. 94, pp. 334-339.
22. Yang, M. (2013), "The Practical Studying of the Aerobics on the Tourism Students in the Polytechnic Institutes of Hubei Province", *Common Development of Sports and Modern Society : International Symposium*, No. 13, pp. 88-93.

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Assessment of the quality of life of persons with traumatic damage to the peripheral nerves of the upper limb

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Purpose: *to assess the quality of life of people with traumatic injuries of the peripheral nerves of the upper limb during surgical treatment.*

Material & Methods: *analysis of scientific and methodological literature; questionnaires, methods of mathematical and statistical data processing. To assess the quality of life, we used the "Brief Health Status Assessment Questionnaire" (MOS SF-36) and "Methodology for assessing the quality of life of a patient" by D. M. Aronov, 2002. SF-36 consists of 36 questions grouped into 8 scales: physical functioning, role-playing activities, bodily pain, general health, vital functions, social functioning, emotional state and mental health. The methodology for assessing the quality of life of a patient according to D. M. Aronov (2002) consists of 17 questions. The technique allows you to evaluate how much the patient considers his life to be full and with what he associates changes in the quality of life. The study was conducted on the basis of SI "Institute of Neurosurgery named after acad. A. P. Romodanova, National Academy of Medical Sciences of Ukraine", Department of Reconstructive Neurosurgery. The examination involved 27 patients with traumatic injuries of the peripheral nerves of the upper limb. All patients underwent surgical treatment.*

Results: *an assessment was made of the physical and psychological health of individuals with traumatic neuropathies of the upper limb according to SF-36. It was revealed that patients with this pathology by the physical health component scored an average of 28 to 71 points. The mental health indicators of these patients did not differ significantly from physical health (30–67 points). In general, among patients, an average level of quality of life was observed – in 74.1% of cases. A low level of quality of life was found in 4 patients (14.8%), a high level in 3 (11.1%). After assessing the quality of life of patients with traumatic neuropathies of the upper limb using the "Methods for assessing the quality of life of a patient" by D. M. Aronov (2002), we found the following: the main reason for the decline in the quality of life of 88.9% of patients was the need to perform surgery on the affected upper limbs, prolonged treatment and the need for rehabilitation courses.*

Conclusions: *a decrease in the quality of life in patients with traumatic neuropathies of the upper limb is due to the need to be treated, a decrease in activity in everyday life, restrictions on leisure and work, a change in the attitude of friends, friends and colleagues, and a decrease in wages.*

Keywords: *quality of life, neuropathy, trauma, upper limb, questionnaire, MOS SF-36.*

Introduction

Currently, the quality of life (QOL) of neurological patients is sharply reduced. Such patients lose their ability to work, in most cases they become disabled, their social activity decreases, as a result of which many of them may be susceptible to depressive states [4]. Diseases of the peripheral nervous system lead to impaired physical condition of the patient and contribute to changes in many other areas – emotional, mental, social. Therefore, an important task in the rehabilitation of neurological patients is not only partial or complete restoration of their lost functions, reduction of pain, but also the restoration and improvement of patients' QOL [3].

One of the most well-known QOL assessment methods is the "Brief Health Status Assessment Questionnaire" (official version of the 36-item MOS Short-Form Health Survey (MOS SF-36)). The SF-36 questionnaire is a non-specific patient QOL assessment questionnaire that is widely used in QOL studies in Europe and the USA. The questionnaire reflects the general well-being and degree of satisfaction with those aspects of human life that are affected by the state of health [5; 11].

However, despite an intensive study of QOL in neurology, QOL determination in patients with traumatic neuropathies of the upper extremities remains poorly understood. It should be noted that for many neurological diseases, special questionnaires to assess and monitor the physical, psychological and social condition of the patient during the rehabilitation phase with physical factors are not enough.

Purpose of the study: to assess the quality of life of people with traumatic injuries of the peripheral nerves of the upper limb during surgical treatment.

Material and Methods of the research

Research methods: analysis of scientific and methodological literature and; survey, methods of mathematical and statistical data processing.

To assess QOL, we used the "Brief Health Status Assessment Questionnaire" (MOS SF-36) and the "Methodology for assessing the quality of life of a patient" by D. Aronova, 2002 [1; 10; 14]. SF-36 consists of 36 questions grouped into 8 scales: physical functioning, role-playing, bodily pain, general health, vitality, social functioning, emotional state and mental health. The indicators of each scale are designed in such a

way that the higher the value of the indicator (from 0 to 100), the better the score on the selected scale. Two parameters form from them: the physical component of health (Physical health) and the psychological component of health (Mental Health). The physical component of health includes scales for "physical functioning", "role-based physical functioning", "pain intensity" and "general health". The constituent scales of the psychological component of health are "mental health", "role-playing emotional functioning", "social functioning" and "vitality" [12; 13].

The methodology for assessing the quality of life of a patient with D. M. Aronov (2002) consists of 17 questions. The time for filling out the questionnaire is from 30–40 s to 5 minutes. The technique allows you to evaluate how much the patient considers his life to be complete and what changes in QOL are associated with [1].

The study was conducted on the basis of the State Institution "Acad. Institute of Neurosurgery A. P. Romodanova, National Academy of Medical Sciences of Ukraine", Department of Reconstructive Neurosurgery. The examination involved 27 patients with traumatic injuries of the peripheral nerves of the upper limb, of which 21 were men (77,8%), 6 (22,2%) women, and the age of the patients ranged from 17 to 68 years. Among the examined patients, patients with working professions predominated (62,9%), the percentage of employees was lower (37,1%). All patients underwent surgical treatment.

Results of the research

Traumatic injuries of peripheral nerves occur with a frequency of 0,5 per 10 thousand. Population. Annually in Ukraine, up to 2500 cases of traumatic injuries of peripheral nerves are recorded, causing long-term disability and disability in 75–81% of patients [8]. Lost function of the limb cannot always be restored due to the implementation of one surgical intervention, especially when it comes to severe or combined injury. Satisfactory results of the restoration of the function of the injured limb are observed in 53–88% of the injured [7], 25–30% of the operated patients with peripheral nerve injury require repeated surgery [8].

A successful combination of modern medical and rehabilitation techniques and the improvement of well-known diagnostic methods and surgical treatment of patients with peripheral nerve injuries make it possible to predict the course of the disease and get as close as possible not only to a satisfactory treatment outcome, but also to improve the quality of life of patients [8; 9].

QOL is one of the basic concepts of modern rehabilitation and is a comprehensive assessment of the physical, psychological, emotional and social functioning of the patient, based on his subjective perception [2]. The complexity of determining QOL is determined by the patient's subjective perceptions of his suffering, because in some cases there is no direct relationship between the severity of the disease and the level of suffering [6].

Describing the SF-36 questionnaire, it is necessary to note the importance of each of the 8 scales as different components of health. The scale of "physical functioning" characterizes the range of feasible physical activity and determines the ability to perform various physical activities: the minimum "physical function" is the ability to self-service, the maximum is the free performance of all types of physical activity (long walking, running, playing sports) without restrictions [5; 15].

"Role-playing physical functioning" scale determines the effect of a physical condition on work or other daily activities. The scale allows you to assess the ability to perform work related to professional activities, housekeeping, etc. Low indicators on this scale indicate that everyday activity is significantly limited by the physical condition of the patient.

The scale "physical pain" reflects the severity of the pain syndrome and its effect on the patient's normal activities. Low scores on this scale indicate that pain significantly limits patient activity. The minimum value of the scale suggests the occurrence of a very strong or prolonged pain syndrome, which cannot but affect the assessment of QOL. The maximum score is an indicator of the complete absence of pain.

The scale "general health" allows you to judge the general condition of the patient. According to this component of the questionnaire, the subjective perception of the previous and current state of health is evaluated, and the prospects for its change are determined. The minimum value of the scale corresponds to a low assessment of one's state of one's health, or indicates a patient's conviction that his state of health will worsen. The maximum value corresponds to the patient's personal beliefs in excellent health.

The scale of "vitality" implies a feeling of being full of strength and energy, or, conversely, exhausted. Low scores indicate patient fatigue, decreased vital activity. High – about feeling energetic and full of strength for most of the time.

The scale of "social functioning" reflects limitations in social life, the ability to fully communicate with relatives, friends, family, and the possibility of adequate professional communication. The scale is determined by the degree to which a physical or emotional state affects social activity. Low scores indicate a significant limitation of social contacts, a decrease in the level of communication due to the deterioration of physical and emotional state.

The scale of "role-playing emotional functioning" reflects the emotional status of the patient, allows you to judge the effect of emotions on everyday activity, behavior with others. The presence or absence of problems during work or other ordinary activities as a result of emotional problems is assessed. Low indicators on this scale are interpreted as a restriction in the performance of daily work due to a deterioration in the emotional state.

The "mental health" scale characterizes the patient's mood: the presence of anxiety, depression, neurotization, a decrease in emotional and behavioral control, gives an estimate of the overall indicator of positive emotions. Low scores indicate the presence of depressive, anxious experiences, mental distress [5; 15].

Based on the foregoing, we conducted a survey of patients with traumatic neuropathies of the upper limb. When analyzing the initial state of physical and psychological health using the SF-36 questionnaire, it was found that patients with traumatic neuropathies in the physical health component scored an average of 28 to 71 points. The mental health indicators of

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Reasons for the decline in the quality of life in people with neuropathies of the upper limb according to the questionnaire "Methods for assessing the quality of life of a patient" (by D. N. Aronov, 2002)

Reasons	number of patients, n=27	
	Abs. units	%
Presence of injury / disease	22	81,5
Need to do surgery on the affected upper limb, continued to be treated and undergo rehabilitation courses	24	88,9
Restrictions on the performance of their duties at work, reduction of time spent at work and salary	16	59,3
Presence of pain	13	48,1
Exercise restriction	15	55,6
Limitations of activity in everyday life, in self-care	16	59,3
Restrictions on doing recreational physical education and sports	10	37,0
Restrictions on spending leisure time with family, friends	11	40,7
Disease-related life limitations related to doctor's recommendations	9	33,3
Fear of causing harm to health	6	22,2
Experiences for your health after treatment	18	66,7

these patients did not differ significantly from physical health (30–67 points).

In general, the average QOL level was observed among patients – in 74,1% of cases. Low QOL was detected in 4 patients (14,8%), high – in 3 (11,1%).

After assessing the QOL of patients with traumatic neuropathies of the upper limb using the "Methods for assessing the quality of life of a patient" by D. Aronov, we found the following: the main reason for QOL reduction was 88.9% of patients who called for surgery on the affected upper limb, continued to be treated and take rehabilitation courses (Table).

In addition, 81,5% of the patients tested fully or partially associated changes in the quality of life with the presence of the disease; 59,3% were worried about activity limitations in daily life and self-care; 55,6% were forced to limit physical activity; 59,3% of patients suffered due to the fact that the disease led to restrictions on work and lower salaries; 51,2% were worried about limitations in physical education and sports.

Patients with traumatic neuropathies of the upper extremity often (48,1% of cases) indicated as one of the reasons that caused life restrictions in connection with the disease (changes in their condition, changes at work, changes in leisure activities, etc.) the presence of pain. Less often, patients noted that the limitations in their lives due to illness associated with the recommendations of a doctor (33,3%), fear of causing harm to their health by stress (22,2%).

So, in order to conduct effective rehabilitation of patients with traumatic neuropathies of the upper limb, it is necessary to conduct surveys using SF-36 and the "Methods for assessing the quality of life of a patient" by D. Aronov, highlight the leading factors that worsen physical and psychological health, and give them special attention in the rehabilitation process.

Conclusions / Discussion

The decrease in the quality of life in patients with diseases of the peripheral nervous system is due to the need to be treated, a decrease in activity in everyday life, restrictions on leisure and work, a change in the attitude of friends, friends and colleagues, and a decrease in wages.

Questionnaires SF-12 and QOLP are convenient for use (require little time to fill out and count test results, informative). They can be recommended for assessing the quality of life of patients with traumatic neuropathies of the upper limb.

The prospects for further research are to develop an algorithm for the use of rehabilitation tools to improve the quality of life in case of neuropathies of the upper limb.

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References

1. Aronov, D.M. & Zaitsev, V.P. (2002), "Methods of assessing the quality of life of patients with cardiovascular diseases", *Kardiologiya*, No 5, pp. 92-95. (in Russ.)
2. Afanasyeva, E.V. (2010), "Health-related Quality of Life Assessment", *Kachestvennaya klinicheskaya praktika*, No. 1, pp. 36-38. (in Russ.)
3. Goldblat, Yu.V. (2015), Mediko-sotsialnaya reabilitatsiya v nevrologii [Medical and social rehabilitation in neurology]. St. Petersburg. (in Russ.)
4. Malkova, A.A., Osetrov, A.S., Shaidurov, K.A. & Shtennes, R.A. (2017), "Quality of Life for Neurological Patients", *Sinergiya nauk*, No. 11, pp. 704-708, available at: http://synergy-journal.ru/archive/article0529. (in Russ.)
5. Morozova, P.N. (2011), "A comparative assessment of the quality of life and the contribution of pain using questionnaires sf-12 and Methodology for assessing the quality of life of a patient", *Gigiena truda*, No. 11 (260), pp. 32-34. (in Russ.)
6. Novik, A.A. & Ionova, T.I. (2002), *Rukovodstvo po issledovaniyu kachestva zhizni v meditsine* [Guidelines for the study of the quality of life in medicine], St. Petersburg, Moscow. (in Russ.)
7. Pysin, V.G. (2002), *Nevrologicheskaya zabolevaemost, obraz i kachestvo zhizni nevrologicheskikh patsientov: avtoref. diss. k. med. nauk.* [Neurological morbidity, lifestyle and quality of life of neurological patients: PhD thesis abstract], Smolensk, 22 p. (in Russ.)
8. Tatarchuk, M.M. (2015), *Povtorni dyferentsiiovani khirurhichni vtruchannia u khvorykh z travmoiu peryferychnykh nerviv verkhnikh kintsi-*

vok: avtoref. dys. na zdobuttia kand. med. n. [Repeated differentiated surgical interventions in patients with trauma to the peripheral nerves of the upper extremities: PhD thesis abstract], Kyiv, 22 p. (in Ukr.)
9. Yagensky, A.V. & Sichkaruk, I.M. (2007), "Assessment of quality of life in modern medical practice", *Vnutrenniaia medytsyna*, No. 3(3). (in Ukr.)
10. Grider, T., Cuthbertson, D., Feely, Sh. & Shy, M. (2014), "Health-Related Quality Of Life By SF-36 in Patients with HNPP Compared To Those With CMT1A (P2.067)", *Open Med*, No. 29, p. 82.
11. Lins, L., Carvalho (2016), "FM SF-36 total score as a single measure of health-related quality of life: Scoping review", *Open Med*., No. 4, doi: 10.1177/2050312116671725.
12. McHorney, C.A., Ware, J.E., Lu, J.F. & Sherbourne, C.D. (1994), "The MOS 36-Item Short-Form Health Survey (SF-36): III. tests of data quality, scaling assumptions and reliability across diverse patient groups", *Med Care*, No. 32(4), pp. 40-66.
13. Unalan, D., Soyuer, F., Ozturk, A. & Mistik, S. (2008), "Comparison of SF-36 and WHOQOL-100 in patients with stroke", *Med Care,* Vol. 56 (4), pp. 426-432.
14. Vukojevic, Z., Pekmezovic, T., Nikolic, A, et al. (2014), "Correlation of clinical and neurophysiological findings with health-related quality of life in patients with diabetic polyneuropathy", *Vojnosanit Pregl,* No. 71, pp. 833-838.
15. Ware, J.E. (1992), "The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection", *Medical Care,* No. 30(6), pp. 473-483.

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Functional indicators of the female athlete's body specializing in rowing

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Purpose: *to conduct a comprehensive study of the functional state of female athlete's specializing in rowing, for the subsequent determination of the prospects in this sport.*

Material & Methods: *girls of various age groups and sports qualifications were examined. The functional state of the athletes was studied according to the developed methodology for measuring the effect of the training action, and the sensorimotor reactions to sound and light stimuli, the power of forced inspiration and expiration, the level of muscular-articular sensitivity and coordination of movements were determined. The testing process simulated typical conditions of training and competitive activity.*

Results: *on the basis of comprehensive studies, it is shown that the most important methodological condition for the formation of a rational technique is the interconnection and interdependence of the structure of movements and the development of physical qualities. Correspondence of an athlete's physical preparedness to the level of possession of sports equipment, structure and the degree of perfection of its characteristics determines the technical preparedness in sports. The proposed research methodology and comparative analysis of average values, as well as relative deviations of the functional state indicators of the examined athletes, may indicate the level of sports preparedness of the rowers.*

Conclusions: *the use of the proposed methodology will maximize focus on the individual characteristics and abilities of each particular athlete when choosing a sports specialization, developing a system of multi-year training, determining the rational structure of training and competitive activity.*

Keywords: *pace and accuracy of movements, time of sensorimotor reactions to sound and light stimuli, inspiratory and expiratory flow rates, level of coordination of movements.*

Introduction

Patterns of adaptation of the human body to physical activity is the basis for the rational use of physical exercises for training, aimed at the formation, preservation, strengthening of qualities such as strength, speed, agility, endurance and flexibility, as well as improving the performance of athletes [1; 2].

Under the influence of physical loads at the cellular and tissue levels, there is a restructuring of various organs and systems of the human body, which is based on general biological processes, and their understanding is a prerequisite for the correct assessment of the level of preparedness [3; 4].

The vital activity of any organism determines the reflex principle of its response to stimuli. This occurs with simple and complex reflex acts that form the athlete's movements. The reaction of an organism is defined as a complex cyclic process in which various structural components participate. During the athlete performs any motor actions, various body systems work: nervous, muscle, respiratory, cardiovascular, excretory, endocrine, metabolism changes. So, each movement of an athlete is the result of combining a large number of different morphological elements (bones, joint-ligamentous apparatus, muscles), organs and systems of the body, aimed at achieving the necessary motor effect [5; 6].

Adaptation of the central regulatory system is implemented in the automation of movements, that is, in the performance of well-fixed motor actions without conscious control from the nerve centers, is a manifestation of profitability. During training, a pool of conditioned reflexes is constantly accumulating and there is an increase in the capabilities of the central nervous system to instantly create algorithms of motor acts necessary for the effective solution of unexpected motor tasks [7].

Training physical activity, its intensity and volume reflect a quantitative measure of the impact on athletes in the process of training. With the proper use of certain physical exercises, it is necessary to take into account adaptations to them and the effect on the human body. In this regard, it is important to study the physiological basis for the adaptation of the athlete's body to physical activity. The severity of changes in body functions in this case depends, first of all, on the individual characteristics of a person and the level of his fitness. The studied functional indicators of the body of athletes can be correctly analyzed and comprehensively evaluated only in relation to the adaptation process [8].

Physiological reactions can be adapted to certain environmental conditions (physical activity) that have passed the adaptation process, or deadaptation, which are in the process of

adaptation. Therefore, individual adaptation of a person in dynamics is defined as the previous process, in which the main is the appearance of new adaptive reactions based on information about changes in the external environment and the further state, already with the presence of adaptive changes made, stored for a long time, and mechanisms of their active search, on the basis of which reactions organisms appear in response, with the help of regulatory systems are brought to optimal [9; 10].

With an increase in the level of motor preparedness, adaptive reactions become more and more specific, which must be taken into account when choosing means and methods of developing motor abilities. To maintain the achieved level of long-term adaptation, it is necessary to systematically use supporting physical activities. The cessation and a significant decrease in training effects causes the opposite process adaptation – deadaptation, which applies to all aspects of the training of students, including physical [11].

To achieve high sports results, much attention is paid to improving the technical training of athletes, is the most effective means of performing sports exercises in order to achieve the best result. In the process of training, the technical level changes from the elementary technique of a beginner to the perfect technique of a qualified athlete [12].

Purpose of the study: to conduct a comprehensive study of the functional state of female athlete's specializing in rowing, for the subsequent determination of the prospects in this sport.

Material and Methods of the research

Pupils of sports schools of Mykolaiv and the Higher School of Physical Culture, girls specializing in kayaking were examined. Individual indicators were determined in different age groups: 11–12 years old – 25 people, 13–14 years old – 28 people, 15–16 years old – 23 people, total – 76 athletes.

The study of the functional state included a test for measuring the effect of the training action (META), created on the basis of the tapping test, which allows you to determine the complex of kinematic characteristics of movements in an autonomous mode. This technique allows you to study the pace of movements and their accuracy by the sum of the points scored, as well as the accuracy of one movement. The study of movements performed with maximum speed and accuracy was considered in various conditions, sequentially in three time periods: for 15 s, 60 s and 15 s. Such a statement of the problem provided an objective assessment of the pace and accuracy of movements in various conditions: with an optimal functional state in the first period of time, during prolonged work in the second and after a long and maximum pace of work in the third period.

A change in the number of movements in the first period of time indicates a high mobility of nervous processes, the second – about balance, the third – about strength and in total – about the state of the nervous system as a whole. This physiological justification allows the trainer to objectively evaluate the processes occurring in the body, and to purposefully conduct management of training and competitive activities. The methodology for studying the effect of the training effect is published in detail in the "Slobozans`kij naukovo-sportivnij visnik" 2019, No. 3(71), pp. 10-17 [13].

The determination of latent periods of visual-motor and auditory-motor reactions was carried out using an electromyoreflexometer (EMR) according to a standard method. These reactions are an indicator of complex psychophysiological processes that reflect the characteristics of receptor perception, nervous and muscular systems, characterizing the mobility of nervous processes, that is, one of the most important indicators of higher nervous activity.

The level of muscular-articular sensitivity and coordination of movements, as well as the diagnostic capabilities of the principle of repeated reproduction of a given load, were studied by the method of reverse dynamometry (DMrev), which was modified and adapted for the purposes of our study. The ability to develop a skill to reproduce a given load without visual correction of each of ten attempts was determined.

The power of forced inspiration and expiration was measured using a pneumotachometer (PT). The air velocity in $l \cdot s^{-1}$ was estimated at the maximum fixed inhalation and exhalation. 10 attempts were used with an interval of at least 20 s. Determining the maximum air flow during inhalation and exhalation allows you to indirectly evaluate the ability of the respiratory muscles to work intensively. With regular sporting activities, the power of forced inspiration and expiration can significantly increase.

The observation results were processed by methods of variation statistics.

Results of the research

In different age groups, tempo indicators were determined by the number of strokes, the total points scored for all movements, the accuracy of one movement. The results of the study of the functional state of girls aged 11–12 are presented in Table 1. In the first period of the test, measuring the effect of the training action determines the starting speed, we observed: the average rate of movement was 25,7±1,65 beats, the maximum figure was 26 beats, the minimum – 21 beats; the average amount is 202±3,06 points, the maximum is 207 points, the minimum is 170 points; accuracy – 7,86±0,44 points; at the maximum pace and total points – 7,96 points, with minimum values – 8,09 points.

In the second period of the test, it reflects speed at a distance, on average, the pace was 26±1,36 beats, the sum was 211±8,25 points, accuracy was 8,12±0,20 points; at the maximum pace – 27,5 beats, the sum was determined – 221,3 points and accuracy – 8,04 points; the minimum pace was 23,5 strokes, the total was 197 points and the accuracy was 8,38 points.

In the third period of the test, it indicates speed endurance, average values were observed: pace – 27,3±1,36 beats, total – 215±13,96 points, accuracy – 7,88±0,14 points, maximum and minimum indicators, respectively, pace – 29 strokes and 25 strokes, the sum – 235 points and 194 points, accuracy – 8,10 points and 7,76 points.

According to the total result of three periods of the test, characterizing speed abilities as a whole, the average was noted: pace – 26,33±1,417 beats, total – 210,3±3,411 points, ac-

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Table 1

Survey results (rowing, girls 11–12 years old)

		Indicators	M±m	M_{max}	M_{min}	σ	C
Effect of the training action	First period	Pace (number of beats)	25,7±1,65	26	21	2,87	12,12
		total points	202±3,06	207	170	5,33	2,64
		Accuracy (points)	7,86±0,44	7,96	8,09	0,77	8,81
	Second period	Pace (number of beats)	104±5,44 (26±1,36)	110 (27,5)	94 (23,5)	9,47	9,10
		total points	845±33 (211±8,25)	885 (221,3)	788 (197)	57,4	6,79
		Accuracy (points)	8,12±0,20	8,04	8,38	0,36	4,38
	Third period	Pace (number of beats)	27,3±1,36	29	25	2,37	8,67
		total points	215±13,96	235	194	24,3	11,28
		Accuracy (points)	7,88±0,14	8,10	7,76	0,24	3
	Total	Pace (number of beats)	158±8,5 (26,33±1,417)	165 (27,5)	140 (23,33)	14,79	9,54
		total points	1262±20,47 (210,3±3,411)	1327 (221,2)	1152 (192)	356,2	24,98
		Accuracy (points)	7,99±0,14	8,04	8,22	0,24	2,92
Test	EMR (c)	sound	0,228±0,026	0,272	0,195	0,046	19,98
		light	0,265±0,026	0,291	0,214	0,046	17,21
	PT ($l \cdot s^{-1}$)	inhale	4,33±0,85	5,5	3,0	1,48	34,16
		exhale	3,9±0,51	4,5	3,0	0,89	22,75
	DM rev. (kg)		2,2±0,48	3,0	1,6	0,83	37,65

Remark. *In parentheses are the data reduced to a single temporary indicator of 15 s.*

curacy – 7,99±0,14 points; by maximum values: pace – 27,5 beats, amount – 221,2 points, accuracy – 8,04 points; according to the minimum indicators: tempo – 23,33 hits, total – 192 points, accuracy – 8,22 points.

In the second period, compared with the first, average indicators increased: pace – by 0,3 beats (1,17%), amount – by 9 points (4,46%) and accuracy – by 0,26 points (3,31%); according to the maximum indicators, there was observed: an increase in pace by 1,5 hits (5,77%), amounts by 14,3 points (6,91%), accuracy by 0,08 points (1,01%); the minimum indicators also recorded an increase: pace – by 2,5 beats (11,91%), amounts – by 27 points (15.88%), accuracy – by 0,29 points (3,58%).

In the third period, compared with the first and second, the average indicators increased, respectively, in terms of movement pace by 1,6 beats (6,23%) and 1,3 beats (5,00%), in total – by 13 points (6,44%) and 4 points (1,91%), but the accuracy remained virtually the same – an increase of 0,02 points (0,25%) and a decrease of 0,24 points (3,05% over the second period)) according to the maximum indicators: an increase in pace by 3 beats (11,54%) and 1,5 beats (5,45%), amounts by 28 points (13,53%) and 13,7 points (6,19%) accuracy – by 0,14 points (1,76%) and 0,06 points (0,75%); according to the minimum indicators: an increase in pace by 4 hits (19,05%) and 1,5 beats (6,38%), amounts by 24 points (14,12%) and a decrease by 3 points (1,55%), however, accuracy is low in the third period and less than in the first – by 0,33 points (4,25%) and in the second – by 0,62 points (7,99%).

In the sum of three periods, the average pace is greater than in the first and second periods, by 0,63 beats (2,45%) and 0,33 beats (1,27%), less than in the third, by 0,97 beats (3,68%); the amount is higher than in the first period by 8,3 points (4,11%), less than in the second and third, by 0,7 points (0,33%) and 4,7 points (2,23%), the accuracy is greater than in the first and third periods, by 0,13 points (1,65%) and by 0,11 points (1,39%), less than in the second, by 0,13 points (1,63%).

Deviations from the average values of the maximum and minimum indicators in the first period amounted, respectively, in terms of pace of movement – 0,3 beats (1,17%) and 4,7 beats (22,38%), total – 5 points (2,48%) and 32 points (18,82%); in the second period: in terms of pace – 1,5 beats (5,77%) and 2 beats (10,64%), total – 10,3 points (4,88%) and 14 points (7,11%); in the third period: in terms of pace – 1,7 beats (6,23%) and 2,3 beats (9,20%), total – 20 points (9,30%) and 21 points (10,82%); in total: by pace – 1,17 beats (4,45%) and 3 beats (12,86%), total – 10,9 points (5,18%) and 18,3 points (9,53%). The result of the accuracy of one movement by the maximum indicator in the first period of the test was higher than the average by 0,1 points (1,27%) and the minimum – also higher than the average by 0,23 points (2,93%); in the second period, at the maximum pace and total points – accuracy is less than average by 0,08 points (0,99%), the minimum pace and total points – accuracy is higher than average by 0,26 points (3,20%); in the third period, the accuracy of the maximum value is higher than the average by 0,22 points (2,79%) and the minimum is less than the average by 0,12 points (1,55%); the total maximum and minimum indicators are more than average, respectively, by 0,05 points (0,63%) and 0,23 points (2,88%).

In the test for determining sensorimotor reactions in girls 11–12 years old, specializing in rowing, the average response time to a sound stimulus is 0,228±0,026 s, the best indicator is 0,195 s, the average response time is 0,033 s (16,92%), and the worst is 0,272 s, s more than average on 0,044 (19,29%); per light signal: average indicator – 0,265±0,026 s, better – 0,214 s, less than average by 0,051 s, worst – 0,291 s, more than average by 0,26 s (9,81%).

The average rate of air flow on inspiration is 4,33±0,85 $l \cdot s^{-1}$, the maximum is 5,5 $l \cdot s^{-1}$, 1,17 $l \cdot s^{-1}$ (27,02%) more than the

average minimal – 3,0 l·s^{-1}, less than average by 1,33 l·s^{-1} (44,33%); on exhalation: on average – 3,9±0,51 l·s^{-1}, maximum – 4,5 l·s^{-1}, more than average by 0,6 l·s^{-1} (15.38%), minimum – 3,0 l·s^{-1}, less than average 1,9 l·s^{-1} (30,00%).

When determining the accuracy of reproduction of a given muscle effort, the average error was 2,2±0,48 kg (14,67%), the maximum – 3 kg (20,00%), the minimum – 1,6 kg (10,67%).

The results of testing the functional state of athletes 13–14 years old are presented in table 2. In the first period of the test, measuring the effect of the training impact, the average indicators were as follows: pace – 28±1,24 beats, maximum 32 strokes, minimum 23 beats; amount – 227±1,47 points, maximum – 248 points, minimum – 179 points; accuracy – 8,11 points, with a maximum pace and total points – accuracy of 7,75 points, minimum – 7,78 points, an increase in pace by 5 beats (21,74%) and 1,8 beats (5,66%), respectively , the amount – by 30 points (16,76%) and 25,5 points (13,89%), accuracy decreased by 0,32 points (4,29%) and increased by 0,54 points (7,81%).

In terms of the sum of three periods and average indicators, the pace was more than in the first period, by 2,37 beats (8,46%), less than in the second and third, by 0,13 beats (0,43%) and 1,83 beats (6,03%); the amount is more than in the first period by 8,8 points (3,88%), less than in the second and third, by 1 point (0,42%) and 5,2 points (2,21%), accuracy is less than in the first – by 0,34 points (4,38%), more than in the second and third periods, by 0,01 points (0,13%) and by 0,29 points (3,88%).

In terms of maximum values, the pace and the sum of points is greater than in the first period by 3,33 beats (10,41%) and 22 points (8,87%), the pace is practically the same with the second period and the amount is 5,8 points less 2,15%), the pace is reduced in relation to the third period by 2,67 beats (7,56%), the total score is the same, the accuracy is less than in the first and second by 0.11 points (1,44%) and 0,13 points (1,71%) more than in the third, 0,56 points (7,91%).

In terms of minimum indicators, the pace and the total score is greater than in the first period, by 3,17 beats (13,78%) and by 8 points (4,47%), with the second period they are practically the same, less than in the third, the pace – 1,83 beats (6,99%) and the amount – 22 points (11,76%), accuracy is less than in the first and third periods, by 0,63 points (8,81%) and by 0,31 point (4,34%), more than the second, by 0,23 points (3,23%).

In the second period of the test, the average values were noted at the level: pace – 30,5±1,73 beats, the sum – 236,8±9,43 points, accuracy – 7,76±0,96 points; maximum: pace – 35,5 beats, total – 275,8 points, accuracy – 7,77 points; minimum: pace – 26,5 beats, total – 183,5 points, accuracy – 6,92 points.

In the third period, average indicators: pace – 32,2±1,92 beats, total – 241±11,5 points, accuracy – 7,48±0,33 points; at the maximum pace – 38 beats, the sum – 269 points, accuracy – 7,08 points; minimum pace – 28 beats; total – 209 points; accuracy – 7,46 points.

According to the sum of three periods, the average values are: tempo – 30,37±1,69 beats, total – 235,8±1,77 points, accuracy – 7,77±0,211 points; at the maximum pace – 35,33 beats, the total – 270 points, accuracy – 7,64 points; at a minimum pace – 26,17 beats, the sum is 187 points, accuracy – 7,15 points.

When comparing the results of the study of the second period with the first in terms of average indicators, it was determined that the pace was higher by 2,5 beats (8,93%), the amount was higher by 9,8 points, the accuracy was lower by 0,35 points (4,51%); at maximum – the rate increased by 3,5 beats (10,94%), the amount – by 27,8 points (11,21%), accuracy –

Table 2

Survey results (rowing, girls 13–14 years old)

		Indicators	M±m	M $_{max}$	M $_{min}$	σ	C
Effect of the training action	First period	Pace (number of beats)	28±1,24	32	23	3,86	2,78
		total points	227±1,47	248	179	21,2	3,15
		Accuracy (points)	8,11±0,34	7,75	7,78	0,77	9,42
	Second period	Pace (number of beats)	122±6,92 (30,5±1,73)	142 (35,5)	106 (26,5)	15,4	13,9
		total points	947±37,72 (236,8±9,43)	1103 (275,8)	734 (183,5)	158,4	16,7
		Accuracy (points)	7,76±0,96	7,77	6,92	0,215	2,75
	Third period	Pace (number of beats)	32,2±1,92	38	28	4,29	13,3
		total points	241±11,5	269	209	25,8	10,7
		Accuracy (points)	7,48±0,33	7,08	7,46	0,73	9,73
	Total	Pace (number of beats)	182,2±10,14 (30,37±1,69)	212 (35,33)	157 (26,17)	31,4	21,27
		total points	1415±10,62 (235,8±1,77)	1620 (270)	1122 (187)	237,8	16,85
		Accuracy (points)	7,77±0,211	7,64	7,15	0,472	6,05
Test	EMR (c)	sound	0,227±0,022	0,286	0,170	0,049	21,93
		light	0,270±0,016	0,312	0,231	0,035	12,87
	PT (l·s^{-1})	inhale	4,1±0,326	4,7	3,0	0,73	17,8
		exhale	4,6±0,249	5,3	4,0	0,56	12,13
	DM rev. (kg)			3,3	1,6	0,73	32,57

Remark. *In parentheses are the data reduced to a single temporary indicator of 15 s.*

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by 0,02 points (0,26%).

In the third period, compared with the first and second, on average, the pace increased by 4,2 beats (15,00%) and 1,7 beats (5,57%), the amount increased by 14 points (6,17%) and 4,2 points (1,77%), accuracy decreased by 0,63 points (8,42%) and 0,28 points (3,74%); maximum rates increased by 6 beats (18,75%) and 2,5 beats (7,04%), the amount – by 21 points (8,47%) and decreased by 6,8 points (2,53%), accuracy decreased by 0,67 points (9,46%) and 0,69 points (9,75%); the minimum tempo increased by 5 beats (21,74%) and 1,8 beats (5,66%), the amount – by 30 points (16,76%) and 25,5 points (13,89%), the accuracy decreased by 0,32 points (4,29%) and increased by 0,54 points (7,81%).

In terms of the sum of three periods and average indicators, the pace was more than in the first period, by 2,37 beats (8,46%), less than in the second and third, by 0,13 beats (0,43%) and 1,83 beats (6,03%); the amount is more than in the first period by 8,8 points (3.88%), less than in the second and third, by 1 point (0,42%) and 5,2 points (2,21%), accuracy is less than in the first one by 0,34 points (4,38%), more than in the second and third periods, by 0,01 points (0,13%) and 0,29 points (3,88%).

Regarding the maximum values – the pace and the total score is 3,33 more beats (10,41%) and 22 points (8,87%) more than in the first period, almost the same pace and a lower amount by 5,8 compared to the second period point (2,15%), in relation to the third period – the pace is 2,67 times less (7,56%), the sum of points is the same, the accuracy is less than in the first and second, by 0,11 points (1,44%) and 0,13 points (1,71%) more than in the third, by 0,56 points (7,91%).

According to the minimum indicators – the pace and the total score is greater than in the first period, by 3,17 beats (13,78%) and by 8 points (4,47%), with the second period they are practically the same, less than in the third, the pace – by 1,83 beats (6,99%) and the amount – by 22 points (11,76%), accuracy is less than in the first and third periods by 0,63 points (8,81%) and by 0,31 points (4,34%), 0,23 points more than in the second (3,32%).

Deviations from the average indicators of the maximum and minimum values, respectively, were more or less: in the first period – by the rate of 4 beats (14,29%) and 5 beats (21,74%), the total – 21 points (9,25%) and 48 points (26,82%); in the second period – at the pace of 5 beats (16,39%) and 4 beats (15,09%), the total – 39 points (16,47%) and 53,3 points (29,05%); in the third period – at a rate of 5,8 beats (18,01%) and 4,2 beats (15,00%), the total – 28 points (11,62%) and 32 points (15,31%); in total over three periods – the rate of 4,96 beats (16,33%) and 4,2 beats (16,05%), the total – 34,2 points (14,51%) and 48,8 points (26,09%).

The accuracy of one movement at the maximum and minimum rates of pace and the amount of points scored in the first period was less than the average by 0,36 points (4,65%) and 0,33 points (4,24%), respectively; in the second period – in fact, it is more by 0,01 points (0,13%) and less by 0,84 points (12,14%); in the third period – less by 0,4 points (5,65%) and 0,02 points (0,27%); for three periods – less by 0,13 points (1,70%) and 0,62 points (8,67%).

The difference between the average values in the sum of the maximum and minimum indicators for the pace was observed in the first period – 36,03%, in the second – 31,48%, in the third – 33,01%, in total – 32,38%; the total score is identical – 36,07%; 45,52%; 26,43; 40,60%, accuracy of one movement, respectively – 8,89%; 12,27%; 5,92%; 10.39%. At high pace and total points, the accuracy of one movement is less than average results, but not significantly, with minimal indicators – the accuracy of movements was determined practically at the level, as well as at high pace and total points.

The response rate of athletes 13–14 years old, specializing in rowing, to a sound stimulus was determined on average as 0,227±0,022 s, the best result was 0,170 s, the average speed was 0,057 s (33,53%) and the worst 0,286 s, more than average – by 0,059 s (25,99%); for a light stimulus, the average indicator is 0,270±0,016 s, better – 0,231 s, less than average – by 0,039 s (16.88%), worse – 0,312 s, more than average – by 0,042 s (15,56%). The deviation from the average value was 59.52% for the sound signal and 32,44% for the light signal; by the difference between the maximum and minimum indicators for sound – 7,54%, for light – 1,32%.

The inspiratory air flow rate is on average 4,1±0,326 $l \cdot s^{-1}$, maximum – 4,7 $l \cdot s^{-1}$ more than the average by 0,6 $l \cdot s^{-1}$ (14,63%), minimum – 3,0 $l \cdot s^{-1}$, less than average – 1,1 $l \cdot s^{-1}$ (36,67%); on exhalation, on average – 4,6±0,249 $l \cdot s^{-1}$, maximum – 5,3 $l \cdot s^{-1}$, more than average 0,7 $l \cdot s^{-1}$ (15,22%), minimum – 4,0 $l \cdot s^{-1}$, less than the average by 0,6 $l \cdot s^{-1}$ (15,00%), deviations from the average: on inspiration – 51,30% and expiration – 30,22% and the difference on inspiration – 22,04% and expiration – 0,22%.

An error in the accuracy of reproducing a given muscle effort was observed on average 2,24±0,33 kg (14,93%), the minimum – 1,6 kg, the average – 0,64 kg (10,67%), the maximum – 3,3 kg 1,06 kg more than average (22,00%); the deviation from the average was 32,67%, the difference between the maximum and minimum errors in the reverse dynamometry test was 11,33%.

The indicators of the test measuring the effect of the training action in girls 15–16 years old, specializing in kayaking, are presented in Table 3.

In the first period of the test, it determines the starting speed, the average values were at the level: pace of movements – 30±0,89 beats, total – 234±8,32 points, accuracy – 7,87±0,22 points; maximum indicators: pace – 36 beats, total – 290 points, accuracy – 8,06 points, more than average, respectively, by 6 beats (20,00%), 56 points (23,93%), 0,19 points (2,41%); minimum indicators: pace – 24 beats, total – 196 points, less than average – by 6 beats (25,00%), 38 points (19,39%), but accuracy – 8,16 points, which is 0,29 more than average point (3,68%).

In the second period of the test, it shows the ability to maintain speed at a distance, the average indicators were: pace – 31,25±0,89 beats, total – 235,75±8,78 points, accuracy – 7,57±0,24 points; maximum indicators: pace – 36,25 beats, total – 280,5 points, accuracy – 7,74 points, which is 5 points (16,00%) more than average, respectively, 44,75 points (18,98%), 0,17 points (2,25%); minimum indicators: pace – 24,25 beats, total – 187,25 points, less than average by 7 hits (28,87%), but accuracy – 7,72 points – more than average by 0,15 points (1,98%).

Table 3

Survey results (rowing, girls 15–16 years old)

		Indicators	M±m	M_{max}	M_{min}	σ	C
Effect of the training action	First period	Pace (number of beats)	30±0,892	36	24	3,46	11,53
		total points	234±8,32	290	196	32,28	13,79
		Accuracy (points)	7,87±0,22	8,06	8,16	0,865	10,99
	Second period	Pace (number of beats)	125±3,56 (31,25±0,89)	145 (36,25)	97 (24,25)	13,83	11,07
		total points	943±35,13 (235,75±8,783)	1122 (280,5)	749 (187,25)	136,3	14,46
		Accuracy (points)	7,57±0,238	7,74	7,72	0,922	12,16
	Third period	Pace (number of beats)	31±0,966	37	24	3,75	12,09
		total points	230±8,245	291	182	31,99	13,91
		Accuracy (points)	6,68±0,245	7,86	7,58	0,951	14,24
	Total	Pace (number of beats)	186±2,80 (31±0,467)	218 (36,33)	145 (24,17)	19,88	10,63
		total points	1407±45,67 (234,5±7,612)	1703 (283,33)	1127 (187,83)	177,2	12,62
		Accuracy (points)	7,56±0,201	7,79	7,77	0,778	10,37
Test	EMR (c)	sound	0,178±0,039	0,205	0,152	0,015	8,43
		light	0,216±0,072	0,279	0,181	1,028	13,08
	PT	inhale	4,6±0,089	5,2	4,0	0,346	7,5
	($l \cdot s^{-1}$)	exhale	4,4±0,156	5,4	3,3	0,603	13,75
		DM rev. (kg)	1,16±0,24	2,67	0,23	0,76	65,49

Remark. *In parentheses are the data reduced to a single temporary indicator of 15 s.*

In the third period of the test, it indicates speed endurance, on average: pace – 31±0,96 beats, total – 230±8,25 points, accuracy – 6,68 points; maximum: pace – 37 beats, total – 291 points, accuracy – 7,86 points, which is 6 points (19,35%) more than average, respectively 61 points (26,52%), 1,18 points (17,66%); minimum: pace – 24 beats, total – 182 points, which is 7 points less than average (29,17%), 48 points (26,37%), but accuracy – 7,58 points – 0,9% more than average point (13,47%).

According to the total indicator of the test of measuring the effect of the training action, it reflects speed abilities in general, average results: pace – 31±0,46 beats, total – 234,5±7,61 points, accuracy – 7,56±0,20 points, maximum indicators: pace – 36,33 beats, total – 283,33 points, accuracy – 7,79 points, which is more than average, respectively, by 5,33 beats (17,19%), 48,73 points (20,82%), 0,23 points (3,04%); minimum indicators: pace – 24,17 beats, total – 187,83 points, which is less than the average by 6,83 beats (28,26%), 46,67 points (24,85%), accuracy – 7,77 points, which is 0,21 points more than average (2,78%).

When comparing the indicators in the second period with the first, the average pace and the total score increased slightly – by 1,25 beats (4,17%) and 1.75 points (0,75%), but the accuracy of one movement decreased by 0,3 points (3,96%); at maximum – the pace actually remained at the same level, an increase of 0,25 beats (0,69%), the total score decreased by 9,5 points (3.39%) and accuracy decreased by 0,32 points (4,13%); at the minimum – the pace has not actually changed, an increase of 0,25 beats (1,04%), the amount decreased by 8,75 points (4,67%), accuracy decreased by 0,44 points (5,69%).

In the third period, compared with the first and second, the changes were insignificant in average values – the rate increased by 1 beats (3,33%) and decreased by 0,25 beats (0,81%), the amount decreased by 4 points (1,74 %) and 5,75 points (2,50%), accuracy decreased by 1,19 points (7,81%) and 0,89 points (13,32%); on the maximum – the rate increased by 1 beats (2,78%) and 0,75 beats (2,07%), the amount did not change compared to the first period and was less by 10.5 points in the second (3,74%), accuracy decreased by 0,2 points (2,54%) and increased by the second period by 0,12 points (1,55%); at the minimum – the rate is the same in all periods, the amount is less by 14 points (7,69%) and 5,25 points (2,88%), accuracy decreased by 0,58 points (7,65%) and by 0,14 points (1,85%).

The total result showed that on average the pace did not actually change, the sum with the first and second periods is the same, the difference with the third is 4,5 points (1,96%), the accuracy is 0,31 points less than in the first (4,10%), the same as the second, more than the third, by 0,88 points (13,17%); by maximum indicators – the rate is the same in all periods of the test, the amount is more than 2,83 points (1,01%) than in the second period and 6,67 points (2,35%) less than in the first and third periods and by 7,67 points (2,71%), accuracy is greater than in the second, by 0,05 points (0,65%), less than in the first and third periods, by 0,27 points (3,47%) and 0,07 points (0,89%); at the minimum – the rate is the same in all periods of the test, the amount is less than the first by 8,17 points (4,63%), the same as the second, more than the third by 5,83 points (3,20%), accuracy is greater than in the second and third periods by 0,05 points (0,65%) and 0,19 points (2,51%), less than in the first, by 0,39 points (5,02%).

The difference between the average indicators in the sum of the maximum and minimum values was: in the first period in terms of rate – 45,00%, total points – 43,32%, accuracy – 6,09%; in the second: by rate – 44,87%, total points – 47,85%, accuracy – 4,23%; in the third period: by pace – 48,52%, total points – 52,89%, accuracy – 31,13%, total behind the pace – 45,45%, total points – 45,67%, accuracy – 5,82% . At the maximum pace and total points, the accuracy of the

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movements was greater than the average in all periods of the test, while the minimum rates and the sum of the points, the accuracy of the movements was also greater than the average results.

The speed of sensorimotor reactions in athletes aged 15–16 to a sound stimulus was determined by the values: average – 0,178±0,039 s, better – 0,152 s, which is less than average by 0,026 s (17,11%), worse – 0,205 s, more than average by 0,027 s (15,17%); for light stimulus: average indicator – 0,216±0,072 s, better – 0,181 s, which is less than average by 0,035 s (19,34%), worst – 0,279 s, which is higher than average by 0,063 s (29,17%); the deviation from the average value amounted to a total of 32,28% for the sound signal, 48,51% for the light signal, the difference between the maximum and minimum indicators for sound – 1,94%, for light – 9,83%.

When conducting pneumotachometry, the average air flow rate was observed on inspiration 4,6±0,089 $l \cdot s^{-1}$, maximum 5,2 $l\ s^{-1}$, more than the average value by 0,6 $l \cdot s^{-1}$ (13,04%) , minimum – 4,0 $l \cdot s^{-1}$, less than the average by 0,6 $l \cdot s^{-1}$ (15,00%); on exhalation – 4,4±0,156 $l \cdot s^{-1}$, maximum – 5,4 $l\ s^{-1}$, more than average by 1 $l \cdot s^{-1}$ (22,73%), minimum – 3,3 $l \cdot s^{-1}$, 1,1 $l \cdot s^{-1}$ (33.33%) less than the average, deviations from the average on inspiration – 28,04%, expiration – 56,06% and the difference on inspiration – 1,96% and expiration – 10,60%.

The average error in reproducing a given muscular effort in the reverse dynamometry test was determined to be 1,16±0,24 kg (7,73%), the minimum – 0,23 kg (1,53%), 0,93 kg less than the average (1,53%), the maximum – 2,67 kg, 1,51 kg (10,07%) more than the average, deviations from the average value were 11,60%, the difference between the maximum and minimum errors was 8,54%.

When comparing the results of the survey, according to our methodology for measuring the effect of a training action, electromyoreflexometry, pneumotachometry, and reverse dynamometry of the functional state of girls of different ages from 11 to 16 years old, specializing in kayaking, the following data were obtained, reflecting the psychophysiological age characteristics, which are determined skill level of the examined athletes.

In the first period of the test, which determines the possibility of a quick start to work, the average indicators – the pace of movement for girls 11–12 years old (first group), was 2,3 times less than 13–14-year-olds (second group) (8,95%) and in 15–16-year-olds (third group) by 4,3 beats (16.73%); the amount of points scored for all movements also increased by 25 points (12,38%) and 32 points (15,84%); the accuracy of movements in the first and third groups was almost the same, the difference was 0,01 points (0,13%) and in the first – less than in the second, by 0,25 points (3,18%). In terms of maximum values, the rate increased from the first group to the second by 6 beats (23,08%) and the third – by 10 beats (38,46%), the amount changed similarly – increased by 41 points (19,81%) and by 83 points (40,09%), the accuracy of movements in the first group was higher than in the second, by 0,21 points (2,71%) and less than in the third, by 0,1 points (1,26%); at the minimum – the rate increased identically by 2 beats (9,52%) and 3 beats (14,29%), the amount – by 9 points (5,29%) and 26 points (15,29%), the accuracy decreased from the first group to the second by 0,31 points (3,98%) and increased to three by 0,07 points (0,87%).

Thus, with increasing age, the average rate and amount of points increase, but the accuracy of movements in 13–14 years is higher than in other age periods; relative to the maximum and minimum indicators, the pace and amount also increase, but the accuracy of movements in 13–14 years is less.

In the second period of the test, it determines the ability to maintain speed at a distance, the average values – the pace in the first group was 4,5 beats (17,31%) less than in the second and 5,25 beats in the third (20,19 %); the amount increased similarly by 25,8 points (12,23%) and by 24,75 points (11,73%), the difference between the second and third groups is insignificant – 1,05 points (0,45%); accuracy of movements also decreased by 0,36 points (4,64%) and 0,55 points (7,27%). In terms of maximum values, the rate increased from the first group to the second by 8 beats (29,09%) and the third by 8,75 beats (31,82%), the amount increased similarly by 54,5 points (24,63%) and 59,2 points (26,75%), accuracy decreased by 0,27 points (3,47%) and 0,3 points (3,88%); at the minimum – the rate increased to the second group by 3 beats (12,77%) and the third by 0,75 beats (3,19%), the amount decreased similarly – 13,5 points (7,36%) and 9,75 points (5,21%), accuracy decreased by 1,46 points (21,09%) and by 0,66 points (8,55%).

With increasing age, the average rate of movements and the sum of points increase, and the accuracy of one movement decreases, the maximum and minimum indicators change identically. At 13–14 years, the minimum pace is greater than at an older age, but the total score and accuracy is less.

In the third period of the test, it determines speed endurance, on average, athletes in the first group had a slower pace of movement than in the second, by 4,9 beats (17,95%) and in the third – by 3,7 beats (13,55%), the amount of points changed similarly – by 26 points (12,09%) and 15 points (6,98%), the accuracy of movements, on the contrary, decreased in the first group – in the second group by 0,4 points (5,35%) and in the third – by 1,2 points (17,96%).

The maximum rate of movement compared with the first group – in the second it was 9 more hits (31,03%) and in the third by 8 beats (27,59%), the amount increased identically by 34 points (14,47%) and 56 points (23,83%), but the accuracy decreased by 1,02 points (14,41%) and 0,24 points (3,05%).

Relative to the minimum indicator – in relation to the first group, the second pace was 3 more beats (12,00%), the sum – 15 points (7,73%); and at the third pace, it is less by 1 beats (4,17%), and the amount is 12 points (6,59%), the accuracy of movements decreased by 0,3 points (4,02%) and by 0,18 points (2,37%).

In the group of 13–14-year-old athletes, an average high pace and the amount of points scored for a given time were observed with high accuracy of movements; at the highest rates of pace and total points, low accuracy was noted; at the minimum – the athletes of this group determined a high pace, the sum of points and the accuracy of movements in comparison with rowers of other groups.

According to the total result of the test of measuring the effect of the training effect, which characterizes speed abilities as a whole, in the group of 11–12-year-old athletes, the aver-

age values were low pace of movement and the sum of points and the highest accuracy of one motor action, in girls 13–14 years old, rowing on kayaks, the pace increased by 4,04 beats (15,34%) and the amount by 25,5 points (12,13%), and accuracy decreased by 0,22 points (2,83%); in 15–16 years, the pace also increased – by 4,67 beats (17,74%) and the amount – by 24,2 points (11,51%), and the accuracy was still reduced by 0,43 points (5,69%).

The indicators between the second and third groups are practically the same – the pace is higher in the third – by 0,63 beats (2,07%), the amount and accuracy is lower in the third – by 1,30 points (0,55%) and 0,21 points (2,78%).

According to the maximum values in the second and third groups, the pace increased compared to the first – by 7,83 beats (28,47%) and by 8,83 beats (32,11%), the sum – by 48,8 points (22,06%) and by 62,13 points (28,09%), accuracy decreased by 0,4 points (5,24%) and 0,25 points (3,21%); when comparing the third group of the second, the difference was minimal, the pace increased by 1 beats (2,83%), the amount by 13,33 points (4,94%), the accuracy by 0,15 points (1,96%).

According to the minimum indicators – the pace in the younger group was lower than that of the older ones – by 2,84 beats (12,17%) and 0,84 beats (3,61%), respectively, the sum was 5 points more (2,67%) and 4,17 points (2,22%), accuracy – higher by 1,07 points (14,97%) and 0,45 points (5,79%); when comparing the second group with the third one, they noted that the pace is more by 2 beats (8,27%), the total score is actually the same, less by 0,83 points (0,44%), the accuracy is less by 0,62 points (8,67%).

The average rate and pace in 13–14-year-old athletes is practically the same with 15–16-year-olds and more than in 11–12-year-olds, however, the accuracy of movements is higher in the younger group, identical results were observed for the maximum and minimum values.

The study of sensorimotor reactions showed that the average response time to the stimulus in the first and second groups was practically the same for a sound signal, but slightly better in the second – by 0,001 s (0,44%), in the third group the reaction time decreased by 0,05 s (28,09%); according to the best indicator, the reaction time from the younger group to the senior decreased, respectively, by 0,025 s (14,71%) and by 0,043 s (28,29%), in the third it was less than in the second – by 0,018 s (11,84 %); worst-case scenario, the worst response time in 13–14-year-old athletes and more than in 11–12-year-olds, by 0,014 s (5,15%) and in 15–16-year-olds by 0,081 s (39,51%).

The average response time to a light signal in the first group is better than in the second, by 0,005 s (1,89%) and worse than in the third, by 0,049 s (22,69%); according to the best indicator, the minimum time in the third group is less than that of the athletes of the first group by 0,033 s (18,23%) and the second group – by 0,05 s (27,62%); at worst, identical results were observed, the response time in 15–16-year-old athletes was less than in 11–12-year-olds by 0,012 s (4,31%) and 13–14-year-olds by 0,033 s (11,83%).

A study of sensorimotor reactions to sound and light stimuli by average, maximum and minimum values found that low and unstable indicators in athletes 13–14 years old, better in 15–16 year old rowers.

The average airflow rate on inspiration in the first group is 0,23 $l \cdot s^{-1}$ (5,61%) more than in the second group and 0,27 $l \cdot s^{-1}$ less than in the third (6,24%), and in the third more than in the second, by 0,5 $l \cdot s^{-1}$ (12,19%); by the maximum – in 11–12 year olds more than in 13–14 year olds, by 0,8 $l \cdot s^{-1}$ (17,02%) and 15–16-year-olds by 0,3 $l \cdot s^{-1}$ (5,77%), and in the latter more than in 13–14-year-olds by 0,5 $l \cdot s^{-1}$ (10,64%); minimal – the results in the first and second groups are the same and less than in the third on 1,0 $l \cdot s^{-1}$ (33,33%).

The values of pneumotachometry on expiration are on average less in the first group than in the second, by 0,7 $l \cdot s^{-1}$ (17,95%) and in the third – by 0,5 $l \cdot s^{-1}$ (12,82%); for the maximum result – in the first group less than 0,8 $l \cdot s^{-1}$ (17,78%) in the second group and 0,9 $l \cdot s^{-1}$ (20,00%) in the third; the minimum – in the first group less than in the second by 1,0 $l \cdot s^{-1}$ (33,33%) and in the third by 0,3 $l \cdot s^{-1}$ (10,00%).

The average air velocity on inspiration and at the maximum indices is the lowest among 13–14 year old athletes and the highest among 15–16 year olds, while exhaling 13–14 year old rowers showed the best results.

Indicators of reverse dynamometry determined that the average error in performing muscle effort in the first and second groups was almost the same, but slightly higher in 13–14-year-old athletes than in 11–12-year-olds by 0,04 kg (0,26%). A minor error in 15–16 year olds is less than in the first group by 1,04 kg (6,94%) and in the second by 1,08 kg (7,20%); the maximum error in all groups was almost the same – from 2,67 kg to 3,3 kg, but in 13–14-year-olds it was more than 0,3 kg (2%) in 11–12-year-olds and in 15–16 year olds per 0,63 kg (4,20%); the minimum error ranged from 0,23 kg (1,53%) in the third group to 1,6 kg (10,6%) in the first and second groups.

The results of the study of the accuracy of muscle effort showed that athletes of 13–14 years of age performed the test with the largest error on average, maximum and minimum indices than athletes of 11–12 years old and 15–16 years old.

Conclusions / Discussion

The most important methodological condition for the formation of a rational technique is the interconnection and interdependence of the structure of movements and the development of physical qualities. Correspondence of an athlete's physical preparedness to the level of possession of sports equipment, the structure and degree of perfection of its characteristics determines the technical preparedness in sports.

When adapting to excessive physical loads for a given organism, a general biological pattern is realized: all adaptive reactions of an organism to unusual environmental factors have only relative expediency, that is, even persistence, long-term adaptation to physical loads has its own functional or structural price, which is a possible, but not necessary condition. The most rational way to prevent adaptation disorders is to use a properly built regime of training, rest and nutrition, hardening, increasing resistance to stress and harmonious physical and mental development of an athlete's personality [1; 12].

Bogush, V., Getmantsev, S., Bogatyirev, K., Reznichenko, O., Kosenchuk, V., Verteleckiy, O. & Kulakov, Yu. (2019), "Functional indicators of the female athlete's body specializing in rowing", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 5(73), pp. 12-21, doi: 10.5281/zenodo.3595087

For the regulation of most human movements, the simplest reflex arc is not enough. The various motor structures of the central nervous system should constantly receive information from the corresponding receptors about the position, speed, acceleration of movement of individual parts of the motor system. All this provides the formation of feedback, which significantly increases the accuracy of movements. In addition, purposeful, conscious movements are performed, the commands for which arise in the cerebral cortex. To meet its needs in a constantly changing environment, the body needs to set certain tasks and achieve the intended result in its behavioral activities. For this, a group of nerve centers is formed in the central nervous system, which is a functional system [6; 8].

With intense physical exertion and systematic exercise, the functional state of the nervous system and neuromuscular system improves. This allows athletes to master complex motor skills, develop speed, ensure coordination of movements, coordination of the muscles (synergists, agonists and antagonists), dynamic stabilization of movements, which are manifested by precise motor acts, timely execution of movements with maximum saving of time and effort.

The physiological reactions of the formation of a specific functional system are the main components of the adaptation process, and the general biological pattern of such adaptive changes applies to any human activity. In achieving sustainable and perfect adaptation, the restructuring of regulatory adaptive mechanisms and the mobilization of physiological reserves, as well as the sequence of their appearance at different functional levels, are of great importance. At first, normal physiological reactions arise, and only then, stress reactions of adaptation mechanisms require significant energy costs using the reserve capabilities of the body, which ultimately leads to the formation of a special functional adaptation system that provides specific human activity.

Such a functional system in athletes represents a newly formed relationship of nerve centers, hormonal, autonomic, and executive organs, which is necessary to solve the problems of adapting the body to physical activity. The morpho-functional basis of such a system is the formation of systemic structural changes in the body in response to muscle work, manifested in the creation of new intercentral relationships, increased activity of respiratory enzymes, hypertrophy of the heart muscle and skeletal muscles, an increase in the number of mitochondria, enhanced hormonal and autonomic systems.

Thus, the formation of a functional adaptive system with the involvement of various morphological and functional structures of the body forms the fundamental basis for long-term adaptation to physical activity and is realized by increasing the efficiency of various organs and systems and the body as a whole.

Frequent use of loads associated with the violation of the optimal balance between needs and their satisfaction, as a result of the development of fatigue, can have a negative impact on the formation of long-term adaptation, is directly dependent on the preferred orientation of the applied training load and, consequently, the development of motor abilities.

The study of the functional state is an integral part of the features of preparing athletes for competitive activity, more fully mobilizing the body's reserves and optimizing adaptation processes.

Excessive increase in the amount of training work can lead to overstrain of functional systems, injuries, shortening the time of performance at a high sports level through great physical and mental stress, and reducing the adaptive capabilities of the body.

Large amounts of physical activity in childhood and adolescence, especially those that do not correspond to future specialization, can affect the achievement of high sports results.

Using the proposed methodology will maximize focus on the individual characteristics and abilities of each particular athlete when choosing a sports specialization, developing a system of multi-year training, determining the rational structure of training and competitive activity.

Prospects for further research. The total capacity of functional systems characterizing the amount of human health determines its viability and performance, and for athletes it also determines professional viability and the ability to achieve high sports results, which will allow us to study the increasing value of body reserves when environmental conditions change, in extreme and extreme situations life, especially with intense sports activities.

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References

1. Platonov, V.N. (2013), *Periodizatsiya sportivnoy trenirovki. Obshaya teoriya i ee prakticheskoe primenenie* [Periodization of sports training. General theory and its practical application], Olymp. lit., Kiev. (in Russ.)
2. Landa, B.Kh. (2017), *Diagnostika fizicheskogo sostoyaniya: obuchayushchie metodika i tekhnologiya* [Diagnosis of physical condition: teaching methods and technology], Moscow. (in Russ.)
3. Seluyanov, V.N. (2003), "Biological patterns in the planning of physical training for athletes", *Teoriya i praktika fizicheskoy kultury*, No. 7, pp. 29-33. (in Russ.)
4. Kondratiev, V.O., Vakulenko, L.I., Bidohina, L.P., Riznyk, A.V. & Savchenko, A.V. (2014), *Otsinka fizychnoho rozvytku ditei riznoho viku* [Assessment of physical development of children of different ages], Dnipropetrovsk. (in Ukr.)
5. Gunina, L., & Cheredny`chenko, O. (2012), "Assessment of the combined effect of nontraining facilities on the indicators of special working capacity and homeostasis parameters of qualified rowers", *Teoriia i metodyka fizychnoho vykhovannia i sportu*, No. 2, pp. 103-107. (in Ukr.)
6. Taymazov, V.A. & Golub, Ya.V. (2004), *Psikhofiziologicheskoe sostoyanie sportsmena. Metody otsenki i korrektsii* [Psychophysiological state of the athlete. Methods of assessment and correction], Olimp SPb, SPb. (in Russ.)
7. Turevskiy, I.M. (2009), "Extreme conditions as a factor in the adaptation of young athletes to the motor", *Materials of the First International*

Scientific and Practical Conference: Gifted in Sporting and Extreme Activities, Moscow, pp. 80. (in Russ.)
8. Rovnyi, A.S. (2015), "Features of the functional activity of kinesthetic and visual sensory systems in athletes of various specializations", *Slobozans`kij naukovo-sportivnij visnik*, No. 1 (45), pp. 104-108, dx.doi.org/10.15391/snsv. 2015-1.020.
9. Sheyko, L.V. (2018), "Dynamics of indicators of the functional state of the cardiovascular and respiratory systems of women under the influence of swimming", *Slobozans`kij naukovo-sportivnij visnik*, No. 1(63), pp. 121-125, doi: 10.15391/snsv.2018-1.022. (in Russ.)
10. Politko, O. (2018), "Model characteristics of physical development and special physical preparedness of swimmers 12–15 years old", *Slobozans'kiy naucovo-sportivniy visnik*, No. 2 (64), pp. 45-49, doi:10.15391/snsv.2018-2.009. (in Russ.)
11. Kamaiev, O.I. (2017), "Structural features and characteristics of the process of training an athlete as a system object", *Slobozans'kiy naucovo-sportivniy visnik*, No. 1 (57), pp. 41-48, doi.: 10.15391/snsv.2017-1.007. (in Russ.)
12. Shinkoruk, O.A. (2013), *Teoriya i metodika pidgotovky sportsmeniv: upravlinnya, kontrol`, vidbir, modeluvannya ta prognoz v olimpijs`komu sporti* [The theory and methods of training athletes: management, control, selection, modeling and forecasting in the Olympic sport], Poligraf ekspres, Kiev. (in Ukr.)
13. Bogush, V., Getmantsev, S., Bogatyirev, K., Tarasova, G., Kulakov, Yu. & Yatsunskjy, Ye. (2019), "Functional state of the rowers on kayaks at the stage of special basic training", *Slobozans'kij naukovo-sportivnij visnik*, No. 3 (71), pp. 10-17, doi:10.15391/ snsv.2019-3.002. (in Russ.)

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Normative legal regulation of physical education of preschool children

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Purpose: *analysis and generalization of the legal regulation of the physical education of children in school and out-of-school time.*

Material & Methods: *in the course of the study, methods of analysis of literary sources and documents, induction and deduction, analysis and synthesis were used, which made it possible to determine the legal support of the system of physical education of schoolchildren in the classroom and after school hours, as well as its current state.*

Results: *in the process of analysis it was found that all components of school and out-of-school physical education of schoolchildren are regulated at the legislative level. However, the main burden on the formation of the physical culture of the person is assigned by the state to the lesson form of employment. At the same time, based on the research materials of many scientists, it can be argued that it is almost impossible to form a physical culture of a person through only lessons.*

Conclusions: *obtained results in the course of the study showed that the methodology for assessing the indicators of the formation of the physical culture of the personality of schoolchildren has not been developed at the legislative level and, accordingly, has not been established, which makes it impossible to effectively monitor the implementation of the goals.*

Keywords: *physical education, schoolchildren, children of school age, physical activity, organization, management, regulatory framework.*

Introduction

Articles 45 and 49 of the Constitution of Ukraine [6] provide for the right of every citizen, including adolescents, to rest and protect their health. Moreover, based on the provisions of Article 49, public health is ensured by the development of the sphere of physical education and sports, and the introduction of health-improving and preventive programs. In addition, article 53 of the Constitution establishes the right of every child to secondary and extracurricular education. So, considering these articles in a complex, we state that every child in Ukraine is guaranteed the right to school, out-of-school physical education and active leisure, to ensure an appropriate level of health.

One of the directions for the implementation of these constitutional provisions is the formation among the younger generation of a healthy lifestyle, as evidenced by the Resolution of the Verkhovna Rada of Ukraine (No. 2992-17 of 03/03/2011). "On the Recommendations of the parliamentary hearings on the situation of youth in Ukraine Youth for a healthy lifestyle" [14]. In particular, the document notes that the low level of involvement of the country's population in physical education and sports is of particular concern. So, only every fifth boy or girl of school age and every tenth student or student has a sufficient level of physical activity of a health-improving orientation, is one of the lowest rates in Europe. 60 percent of Ukrainian schoolchildren are not able to fulfill the requirements of the European tests of physical fitness "Eurofit".

In our opinion, one of the reasons for this situation is the lack of legal support for physical education, namely the lack of consistency and imitation between the components of school and extracurricular education. Testing this hypothesis determined the **purpose of this study**, namely, to analyze and generalize the legal regulation of the physical education of children in school and out-of-school time.

Material and Methods of the research

In the course of the study, methods of analysis of literary sources and documents, induction and deduction, analysis and synthesis were used, which made it possible to determine the system of legal support for the physical education of schoolchildren in the classroom and after school hours, as well as its current state.

Results of the research

One of the directions of state policy in Ukraine is to improve the active leisure of the younger generation, in particular, through the system of physical education, as a holistic pedagogical system, the purpose of which is to create conditions for the formation of the components of the physical culture of the personality of children and youth.

Education is a combination of educational institutions (table). In particular, to ensure the education and upbringing of schoolchildren, there are general educational institutions and out-of-school educational institutions (youth sports schools, clubs, a small art academy, a small academy of sciences for students, health-improving institutions for children and youth, centers, palaces, houses, clubs art, tourism and military-patriotic education) (Resolution of the CMU of May 6, 2001 No. 433).

So, physical education in *secondary schools* in the classroom and after school hours is regulated by the Order of the Min-

istry of Education and Science of Ukraine dated 02.08.2005, No. 458 "On approval of the Regulation on the organization of physical education and mass sports in preschool, general educational and vocational schools Ukraine" (Table). In this document, the main form of conducting classes in physical education is a lesson. It is he who is entrusted with the realization of the goal of physical education – the formation of the physical culture of the student's personality. This document also defines the main approaches to building a system of physical education for schoolchildren in the education system as a whole.

The specified normative act determines that the physical education of students in general educational institutions is an integral component of education, which provides the opportunity for each child to obtain the necessary scientifically based knowledge about health and the means to strengthen it, the methods of organizing meaningful leisure activities and is aimed at developing their physical, social and spiritual health etc.

The analysis of this normative act showed that for the organization of extracurricular physical education and sports activities in general educational institutions, public physical education associations can be created – clubs (cells) of the sports union of student youth, which ensure the development of mass sports and physical education. This is also provided for by the provisions of the Order of the Ministry of Education and Science of Ukraine "On the formation of sports clubs and their cells in higher, secondary and vocational schools". In addition, the creation of public sports organizations and clubs is regulated by the Law of Ukraine "On Physical Culture and Sport". One of the norms of the Law of Ukraine "On Physical Culture and Sport" is determined by the involvement of schools of public organizations of physical education and sports in the organization of after-school physical education and sports work with students, taking into account local conditions, interests and requests of students of secondary schools. However, in practice, as evidenced by the results of the study [2], only a small number of schools have formed sports clubs or have contractual relations with public organizations in the sports field.

Out-of-school physical education and sports activities are no less important in ensuring the active leisure of schoolchildren (Table). An extracurricular education system has been created and funded to support it. Based on the analysis of the provisions of the Law of Ukraine "On Extracurricular Educa-

Regulatory framework for the physical education of schoolchildren in the education system

At school	Outside of school		
Extracurricular activities	*Children and Youth Sports School*	*Children's recreation facility*	*Students Activity Center, military sports clubs, centers of patriotic education*
1. Law of Ukraine "On General Secondary Education" [3]; 2. Order of the Ministry of Education and Science of Ukraine of 02.08.2005 No. 458 "On approval of the Regulation on the organization of physical education and mass sports in preschool, general education and vocational schools institutions of Ukraine" [7]; 3. Order of the Ministry of Education and Science of Ukraine No. 210 of 03.22.2002 "On the Formation of Sports and Fitness Clubs and Their Cells in Higher, Secondary, and Vocational Educational Institutions" [10].	1. Law of Ukraine "On Extracurricular Education" [4]; 2. Resolution of the Cabinet of Ministers of Ukraine "On the approval of the list of types of extracurricular educational institutions and the Regulation on the extracurricular educational institution" dated May 6, 2001 No. 433 [15]; 3. Resolution of the CMU of November 5, 2008 No. 993 "On approval of the Regulations on the youth sports school" [17].	1. Law of Ukraine "On Extracurricular Education" [4]; 2. Law of Ukraine "On the recovery and recreation of children" dated 04.09.2008 No. 375-VI [5]; 3. Decree of the Cabinet of Ministers of Ukraine "On the approval of the list of types of extracurricular educational institutions and the Regulation on the extracurricular educational institution" dated May 6, 2001 No. 433 [15]; 4. Order of the Ministry of Ukraine for Family, Youth and Sports dated 08/13/2009 No. 2881 "On approval of the State social standard of recreation and rehabilitation" [11]; 5. Order of the Cabinet of Ministers of November 3, 2010 No. 2056-r "On Approval of the Concept of the State Target Social Program for the Improvement and Rest of Children for the period until 2015" [18].	1. Law of Ukraine "On Extracurricular Education" [4]; 2. Resolution of the Cabinet of Ministers of Ukraine "On the approval of the list of types of extracurricular educational institutions and the Regulation on the extracurricular educational institution" dated May 6, 2001 No. 433 [15]; 3. Order of the Ministry of Education and Science of Ukraine of 05.11.2009 No. 1010 "On the Approval of the Regulations on Centers, Houses, Clubs of Artistic Creativity of Children and Youth" [8]; 4. Order of the Ministry of Education and Science of Ukraine of 06.11.2009 No. 1022 "On the approval of the Regulation on the youth clubs of young sailors, riverine crews, aviators, astronauts, paratroopers, paratroopers, border guards, radio operators" [9]; 5. Order of the Ministry of Youth and Sports of 10.23.2013 No. 720 "On approval of the Regulation on the Center for Patriotic Education" [12].

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tion", it helps to create additional conditions for the spiritual, intellectual and physical development of the child. The analytics, which is presented in the explanatory note to the State target social program for the development of out-of-school education for the period up to 2014 (Decree of the Cabinet of Ministers of August 27, 2010 No. 785) shows that today out-of-school educational institutions employ only 35,7% school children.

From the point of view of the State Audit Service of Ukraine, the main drawbacks of the functioning of out-of-school educational institutions are the reduction in the network of out-of-school educational institutions (in particular, the Children's and Youth Sports School), the level of quality of out-of-school education for women, the insufficient level of educational, methodological and scientific-methodological support for the activities of out-of-school educational institutions, lack of knowledge of many problematic issues of parenting in modern social conditions.

In our opinion, these problematic issues are also caused by an imperfect regulatory framework, which includes contradictions. For example, the activities of *Children's and Youth Sports Schools* (Table) are governed by the Regulation on Children and Youth Sports Schools, approved by the Decree of the CMU of November 5, 2008 No. 993. According to this Regulation, the activities of the Children's and Youth Sports School are aimed at ensuring the development of the abilities of pupils in the chosen sport, creates the necessary conditions for harmonious education, physical development, full recovery, meaningful rest and leisure for children and youth, self-realization, acquisition of healthy lifestyle skills, training and sports reserve for the national teams of Ukraine. However, only the indicators of the training of high-class athletes, prizes and a simple increase in students, and not an increase in the quality of education, are taken as the result of the quality of the youth sports school activity. An increase in the level of motor activity of all children who study at the Children's Sports School and their involvement in the values of physical culture and sports are not considered an effective indicator in general [13].

Considering the activities of the *establishments of artistic and aesthetic creativity* (centers, palaces, houses, art clubs for children and youth), we conclude that it is not associated at all with the fitness sector, although Order of the Ministry of Education and Science of Ukraine of 05.11.2009 No. 1010 is among the main The tasks of preschool institutions indicate the organization of their rehabilitation, leisure and recreation (table). The implementation of these tasks is ensured, in particular, by the following activities: circus and choreographic. Based on the analysis of the works of T. Rothers, we note that the aforementioned circles provide sports and aesthetic education for children and youth [19].

Educational institutions that provide *military-patriotic education* of children and adolescents have various youth clubs for young sailors, rivermen, aviators, astronauts, paratroopers, paratroopers, border guards, radio operators, etc. (Order of the Ministry of Education and Science of Ukraine of November 6, 2009 No. 1022) and centers for patriotic education (Order of the Ministry of Youth Sports No. 720 of October 23, 2013) (Table). These institutions are specialized out-of-school educational institutions, the main activity of which is patriotic. However, among their tasks is the education of children and youth of a conscious attitude to their own safety and the safety of others, the formation of a healthy lifestyle; improving the physical development of youth, preparing for military service in the Armed Forces and other military formations of Ukraine; organization of meaningful leisure for youth. Consequently, in these extracurricular institutions to a large extent use the means of physical education.

The analysis shows that in the educational process of institutions of artistic, aesthetic and military-patriotic education, physical culture means are used, and one of the main tasks of their functioning is the formation of a healthy lifestyle and the improvement of the physical nature of children (physical qualities and development). However, at the legislative and educational-program levels, the unresolved issues of the activities of the above-mentioned institutions as such, ensuring the formation of personality physical education among students. In addition, statistics on the volume of motor activity of children in these institutions are not taken into account but not generalized.

Legislation also refers to out-of-school establishments for children's *health and recreation* facilities (the Law of Ukraine "On Health and Leisure of Children"), the main purpose of which is to ensure active leisure for children and adolescents, in particular during vacation time, by organizing a health-educational process (Table)

The state social standard of health and recreation (Order of the Ministry of Youth and Sports dated 08.13.2009 No. 2881) establishes social norms and standards in the field of health and recreation for children. They consist of wellness and relaxation services. Accordingly, the first is a set of special events of a social, educational, medical, hygienic, sports nature, carried out by the children's institution for health and recreation and are aimed at restoring and improving the physical and mental state of health. The second – measures aimed at organizing leisure activities for children in compliance with the period of active and passive rest, and the like. In particular, the list of services for the organization of physical culture and sports activities includes daily classes from morning hygienic gymnastics; organization of competitions and sporting events; conducting classes in physical education and sports, swimming in open and closed bodies of water; conducting hiking trips and the like.

However, according to the Order of the Cabinet of Ministers of November 3, 2010 No. 2056-p "On Approval of the Concept of the State Targeted Social Program for the Improvement and Rest of Children for the Period Until 2015", the level of organization of the educational process and leisure time in institutions does not meet the modern needs of children, in particular fully active forms of recreation and recreation.

In our opinion, when solving the problems of Children's recreation facility, one should also take into account the fulfillment of their functions in the practical implementation of the knowledge acquired by adolescents during the school year in general and extracurricular educational institutions to strengthen health and physical improvement, and to implement acquired values of physical education. This approach will provide a comprehensive solution in the education system (school and extracurricular) of certain tasks for the rehabilitation and upbringing of children and adolescents.

Conclusions / Discussion

So, an analysis of the regulatory framework of Ukraine, which regulates relations in the system of physical education of schoolchildren, allowed to draw conclusions:

1. At the legislative level, the physical education of schoolchildren is normalized in all components of school and extracurricular education. However, the main burden on the formation of the physical culture of the individual is laid by the state on the lesson form of classes. However, based on the research materials of many scientists, it can be argued that it is almost impossible to form a physical culture of a person through only lessons.

2. Some regulatory acts are not related to each other, but then, certain types of organized motor activity remain outside the system of physical education of school-age children. Accordingly, such activities are not regulated by special physical education programs that complement school physical education, and, as regards such physical activity, the necessary statistical data on sports and fitness activities are hardly collected.

3. At the legislative level, a methodology for assessing the indicators of the formation of the physical culture of the personality of schoolchildren has not been developed, but also not fixed, but then, there is no effective system for monitoring the implementation of certain goals.

In our opinion, for the sake of increasing the efficiency of the functioning of the system of physical education of schoolchildren, it is necessary to legislatively systematize the activities of all educational institutions. In addition, it requires the development of a methodology for monitoring the state of formation of the physical culture of the personality of students. This will improve the efficiency of the functioning of the system of physical education of schoolchildren, which predetermines the prospects for further **research.**

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References

1. State Audit Service of Ukraine (2018), Audit Report "On the results of the state financial audit of the implementation of the budget program" Development of youth and reserve sports "for the period from 01.01.2014 to 31.12.2017", available at: http: //dkrs .kmu.gov.ua/en/doccatalog/document?id=138615. *(in Ukr.)*
2. Bondar, T.S. (2010), *Orhanizatsiino-pedahohichna tekhnolohiia menedzhmentu uchnivskykh fizkulturno-ozdorovchykh klubiv: Dys. kand. nauk fiz. vykh.* [Organizational and pedagogical technology of management of students' fitness clubs: PhD diss.], Kharkiv State Academy of Physical Education, Kharkiv, 232 p. *(in Ukr.)*
3. VRU (1999), Law of Ukraine "On General Secondary Education", available at: https://zakon.rada.gov.ua/laws/show/651-14. *(in Ukr.)*
4. VRU (2000), Law of Ukraine "On Extracurricular Education", available at: https://zakon.rada.gov.ua/laws/show/1841-14. *(in Ukr.)*
5. VRU (2008), Law of Ukraine "On improving and resting children", available at: https://zakon.rada.gov.ua/laws/show/375-17. *(in Ukr.)*
6. VRU (1996), Constitution of Ukraine, available at: https://zakon.rada.gov.ua/laws/show/254к/96-vr. *(in Ukr.)*
7. Ministry of Education and Science of Ukraine (2005), Order "On Approval of the Regulations on the Organization of Physical Education and Mass Sports in Preschool, General and Vocational Schools of Ukraine", available at: https://zakon.rada.gov.ua / laws / show / z0909-05. *(in Ukr.)*
8. Ministry of Education and Science of Ukraine (2009), Order "On Approval of the Regulations on Centers, Palaces, Houses, Artistic Clubs of Children, Youth and Youth", available at: https://zakon.rada.gov.ua/laws/ show / z1152-09. *(in Ukr.)*
9. Ministry of Education and Science of Ukraine (2009), Order "On Approval of the Regulations on Children's and Youth Clubs of Young Sailors, Rivermen, Airmen, Cosmonauts, Paratroopers, Paratroopers, Border Guards, Radarists", available at: https://zakon.rada.gov.ua/laws/show/z1153-09. *(in Ukr.)*
10. Ministry of Education and Science of Ukraine (2002), Order "On the formation of sports clubs and their centers in higher, secondary and vocational schools", available at: https://zakon.rada.gov.ua/rada/show/v0210290-02. *(in Ukr.)*
11. Ministry of Ukraine for Family, Youth and Sports (2009), Order "On Approval of the State Social Standard for Health and Recreation", available at: https://zakon.rada.gov.ua/laws/show/z0854-09. *(in Ukr.)*
12. Ministry of Ukraine for Family, Youth and Sports (2013), Order "On Approval of the Regulations on the Center for Patriotic Education", available at: https://zakon.rada.gov.ua/laws/show/z1941-13. *(in Ukr.)*
13. Ministry of Youth and Sports of Ukraine (2016), Order "On Approval of the Model List of Budget Programs and Performance Indicators for Local Budgets in the Field of Physical Culture and Sports", available at: https://zakon.rada.gov.ua/laws/show/z1610-16. *(in Ukr.)*
14. Verkhovna Rada of Ukraine (2011), Resolution "On Recommendations of the Parliamentary Hearings on the Situation of Youth in Ukraine" Youth for a Healthy Lifestyle", available at: https://zakon.rada.gov.ua/laws/show/2992-17. *(in Ukr.)*
15. Cabinet of Ministers of Ukraine (2001), Resolution "On Approval of the List of Types of Extra-curricular Institutions and Regulations on Extra-curricular Institution", available at: https://zakon.rada.gov.ua/laws/show/433-2001-p. *(in Ukr.)*
16. Cabinet of Ministers of Ukraine (2010), Decree "On approval of the State Target Social Program for the Development of Extracurricular Education for the Period up to 2014", available at: https://zakon.rada.gov.ua/laws/show/785-2010-n. *(in Ukr.)*
17. Cabinet of Ministers of Ukraine (2008), Resolution "On Approval of the Regulations on Children and Youth Sports School", available at: https://zakon.rada.gov.ua/laws/show/993-2008-p. *(in Ukr.)*
18. Cabinet of Ministers of Ukraine (2010), Decree "On approval of the Concept of the State Targeted Social Program for Recreation and Rest of Children for the Period up to 2015", available at: https://zakon.rada.gov.ua/laws/show/2056-2010. *(in Ukr.)*
19. Roters, T.T. (1998), *Ritmicheskoe razvitie lichnosti shkolnika (analiz vzaimodeystviya fizicheskogo i esteticheskogo vospitaniya* [Rhythmic development of the student's personality (analysis of the interaction of physical and aesthetic education], Znanie, Lugansk. *(in Russ.)*

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Study of the level of physical fitness of young acrobat athletes at the initial stage of training

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Purpose: *determine the level of physical preparedness of young acrobat athletes of the first year of training.*

Material & Methods: *the study was conducted on the basis of the Integrated Children's Sports School No. 6 of the Sloboda district (Kharkiv). The study involved 16 children 5–6 years old, engaged in sports acrobatics in sports and fitness groups. Enrollment in primary training groups was carried out in accordance with the regulations established by the administration of the children's sports school. Pedagogical testing of physical and functional-motor readiness of children was carried out using tests provided by the State standard of sports training in sports acrobatics to assess general and special physical preparedness. The level of speed strength, special flexibility in the hip joint and spinal column, dynamic strength, speed, static strength were determined.*

Results: *using correlation analysis, it was established that there are interconnections of a predominantly average level between the indicators of general and special physical preparedness of young athletes.*

Conclusions: *studies have established that young beginner acrobats have a high level of flexibility, other indicators of physical qualities have heterogeneous results, mainly of an average level of correlation between exercises of general and special physical fitness.*

Keywords: *acrobatics, physical qualities, training, young athletes*.

Introduction

Acrobatics is a highly coordinated sport that requires the manifestation of motor qualities in a limited time. Along with this, acrobatics is characterized not only by the complexity of the execution of elements, but also by the development of the dance, theater and choreographic direction [3; 5]. You can also observe the progress in the originality and complexity of the compositions. In connection with the rapid development of acrobatics, new teaching methods, new elements requiring new teaching methods for performing exercises appear [7; 8].

In many modern publications, scientists emphasize the need to modernize the existing training system in acrobatics. This need is primarily due to the fact that traditional organizational approaches to the process of training athletes are not focused on the features of activity, and thus do not allow maximally effectively developing the balance and coordination abilities of athletes while improving their health [1; 6].

The problem of improving the physical and technical preparedness of acrobats is due to mistakes made by athletes in the process of training sessions and competitive activities [8]

Given the characteristics of competitive activity, in-depth specialization in sports acrobatics begins at preschool age, and athletes demonstrate high achievements already at the age of 12–15 years. Thus, at the initial training stage, athletes need to create a wide range of motor skills, various special basic and special movements, create a foundation of physical fitness for mastering complex motor skills in the next stage [2; 10].

The lack of a planned system in physical and technical training in acrobatics, in particular, at the initial stage of preparation, can lead to a chaotic formation of motor skills. In this regard, there is a need to develop a scientifically based plan of educational exercises in sports acrobatics at the initial stage of preparation. It should be noted that for load planning it is necessary to focus on the level of physical fitness of young athletes. Therefore, the urgent is the problem of determining the level of development of physical qualities of children 5–6 years old, engaged in sports acrobatics for further mastering the elements of acrobatics technique.

Purpose of the study: to determine the level of physical preparedness of young acrobat athletes of the first year of training.

Objectives of the study:

1. Identify test exercises and establish the level of general and special physical preparedness of athletes involved in acrobatics.
2. To establish the existing relationships between the indicators of general and special physical preparedness of young acrobat athletes.

Material and Methods of the research

The study was conducted on the basis of the Integrated Children's Sports School No. 6 of the Sloboda district (Kharkiv). The study involved 16 children 5–6 years old, engaged in sports acrobatics in sports and fitness groups. Enrollment in primary training groups was carried out in accordance with the regulations established by the administration of the children's

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Table 1

Results of testing the general preparedness of young acrobat athletes 5–6 years old (n=16)

Name of the test	$\bar{X}$±m	σ	V, %	Test level by program
Bending and unbending arms of the arms in the supine position, number of times	3,44±0,18	0,73	21,16	5 – 5 4 – 4 3 – 3
In the back with the back to the gymnastic wall, the content of the angle is flexion and extension of the legs, number of times	3,94±0,19	0,77	19,60	5 – 5 4 – 4 3 – 3
Standing long jump from a place, cm	107,50±6,06	24,24	22,55	150–140 – 5 140–135 – 4 135–130 – 3
Running 30 m from the stop crouching (15 m – in one direction, 15 m – in the opposite), s	11,03±0,07	0,28	2,58	10,5–10,8 – 5 10,6–11,0 – 4 10,7–11,2 – 3
A crab position from a prone position, number of times	3,75±0,23	0,93	24,83	1. Hands upright to the floor, legs straightened – 5 2. Arms or bent legs slightly deflected – 4 3. Arms bent, legs bent – 3
Sitting on the floor with feet together, bending forward, points	3,86±0,23	0,86	22,41	1. Breastfeed – 5 2. Touch toe head – 4 3. Head touches with elastic movement – 3

sports school. Pedagogical testing of physical and functional-motor readiness of children was carried out using tests provided by the State standard of sports training in sports acrobatics to assess general and special physical fitness. The level of speed strength, special flexibility in the hip joint and spinal column, dynamic strength, speed, static strength were determined.

Results of the research

At the beginning of September 2019, testing was carried out on the general and special physical fitness of young athletes 5–6 years old, engaged in sports acrobatics in sports and fitness groups (Tables 1, 2). To analyze the test results used methods of mathematical statistics. The arithmetic mean value (X), standard error of the mean value (m), standard deviation (σ), coefficient of variation (V) were calculated. To identify the presence and nature of the relationship between the studied characters used correlation analysis.

the test results showed that the group of tested children is heterogeneous in most tests (V>20%), namely: bending and unbending arms in a lying position (21,16%), long jump from a place (22,55%), crab position from a prone position (24,83%), sitting on the floor of the legs together, leaning forward (22,41%), jumping rope on 2 legs (42,32%), static balance according to the Bondarevsky method (64,8%), the balance of the "swallow" (141,72%). The above indicates that children in this group have significant differences in the level of development of physical qualities, therefore there is a need to form subgroups according to uniform results. This approach will create conditions for a more rational distribution of loads in the classroom, adequate to the level of preparedness of children. A prerequisite for this is the pedagogical testing of children according to the proposed tests at the beginning of the training cycle and comparing its results with the data of current and stage control.

Evaluation of the results using software standards has allowed us to establish that in terms of the development of general physical qualities, most children in this group have a satisfactory level – from 31,3 to 87,5%. An average level is from 12,5 to 43,8% of children, a high level is from 12,5 to 31.3% of children according to different motor tests (Figure 1). Pedagogical testing revealed that in this group of children there is a high level of development of flexibility, in particular, of the spinal column. In our opinion, this is due to the specifics of performing acrobatic exercises and a large number of exercises to develop flexibility in the training process.

Conducting a correlation analysis made it possible to establish the presence and nature of the relationship between the results of various tests (Table 3).

So, the average relationship between the indicators is revealed:

– speed-strength qualities with coordination abilities accord-

Table 2

Results of testing the special preparedness of young acrobats athletes 5–6 years old (n=16)

Name of the test	$\bar{X}$±m	σ	V, %
Shuttle run 3x10 m with running around stuffed balls, s	15,45±0,27	1,10	7,09
Lifting the body from a prone position for 60 s, number of time	29,06±1,11	4,45	15,31
30 m running, s	11,07±0,15	0,62	5,57
Jumping rope on 2 legs, number of times	14,69±1,55	6,22	42,32
Static equilibrium according to the Bondarevsky method, s	64,44±10,44	41,76	64,80
Romberg test complicated, s	4,63±0,13	0,50	10,81
Balance "swallow", s	5,46±1,93	7,73	141,72

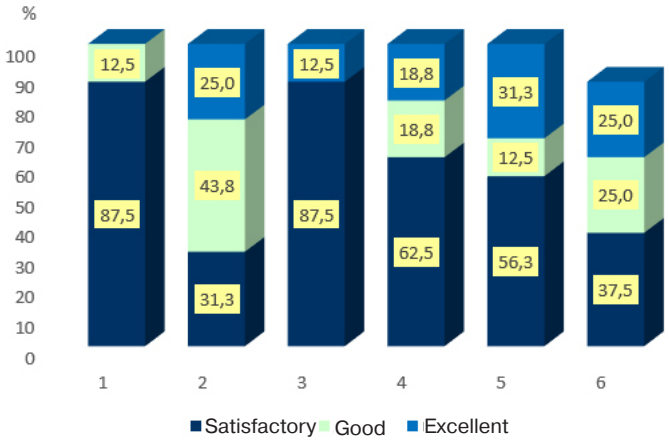

Fig. 1. Assessment of the results of testing the general physical fitness of acrobats athletes 5–6 years old according to control standards:
1 – bending and unbending arms of the arms in the supine position, number of times; 2 – in the back with the back to the gymnastic wall, the content of the angle is flexion and extension of the legs, number of times; 3 – standing long jump from a place, cm; 4 – Running 30 m from the stop crouching (15 m - in one direction, 15 m - in the opposite), s; 5 – crab position from a prone position, number of times; 6 – Sitting on the floor with feet together, bending forward, points.

ing to tests, shuttle run (r=–0,66) and Romberg test (r=0,63);
– flexibility according to the test "Crab position from a prone position" and static equilibrium according to the Bondarevsky method (r=0,60), Romberg breakdown (r=0,46)
– flexibility according to the test "Sitting on the floor legs together, leaning forward" and static equilibrium according to the Bondarevsky method (r=–0,54);
– abdominal muscle strength with the exercise of lifting the torso from a supine position for 60 s (r=0,55) and with static equilibrium according to the Bondarevsky method (r=–0,41) and Romberg test (r=0,46).

Studying the relationship between the indicators of general and special physical preparedness of young acrobats makes it possible to take into account the use of appropriate physical exercises for the development of general and special physical qualities.

Conclusions / Discussion

The level of development of modern acrobatics is characterized by exceptionally high sports achievements, a significant increase in competition among athletes, necessitates the search for new ways to improve training, especially for beginners, when physical and technical preparedness is formed.

When mastering certain elements of technology, a certain level of physical qualities is necessary, without which it is impossible to perform them or there is a threat of mastering movements with significant errors, in the future it will negatively affect their structural quality. Today, there are studies (S. S. Koval, 2010; T. I. Kharchenko) [11] about the features of the integrated development of motor qualities and the assimilation of elements of technology in young athletes at the initial training stage in figure skating and football, which gave a positive effect.

Using correlation analysis, the presence of interconnections of a predominantly average level between the indicators of general and special physical preparedness of young athletes was established. This indicates a significant interdependence of the manifestation of physical qualities in the preparation of young acrobats.

A study of the general and special physical preparedness of young athletes revealed a high level of development of flex-

Table 3

Quantitative indicators of the relationship between the results of testing the general and special physical preparedness of young acrobat athletes 5–6 years old (n=16)

Name of the test	Shuttle run 3x10 m with running around stuffed balls,	Lifting the body from a prone position for 60 s	30 m running	Jumping rope on 2 legs	Static equilibrium according to the Bondarevsky method	Romberg test complicated	Balance "swallow"
Bending and unbending arms of the arms in the supine position, number of times	0,28	–0,34	0,20	0,22	–0,33	0,27	–0,26
In the back with the back to the gymnastic wall, the content of the angle is flexion and extension of the legs, number of times	–0,21	0,55	0,29	0,28	–0,41	0,46	0,04
Standing long jump from a place, cm	–0,66*	0,33	–0,08	–0,51	–0,10	0,63*	0,35
Running 30 m from the stop crouching (15 m – in one direction, 15 m – in the opposite), s	0,50	–0,32	–0,58	–0,46	0,49	–0,16	–0,08
A crab position from a prone position, number of times	0,00	0,26	0,22	0,28	–0,60*	0,46	0,09
Sitting on the floor with feet together, bending forward, points	–0,17	0,54	0,39	0,24	–0,54*	0,37	0,39

Remark. ** – reliability of the correlation coefficient p<0,05.*

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ibility in this group. It was established that in terms of the level of development of strength, speed and strength qualities, speed and balance, this group is heterogeneous (V>20%), therefore, when planning the training process, it is advisable to divide the children into subgroups in accordance with their level of preparedness.

Given that acrobatics is a complex-coordinated sport that has its own characteristics, both in the structure of movements and in the level and significance of physical qualities, the definition of motor qualities and their level of development for the further assimilation of the basic elements of technology is an actual scientific research.

Prospects for further research include the determination of motor qualities to perform basic elements by young acrobats at the initial training stage.

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References

1. Boloban, V.N. (1988), "Methodology for the selection of children for acrobatics", *Sportivnaya akrobatika*, Vyshcha shkola, Kiev, pp. 18-32; 59-64. (in Russ.)
2. Volkov, L.V. (2002), *Teoriya i metodika detskogo i yunosheskogo sporta* [Theory and Methods of Children and Youth Sports], Olimpiyskaya literatura, Kiev. (in Russ.)
3. Guba, V.P. (2008), "Innovative Methodology and Technology for Early Sports Orienteering and Selection", *XII Mezhdunarodnyy nauchnyy kongress "Sovremennyy olimpiyskiy i paralimpiyskiy sport i sport dlya vsekh"*, Fizicheskaya kultura, Moscow, Vol. 1, pp. 157-158. (in Russ.)
4. Issurin, V.B. (2016), *Podgotovka sportsmenov XXI veka: nauchnye osnovy i postroenie trenirovki* [Training Athletes of the 21st Century: Scientific Foundations and Building Training], Sport, Moscow. (in Russ.)
5. Kalenskaya, G.A. & Barbashov S.V. (2017), "Theoretical Background to the Choreographic Training Program for Young Acrobats", *Vestnik Yugorskogo gosudarstvennogo universiteta*, Vypusk 1 (44), pp. 105-112. (in Russ.)
6. Kostiukevych, V.M. (2007), *Teoriia i metodyka trenuvannia sportsmeniv vysokoi kvalifikatsii: Navchalnyi posibnyk* [Theory and Methods of Training High-Qualified Athletes], Vinnytsia. (in Ukr.)
7. Matveev, L.P. (1999), *Osnovy obshchey teorii sporta i sistemy podgotovki sportsmenov* [Fundamentals of the general theory of sports and the system of training athletes], Olimpiyskaya literatura, Kiev. (in Russ.)
8. Platonov, V.N. & Sakhnovskiy, K.P. (1988), *Podgotovka yunogo sportsmena* [Training of a young athlete], Radyanska shkola, Kiev. (in Russ.)
9. Pomazan, A.A. (2011), "Motor characteristics of boys 4-6 years to determine the prospects for gymnastics", *Pedahohika, psykholohiia ta medyko-biolohichni problemy fizychnoho vykhovannia i sportu*, No. 10, pp. 57-60. (in Ukr.)
10. Rozin, Ye.Yu. (1999), *Metodika otbora i prognozirovaniya sposobnostey k zanyatiyam sportivnoy gimnastikoy: Uchebnoe posobie dlya studentov fakulteta fizicheskoy kultury* [Methodology for the selection and prediction of abilities for gymnastics], Moscow. (in Russ.)
11. Surovov, O.A., Bondar, T.S. & Koval, S.S. (2012), "Socio-pedagogical prerequisites for the introduction of interactive teaching technologies in the process of professional training of teachers of physical culture", *Slobozans`kij naukovo-sportivnij visnik*, No. 4, pp. 169-172. (in Ukr.)

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Features of the application of electromagnetic bioresonant therapy of inflammatory infectious diseases

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Purpose: *to develop an apparatus and method for electromagnetic bioresonance therapy of inflammatory infectious diseases.*

Material & Methods: *analysis of scientific and medical literature and information sources on the coverage of the influence of electromagnetic fields on biological objects, systematization and generalization of the results on the research topic.*

Results: *an apparatus and method for electromagnetic bioresonance therapy with the determination of the frequency of natural vibrations of the causative agents of the disease with the subsequent generation of forced pulses by the magnitude of their frequency, which coincides with the bioresonant frequency, were developed.*

Conclusions: *the determination of the frequency of natural oscillations of the causative agents of the disease and the further generation of forced pulses by the magnitude of their frequency, which coincides with the bioresonant frequency, significantly increases the therapeutic effect of treatment and at the same time reduces the duration of each cycle of action of the forcedly generated pulses, as well as the total time of treatment of the disease.*

Keywords: *electromagnetic bioresonance therapy, inflammatory infectious diseases.*

Introduction

Many years of research by scientists have shown that absolutely all living things emit electromagnetic waves. The frequency range emitted by humans varies from 1520 to 9460 kHz, and pathogenic ones (molds, viruses, bacteria, worms, ticks) range from 30–900 kHz [3]. Many diseases are closely related to the presence of parasitic, bacterial and viral agents in the body, both infectious and living in various organs in a state of symbiosis with the tissue structures of this organ [8]. In order to suppress certain agents, it is not necessary to introduce antibiotics into the body, i.e. use chemotherapy methods that are far from harmless to the body [6]. Preventive measures, the use of various kinds of vaccines and antibiotics, antiviral and antifungal drugs does not lead to the complete destruction of these diseases. This is due to the emergence of resistant strains of microorganisms and the development of allergic reactions to medications. Medicines with a wider spectrum of action are constantly being created, which, at the same time, have significant contraindications to their use in a fairly wide range of patients and side effects. Therefore, medicine in the fight against these diseases pays increasing attention to non-drug methods of treatment. One of these methods at present is low-frequency electromagnetic therapy, based on the action of radiation of forcedly generated electromagnetic pulsed oscillations of a certain frequency, shape and amplitude in the bioresonance mode on various types of pathogens [1].

Knowing the frequencies of metabolic activity of certain agents, one can influence them with frequency fluctuations that will violate their own rhythms and thereby suppress their normal metabolic activity. According to relevant studies, such actions are absolutely harmless to the human body. The frequencies of parasites and other pathogenic organisms lie in the range from 30 to 900 kHz. The resonant frequencies of the structures of the human body are in the range of 1–10 MHz. Frequencies harmful to the human body lie in the range of more than 1 MHz. Studies have shown that exposure to an extremely low range of electromagnetic fields of 3–30 Hz (electromagnetic vacuum) affects the specific rate of carbonate carbon assimilation in the time interval during which the visible development of microorganisms is observed after infection. The influence of an electromagnetic field in the range from 30 kHz to 100 kHz on microorganisms causes aggression of rod-shaped bacteria and increases reproduction [7].

Due to the action of such electromagnetic pulsed oscillations in the localization zone of pathogens or individual organs and systems of the body, the protective functions of pathogenic microorganisms are weakened, their metabolism is disrupted, the regulation of biochemical processes and their biological functions are reduced, and the amount of endotoxins assimilated by them and their metabolic products decreases. Moreover, the function of organs and systems of the human body is not violated [5].

It is known that living cells, organs of living beings, microorganisms are oscillatory circuits with a certain electric capacity and resistance and have properties such as inductance and the ability to generate and emit own pulses of an electromagnetic field that forms around them with a frequency and amplitude defined for different circuits . The source of these impulses are biochemical processes and metabolic activity of macro- or microorganism cells [6].

Known methods for electromagnetic bioresonance therapy of inflammatory infectious diseases are associated with the

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generation of forced low-frequency electromagnetic pulses with a frequency that reproduces the bioresonant frequency of natural vibrations of pathogens outside the body and the directed action of these forced electromagnetic pulses through biologically active points or bioactive zones of localization of pathogens.

Currently, in medical practice, a method of electromagnetic low-frequency therapy is applied, based on the action of short electromagnetic pulses from 0.1 to 100 ms, with a current from 0.1 to 100 mA through electrodes to biologically active points of the human body (Pat. RU No. 2164424, A61N2/04, 2001) [2]. But the disadvantage of this method of treatment is its limited properties: it is suitable only for normalizing the functional state of human organs and systems affected by the disease and does not affect the etiological factors of inflammatory diseases caused by invasion of pathogenic and conditionally pathogenic microorganisms - bacteria, protozoa, microscopic fungi, viruses. All of the above lengthens the duration of treatment, does not allow achieving stable remission and reduces the period of remission of the disease, limits the use of this method of treatment.

In order to influence inflammatory infectious diseases, a method of electromagnetic bioresonance therapy is currently widespread, based on a previous clinical analysis of the type of pathogen or pathogens, determining the calculated range of natural frequencies and the amplitude of the electromagnetic waves of these pathogens and their localization zone and further multi-cycle action through the guiding antenna to the specified zone forcibly generated outside the body of low-frequency electromagnetic pulses with a frequency that reproduces the biological frequency of the natural vibrations of pathogens according to a given program (Pat. RU № 2055604, A61M37/00; A61N2/04, 1996) [9]. Thus, electromagnetic therapy allows you to rid the human body of the causative agents of the disease by treating the zone of their localization of forcibly generated electromagnetic pulse oscillations outside the body. At the same time, different invasiveness and features of metabolic processes in pathogens of inflammatory diseases in combination with features of the physical state, degree of immunity and the course of the pathological process in patients do not allow the exact determination by technical means of the physical characteristics of the natural vibrations of these pathogens, and, consequently, the generation of forced electromagnetic pulsed oscillations and their adequate treatment of the localization zone of pathogens of inflammatory infectious diseases bolevany [4]. This forces the multi-cycle processing of the localization zone of pathogens by electromagnetic pulsed oscillations by successively increasing their frequencies from an initial small value to a larger final value for each zone processing cycle. It is assumed that at what frequency of such generated pulses the latter will coincide with the frequency of natural vibrations of pathogens and occur as a bioresonance of vibrations of microorganisms, which causes a bactericidal or bacteriostatic effect. The effectiveness of such therapy, as well as the duration of the procedure, depends on the number of coincidences of the frequency of the natural oscillations of the pathogens and the forcedly generated pulsed oscillations, i.e. the duration of the bioresonance phenomenon. The more phenomena of bioresonance per unit time are realized, the greater and faster will be the bacteriostatic or bactericidal effect of electromagnetic therapy. In addition, when performing such therapy, the amplitude of the bioresonant frequency of natural vibrations of pathogens can fluctuate in sufficiently small values from the ascending value, will not positively affect the results of therapy due to insufficient bactericidal or bacteriostatic effect on pathogens. On the other hand, too large an amplitude of resonant frequency oscillations does not exclude the possibility of destruction of human organ tissues. Control over a certain magnitude of the amplitude of the electromagnetic oscillations of the causative agents of the disease in the known method of bioresonance therapy is not expected, which also negatively affects the quality of treatment.

Purpose of the study: to develop an apparatus and method for electromagnetic bioresonance therapy of inflammatory infectious diseases, provides an accurate determination of the frequency and amplitude of natural vibrations of pathogens at the time of their bioresonance and the continuous generation of forced pulsed oscillations only at a certain frequency and a given amplitude of natural vibrations of pathogens, contributes to a significant increase in the number of power hitting them per unit time of therapy, reducing the total time therapy and increase the effectiveness of treatment.

Material and Methods of the research

Analysis of scientific and pedagogical literature and information sources on the coverage of the influence of electromagnetic fields on biological objects, systematization and generalization of results on the topic of research.

Results of the research

We have developed and proposed for use in medicine an apparatus and method for electromagnetic bioresonance therapy of inflammatory infectious diseases, which provides for determining and fixing the frequency of their oscillations in the mode of bioresonance of their own electromagnetic oscillations of pathogens at a certain amplitude in the first cycles of the multi-cycle action of forcibly generated electromagnetic pulses, and the following therapy to carry out forcibly generated pulses in the fixed frequency mode, and, thus, help to reduce the duration of procedures and improve the quality of such therapy (Figure 1).

The problem is solved in that in the method of electromagnetic bioresonance therapy of infectious inflammatory diseases, based on a preliminary analysis of the type of pathogen, determining the calculated range of natural frequencies and the amplitude of the electromagnetic waves of the pathogen and

Fig. 1. Apparatus for electromagnetic bioresonance therapy of infectious inflammatory diseases

their localization zone and further multi-cycle action through the guide antenna to the specified zone of the compulsorily generated low-frequency electromagnetic pulses with a frequency that reproduces the bioresonance frequency of the proper path vibrations, according to a given program, according to the invention, in the first cycles of the action of forcedly generated electromagnetic pulses, their frequency is determined at which the bioresonance of the natural vibrations of the pathogens occurs, and in subsequent cycles, the action of the generated pulses is carried out by the magnitude of their frequency of oscillations reproduces the bioresonance of the natural vibrations of the pathogens, while the amplitude of the bioresonance frequency oscillations must be in the range of 1,5–2,5 upward amplitude of these oscillations.

Determining the frequency of natural oscillations of pathogens of the disease at the first stages of the action of forcedly generated electromagnetic pulses in the bioresonance mode of natural vibrations of pathogens and the further generation of forced pulses by the magnitude of their frequency, coincides with the bioresonant frequency, significantly increases the therapeutic effect of treatment and simultaneously reduces the duration of each cycle of the action of forcedly generated pulses and the total time of treatment of the disease.

Tracking the amplitude of the natural vibrations of pathogens when they are forced to generate electromagnetic pulses, and conducting electromagnetic therapy under conditions when the amplitude of the natural vibrations of pathogens in the conditions of their bioresonance should be within 1.5–2.5 of the rising amplitude of natural vibrations, provides the optimal bactericidal action on pathogens does not create conditions for organ damage and maintains the balance of microbiota (beneficial microflora) in the human body.

The method of electromagnetic bioresonance therapy of inflammatory infectious diseases is as follows. Previously, before the indicated therapy, an analysis of the type of pathogens (bacteria, protozoa, microscopic fungi, viruses, etc.) is carried out and determined from the official tabular data of the guidelines for electromagnetic therapy, the calculated frequency range of electromagnetic oscillations of pathogens F_z and their ascending amplitude A_v, as well as the localization zone of pathogens. Using a microprocessor, a control program is drawn up through the control keyboard, which consists of a cycle-cycle effect on the localization zone of pathogens forcibly generated by the generator of low-frequency electromagnetic pulses F_g with a gradually increasing frequency from the initial frequency $F_н$ to the final frequency F_c during the first two or three cycles of action indicated pulses. At the same time, during one or several cycles of the action of forcedly generated pulses, their frequencies coincide with the frequencies of natural vibrations of pathogens F_v. This is recorded on the indicator of the apparatus at the moment of bioresonance of oscillations of pathogens, at which the amplitude of their oscillations A_p increases by 1,5–2,5 times compared with their ascending value A_v. The moment of reaching the target amplitude of the bioresonance is controlled by a bioresonance sensor, which sends a signal to the interruption module of the generation of forced electromagnetic pulses, which, in turn, fixes this frequency, coincides with the frequency F in the natural oscillations of the pathogens, in the memory unit.

In the following cycles of therapy, the generator generates electromagnetic pulses with an oscillation frequency F_p, which corresponds to the frequency of electromagnetic oscillations of pathogens at the moment of their bioresonance, at which the amplitude Ap of their oscillations increases significantly, creates conditions that adversely affect the functioning of pathogens in the human body (Figure 2).

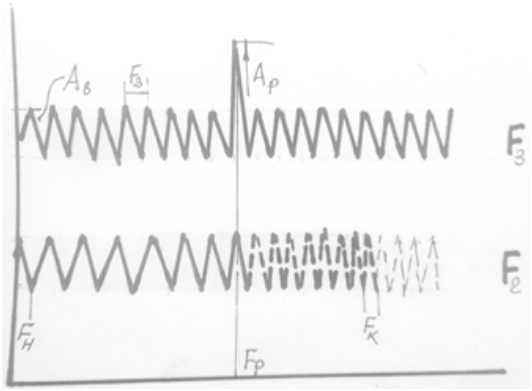

Fig. 2. United diagrams of electromagnetic impulse oscillations: F_z – natural oscillations of pathogens, F_g – forcedly generated in the zone of their localization of electromagnetic low-frequency impulses

Achieving the amplitude A_p of the electromagnetic waves of the causative agents of the disease at the time of their bioresonance, which should exceed the ascending amplitude of A_v by 1,5–2,5 times, provides the proper bactericidal effect of the compulsively generated impulses and does not create conditions for damage to organs and beneficial microflora of the human body. Moreover, the duration of each session of such therapy is within 15–20 minutes, and the total duration of treatment is 6–10 sessions.

Clinical case.

Patient S., 32 years old, male, complained of abdominal pain, stool 5–6 times a day with mucus and blood, weight loss, general weakness, decreased performance. Sick for 3 years with periodic (1–2 times a year) exacerbations that occur after an error in nutrition and psycho-emotional stress. Clinical diagnosis: ulcerative colitis, chronic recurrent course, stage of exacerbation, moderate form. Coprogram data: the consistency of feces is mushy, alkaline, an admixture of mucus and blood. Microscopy revealed muscle fibers, undigested fiber, starch grains, iodophilic flora; a significant number of leukocytes, red blood cells, intestinal epithelial cells. Stool analysis for the detection of Staphylococcus aureus (Staphylococus aureus) is positive. According to table recommendations, the range of natural oscillations of Staphylococcus aureus: 352000 kHz – 357 200 kHz.

Patient S. was assigned electromagnetic low-frequency therapy with a frequency of forcedly generated electromagnetic pulses, increased during one cycle: the initial frequency was 352,000 kHz, the final frequency was 357,200 kHz, and the degree of increase in frequency was 10 Hz. In the first cycle of therapy, a bioresonance was determined with the amplitude A_p of oscillations of the pathogen, which exceeded the ascending amplitude A_v by 1,5–2,5 times, when the oscillation frequency F_p of the compulsory generated pulses reached 356970 kHz and coincided with the same oscillation frequency of the pathogens. In subsequent cycles of the action of the compulsory generated impulses, an influence was carried out through the guide antenna into the zone of the intestinal

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projection with a frequency of 356 970 kHz, the duration of the procedure was twenty minutes. The procedures were appointed every other day, the total number of procedures – 7. After the electromagnetic bioresonance therapy, the general condition of the patient improved, the clinical manifestations of the disease decreased, a repeated coprogram indicates the absence of Staphylococcus aureus in the feces.

Conclusions / Discussion

1. The determination of the frequency of natural vibrations of the causative agents of the disease and the further generation of forced pulses by the magnitude of their frequency coincides with the bioresonance frequency, significantly increases the therapeutic effect of treatment and at the same time reduces the duration of each cycle of action of the forced pulses, as well as the total time of treatment of the disease.
2. Monitoring the health status of patients who underwent a full course of electromagnetic therapy according to the proposed methodology testifies to the high effectiveness of treatment, the total duration of treatment is reduced by 1,5–1,85 times.

Prospects for further research. It is promising to develop an apparatus and method for ultrasonic exposure in inflammatory infectious diseases.

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References

1. Zlepko, S.M., Pavlov, S.V., Vasylenko, V.B., Tymchyk, S.V. & Kasiianenko, V.Kh. (2011), *Aparatura dlia fizioterapii ta diahnostyky: navchalnyi posibnyk* [Apparatus for physiotherapy and diagnostics], Vinnytsia. (in Ukr.)
2. Konoplev, S.P. & Konopleva, T.P. (2001), Method for low-frequency electromagnetic therapy and device for its implementation, US Pat. RU No. 2164424, A61N2/04; declared 06/28/1999; publ. 03/27/2001, Bull. No. 9. (in Russ.)
3. Lekhtlaan-Tinisson, N.P., Shaposhnikova, Ye.B. & Kholmogorov, V.Ye. (2003), "The effect of a low-frequency magnetic field on cultures of E. Coli bacteria", *Vestnik VGU. Seriya: Khimiya. Biologiya. Farmatsiya*, No. 2, pp. 145-147. (in Russ.)
4. Cherepok, O.O. & Volokh, N.H. (ed.) (2016), *Likuvalne zastosuvannia elektrychnoho strumu, elektrychnoho ta mahnitnoho poliv, elektromahnitnoho vyprominiuvannia: navchalnyi posibnyk* [Therapeutic application of electric current, electric and magnetic fields, electromagnetic radiation], Zaporizhzhia. (in Ukr.)
5. Malyutina, I.V. (2011), *Prostoy put, vedushchiy k vosstanovleniyu i sokhraneniyu zdorovya. Kompleksy lechebnykh programm dlya priborov serii "BIOMYeDIS" i "BIOMYeDIS M": metodicheskoe posobie* [A Simple Pathway to Restoring and Maintaining Health. Complexes of treatment programs for devices of the BIOMEDIS and BIOMEDIS M series], Moscow. (in Russ.)
6. Melnykova, O.Z. & Ivanchenko, O.Z. (2016), *Diia na orhanizm liudyny faktoriv elektromahnitnoi pryrody i yikh zastosuvannia v medytsyni: metodychnyi posibnyk dlia vykladachiv* [Effects on the human body of factors of electromagnetic nature and their application in medicine], Zaporizhzhia. (in Ukr.)
7. Minakova, A.V., Limarenko, N.V. & Trints, D.V. (2016), "Analiz vozdeystviy elektromagnitnogo polya na biologicheskie obekty – palochkovidnye bakterii", *Molodoy issledovatel Dona*, No. 3(3), available at: http://mid-journal.ru (accessed: 17.04.2019). (in Russ.)
8. Naumchyk, P. (2018), "Impact of electromagnetic fields on bio-objects", *Portal of scientific conferences. Volodymyr Vinnychenko Central State Pedagogical University*, available at: https://www.cuspu.edu.ua/en/iv-a-mizhnarodna-naukovo-praktychna-onlain-internet-konferentsiia-problemy-ta-innovatsiyi-v-pryrodnycho-matematychniy-tekhnolohichniy-i-profesiyniy-osviti-2018/sektsiia-5 (accessed: 06.02.2019). (in Ukr.)
9. Petrenko, S.I. (1996), A device for changing the activity of a biological cell, US Pat. RU No. 2055604, A61M37/00; A61N2/04; declared 09/13/1993; publ. 03/10/1996, available at: http://www.freepatent.ru/patents/2055604 (accessed: 18.12.2018) (in Russ.)

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Structure of the incidence of older people in a demographic context

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The scientific article is devoted to the study of the incidence of elderly people through the prism of the demographic status of the population of Ukraine during 2010–2019.

Purpose: *to study the dynamics of aging of the population of Ukraine and determine the incidence of elderly people.*

Material & Methods: *analysis of scientific, methodological, regulatory literature, research of data from the State Statistics of Ukraine, copying from medical records. The study processed 487 medical records of the elderly.*

Results: *according to the State Statistics Service of Ukraine, it was determined that from 2010 to 2019 the proportion of people over working age is 1/6 of the country's population and has some upward trend. In the structure of the incidence of elderly people, diseases of the circulatory system, diseases of the musculoskeletal system and connective tissue, and diseases of the nervous system were most often encountered.*

Conclusions: *in Ukraine, as in most countries of the world, the nation is aging. In connection with the deterioration in the health of the population of Ukraine, as evidenced by the results of screening studies, scientists pay attention to the problem of attracting to motor activity.*

Keywords: *elderly, health, incidence, physical activity.*

Introduction

The data of literary sources indicate that there is an increase in the elderly population both in the world and in Ukraine [1; 2; 6; 10 and others]. A. V. Kabachkova et al. (2015) indicate that as of 2013, almost every fifth resident of Ukraine, which is 8,4 million people, was older than able-bodied [4]. In the Belarusian Republic, a similar trend is observed. So, T. V. Matveychik et al. (2016), analyzing mortality in the period 1970–2013. It was found that over the study period, the proportion of the population older than 70 years increased in men from 3,5% to 6,6%, in women – from 5,4% to 13,8% [5].

However, regardless of the demographic situation, the elderly remain the most vulnerable socially. There is an acute question of the extremely low standard of living of this group of the population, therefore, there is a need to create conditions for the socialization of a person of retirement age, to activate life in old age in order to improve its quality. It is worth noting that domestic scientists indicate that old age can become a period not only of maintaining social roles, but also the development of new [3; 9; 12].

Aging of the population becomes a state problem in almost all countries, in connection with which society is interested in prolonging the period of activity in the elderly, finding ways to solve their problems, acceptable and modern methods of non-pharmacological correction of growing changes in their health [7; 13].

To maintain the health and physical performance of older people and improve their quality of life, physical activity is of great importance. An increase in motor activity helps to maintain and strengthen health, increase the adaptive capabilities of their body, reduce the frequency of exacerbations of chronic diseases and improve the psycho-emotional sphere of a person, while reducing the risk of undesirable effects, such as a decrease in cognitive dysfunction, poor mental health, mobility [8].

According to the authors, among the elderly there are few who care about their health properly [11], probably due to low motivation, low socio-economic status. With increasing age, there is a decrease in muscle mass in conjunction with a decrease in activity and performance. After fifty years, strength decreases by 12–14%, at the age of 65–85 years – a decrease in strength occurs by 3–5% per year [5]. It is these indicators that become the basis of a large number of morbidity among the studied age category.

Purpose of our study is to study the dynamics of aging of the population of Ukraine and determine the incidence of elderly people.

Material and Methods of the research

To ensure the completeness of the research information field, a set of mutually complementary research methods was used: analysis of scientific, methodological, regulatory and legal literature, research of data from the State Statistics of Ukraine, and copies from medical records. The incidence rate was determined by ICD-10, the tenth revision of the International Statistical Classification of Diseases and Health Problems, conducted from September 25 to October 2, 1989 by the World Health Organization in Geneva. ICD-10 was approved at the Forty-third World Health Assembly in May 1990 and, since 1994, has begun to be implemented in WHO Member States. These codes are developed by the World Health Organization and are publicly owned. The study processed 487 medical records of older people.

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Results of the research

Maintaining the health of each individual throughout his life is a priority for public health. One of the most important components in this case should be personal motivational attitudes [3].

This dictates the need for preventive measures in the prenosologic period in order to prevent the incidence of those pathologies that can further contribute to disability and sociopsychological disintegration of an elderly person in society.

Around the world, an aging population is continuing at an intensive pace. According to the State Statistics Service of Ukraine, from 2010 to 2019 the proportion of people over working age is 1/6 of the population and has some tendency to increase (Figure 1).

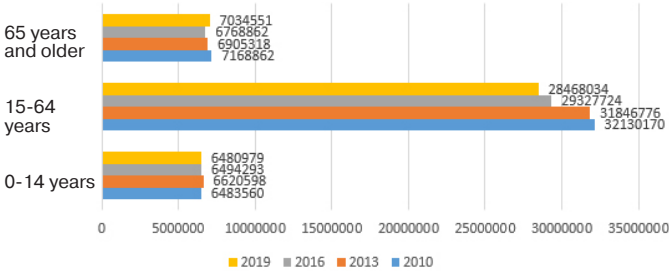

Fig. 1. Demographic data of the State Statistics Service of Ukraine from 2010 to 2019 number of persons

A characteristic feature of older people is the slowed down aging processes, which are expressed in involutional changes in specific organs and systems of the body. On the whole, the activity of nonspecific and the tension of specific immunity decreases, the adaptive capabilities of the body to external factors, in particular, to physical exertion, worsen, and the periods of development and recovery increase.

For a detailed determination of the morbidity structure according to the ICD-10 classes, we studied the results of comprehensive medical examinations of 487 elderly people during 2016 and 2019 (Table 1).

A comprehensive medical examination was organized in the city clinic of the city of Chernivtsi. The results of the medical examination showed that the leading ones were chronic diseases and pathological conditions of the cardiovascular system (53,3 and 52,8 per 100 examined) – ischemic heart disease: angina pectoris in the compensation stage, hypertension stage 1 and 2 in the compensation phase, chronic artery disease , arterioles and veins in remission. The second place in importance was occupied by chronic diseases of the musculoskeletal system (arthrosis, arthritis) – 55,6 and 45,9 per 100 examined. The third ranking place was accounted for by diseases of the nervous system, which were mainly represented by radiculitis of various localization (sacro-sacral, cervical) – 17,4 and 16,6 per 100 examined. The average – for one elderly person examined, 1,9 in 2010 and in 2019 – 1,3 chronic diseases in the compensation stage or phase of remission or pathological condition, does not affect the functions of organs and systems. From 487 elderly people, ac-

Table 1

Structure of the incidence of women aged 60–75 years according to a comprehensive medical examination (2016 and 2019, n=309)

Class ICD-10	Chronic diseases and pathological conditions	2016 (n=178)		2019 (n=309)	
		Number of cases	per 100 people	Number of cases	per 100 people
III	Blood diseases (including: anemia)	8	4,5	13	4,2
IV	Diseases of the endocrine system (including: thyroid disease, diabetes, overweight, obesity of 1 degree)	24	13,5	32	10,4
VI	Diseases of the nervous system (including: lumbosacral radiculitis, cervical radiculitis, lumbago in remission)	31	17,4	45	16,6
VII	Diseases of the eye and its adnexa (including: myopia, hyperopia in a correction state)	22	12,4	31	10,0
VIII	Diseases of the ear and mastoid process (including: chronic otitis media in remission, auditory tube diseases in compensation)	7	3,9	11	3,6
IX	Diseases of the circulatory system (including: coronary heart disease: stable angina pectoris class 1 and class 2 in the compensation stage, hypertension of the 1st and 2nd stage in the compensation phase, diseases of arteries, arterioles and capillaries in the compensation stage, vein disease, lymphatic vessels and nodes in the compensation stage)	102	53,3	163	52,8
X	Respiratory diseases (including: chronic bronchitis, emphysema in the stage of compensation)	12	6,7	16	5,2
XI	Digestive diseases (including: liver disease, gallbladder and biliary tract disease, pancreatic disease in remission)	16	8,9	24	7,8
XII	Diseases of the skin and subcutaneous tissue	5	2,8	7	2,3
XIII	Diseases of the musculoskeletal system and connective tissue (including: osteochondrosis: arthropathy (arthrosis), dorsapathy)	99	55,6	142	45,9
XIV	Diseases of the genitourinary system (including: urolithiasis in the stage of compensation)	8	4,5	12	3,9
Total		334	1,9	396	1,3
No diseases detected		11	6,2	15	4,9

cording to a comprehensive preventive examination, 15 and 11 people were practically healthy.

The structure of diseases of the circulatory system is dominated by "diseases characterized by high blood pressure", including "hypertensive heart disease".

In the structure of respiratory diseases, acute respiratory infections of the upper respiratory tract came first in the periods under consideration, due to age-related anatomical and morphological changes in the body and the formation of physiological senile immunodeficiency, as well as the deterioration of the environmental situation and socio-economic situation of this age group. This also confirms a three-fold increase in the incidence of influenza over a given period of time.

Among the diseases of the musculoskeletal system and connective tissue, the most frequently detected pathologies were arthritis and arthrosis.

It should be noted that in the structure of the diseases of the genitourinary system, high growth rates have breast dysplasia and endometriosis. Thus, an increase in indicators is noted for diseases associated with structural and hormonal changes.

Conclusions / Discussion

The results of the study made it possible to establish the demographic share of older people compared with 2010 to 2019 inclusive. It should be noted that in Ukraine, as in most countries of the world, the nation is aging. In connection with the deterioration in the health of the population of Ukraine, as evidenced by the results of screening studies, scientists pay attention to the problem of attracting to motor activity. The diseases of the circulatory system (2016 – 53,3%; 2019 – 52,8%), diseases of the musculoskeletal system and connective tissue (2016 – 55,6%; 2019 – 45,9%) were most often found in the structure of the incidence of elderly people and diseases of the nervous system (2016 – 17,4%; 2019 – 16,6%).

This study will serve as a perspective for the scientific justification, development and introduction of new measures in the recreational and health activities of older people.

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References

1. Hakman, A.V. (2018), "The role of motor activity and aging processes for the elderly", *Young*, No. 55 (3.3), pp. 34-37.
2. Duditska, S.P. (2019), "Domestic and foreign experience of using the means of health-recreational motor activity in the elderly", *Naukovyi chasopys Natsionalnoho pedahohichnoho universytetu imeni M. P. Drahomanova. Seriia 15 : Naukovo-pedahohichni problemy fizychnoi kultury (fizychna kultura i sport) : zb. nauk. prats.*, No. 3 (111), pp. 56-61.
3. Duditska, S.P. (2019), "Motives and varieties of recreational and health activities of the elderly", *Visnyk Prykarpatskoho Universytetu imeni Vasylia Stefanyka. Fizychna Kultura*, No. 31, pp. 45-49.
4. Kabachkova, A.V. & Dmytryeva, A.M. (2015), "Possibilities of improving physical education for elderly women (55-68 years old)", *Vestnyk Tomskoho hosudarstvennoho unyversyteta*, No. (391), pp. 195-201.
5. Matveichyk, T.V., Antypov, V.V. & Antypova, S.Y. (2016), "Problems in the state of health of the population of the Republic of Belarus: age-related aspects of mortality", *Obshchestvo s ohranychennoi otvetstvennostiu "Yzdatelstvo "Nauchnoe obozrenye"*, No. 1(7), pp. 107-115.
6. Polishchuk, M.Ie., Krasovskyi, K.S. & Andrieieva, T.I. (2013), "Reduction of mortality among the population of Ukraine in 2008 – 2012", *Zhurn. NAMN Ukrainy*, Vol. 19, No. 1, pp. 90-94.
7. Prokopenko, N. & Bezrukov, V. (2008), "Comprehensive assessment of the impact of social and environmental factors on human health", *Problemy starenyia y dolholetyia*, Vol. 17, No. 1, pp. 66-74.
8. Рынhach, N.A. (2012), "Autumn of Life: Options for Reducing Mortality in the Elderly", *Rossyia: tendentsyy y perspektyvы razvytyia. Ezhehodn*, No. 7, Part 1, pp. 672-678.
9. Foiht, N.A. (2011), *Public Administration of Public Health in Demographic Aging in Ukraine*, Kyiv.
10. Andrieieva, O. & Hakman, A. (2018), "Health status and morbidity of children 11-14 years of age during school", *Journal of Physical Education and Sport*, Supplement issue 2, pp. 1231-1236.
11. Andrieieva, O., Hakman, A., Kashuba, V., Vasylenko, M., Patsaliuk, K., Koshura, A. & Istyniuk, I. (2019), "Effects of physical activity on aging processes in elderly persons", *Journal of Physical Education and Sport*, Supplement issue 4, pp. 1308-1314.
12. Kozina, Z., Iermakov, S., Bartнk, P., Yermakova, T. & Michal, J. (2018), "Influence of self – regulation psychological and physical means on aged peopler's functional state", *Journal of Human Sport and Exercise*, No. 13(1), pp. 99-115.
13. Monteiro, A.M., Silva, P., Forte, P. & Carvalho, J. (2018), "The effects of daily physical activity on functional fitness, isokinetic strength and body composition in elderly community-dwelling women", *Journal of Human Sport and Exercise*, doi: https://doi.org/10.14198/jhse.2019.142.11.

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Legal bases of sports activity as an object of the theory of system organization

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Today, the state of development of the sphere of physical culture and sports is characterized by the presence of organizational and legal problems at the level of functioning of all its components (physical education, professional or mass sport, etc.) on the way to solving socially significant social problems. The lack of an objective assessment of the current state of the public relations industry, which is covered by physical education and sports, taking into account the state policy of Ukraine's integration with the international community, leads to the process of assimilation of this industry in favor of a stronger partnership, which is being formed.

Purpose: *to analyze the activities of physical education and sports organizations from the position of conceptual provisions of the theory of system organization.*

Material & Methods: *analysis of literary sources; analysis of documents; system analysis; historicism method; a method of analogy of observed patterns; mathematical modeling method.*

Results: *the problem of managing complex social systems in the context of the functioning of the sports law industry is considered. The theoretical foundations of self-organization of collective interdependent relations in the field of physical culture are substantiated from the position of conceptual provisions of the theory of system organization.*

Conclusions: *it has been established that at the present stage of development of public sports associations, the international sports movement and international sports federations, successful managerial activity can only be based on the condition that it is built on the basis of systems theory. It is established that the process of formation of interdependent relationships is based on the general principles of interaction of the object in question and its environment. It is the interaction of the object and the environment as a whole that acts as one of the determining principles of effective management and the key to maintaining the equilibrium state of the system.*

Keywords: *system, sports law, physical education and sports, theory, environment, interaction.*

Introduction

The source of law is the dynamics of the organization of behavior in the corresponding social structure generated by the statistical principle of the formation of general, mutually dependent relations in it. Depending on the social groups that have developed on the basis of existing relations with their own rules and obligations, enshrined in customs or laws for each zone of the statistical distribution of groups, united by any signs of a ranked category of persons, determining norms of their legal behavior are formed. The stability of social conditions leads to the same stability of the reproduction of the corresponding forms of behavior [10].

The state, as the organization of the political power of society, exercises its control, protects its economic and social structure, is an open system and, to ensure its viability, requires systematic replenishment of the necessary potential for energy-mass exchange of services. The decisive role in the distribution of the available potential between the various structural elements and their sectors is played by competitive relations, and in them the economical use of the necessary part of the energy-mass-exchange potential distributed by them [6].

The functioning of the sphere of physical culture, as a specific state structure or its industry, is strictly determined by the level of organization of a holistic social system and cannot be copied or created by analogs of more developed social entities, to a certain extent affects the efficiency of the creation and functioning of various types of associations, unions, federations. The state of physical education is currently at the level of survival with clearly violated relationships between the functioning of their private components in meeting the needs of society. The lack of an objective assessment of the current state of the whole field of public relations, which is covered by physical culture in the inevitable integration of Ukraine into the international community, leads to the process of assimilation of this industry in favor of a stronger part in the partnership that is being formed. The successful functioning of the branch of law in the field of physical culture in the legal regulation of legislation in the government of Ukraine can and should be organized on the modern achievements of the science of managing complex social systems, self-organizing in the conditions of their development in tolerant spaces, using the capabilities of modern computer technology that provides the necessary processing information and decision making. Analysis of recent research and publications. The relevance of the problem of managing complex social systems is confirmed by the attention of scientists.

Thus, theories of systemic organization are found in the works of L. Bartalanfi [16], K. P. Anokhin [1], L. A. Zadeh [17], G. Hagan [14] and other scientists. In our opinion, it is worth noting the special contribution to the study of systems, self-organizing by such authors as W. R. Ashby [15] V. M. Samsonkin, V. A. Druz, E. S. Fedorovich [13], A. A. Voronov [4],

A. A. Denisov, D. N. Kolesnikov [7], I. Prigogine [12] and others. At the same time, the dynamic development of social relations, as well as complications of the mechanisms of their legal regulation, in particular in the field of physical education, determine the necessity and relevance of our study.

Purpose of the study is to clarify and justify the theoretical foundations of self-organization of collective interdependent relations in the field of physical culture from the position of conceptual provisions of the theory of system organization.

Research objectives: to summarize the modern achievements of the science of managing complex social systems, self-organizing.

Material and Methods of the research

Methods: analysis of literary sources; analysis of documents; system analysis; historicism method; a method of analogy of observed patterns; mathematical modeling method**.**

Results of the research

The process of globalization, which takes place all over the world, covers all types of interstate relations, which leads to the creation of all kinds of alliances, blocs, alliances, and legends that are fiercely competitive for a dominant global position on the planet. Such a struggle affects all spheres of their interactions - in economic, cultural, political and scientific, forming a general regulation of relations. The determination of these processes is based on the basic principles of the flow of self-organizing.

Competition in each area of activity of interdependent interstate relations has an independent character, which determines the features of their priority orientation, both of an individual state and at the level of interstate relations. This gives rise to features of the course of competition in each of the spheres of activity both within the state and at the level of interstate relations. The nature of these relationships may be different. When analyzing the nature of these relations, it is necessary to take into account the levels of their organization, based on the theory of synergetic systems. In the global system of interstate relations, each of the states acts as a "connected" system (agency) in competitive relations, the formation of a unified international system in which the partial significance that each of them brings into the corresponding sphere of social relations is formed. The results of these areas of activity within each of the states should be considered as those occurring in the "autonomous" system. Moreover, external relations are considered as controlling parameters in relation to this domestic sphere of activity. A complete set of the presence of all the marked parameters, taking into account the need to know the different dynamics of their course and achieve synchronization of complex interdependent relationships, can only be represented as the structure of the levels of their mathematical description. A verbal description of this process is practically not possible, especially since it is necessary to take into account the tolerance of the space of its course and the number of sides in the structure [4].

In 1968, L. Bertalanfi put forward the systemic concept of the "general theory of systems", whose task was to develop a mathematical apparatus for describing various types of systems [8; 10; 16]. Almost simultaneously with the "general theory of systems" L. Bertalanfi was developed by the "theory of functional systems" by K. P. Anokhin, which substantiates not only the need for the presence of differentiated structures in the system, but also the consideration of their participation in obtaining the final result depending on the conditions the course of adaptation-compensatory processes of the system in question, aimed at maintaining its equilibrium state with the environment [1; 16].

In contrast to the "general theory of systems" L. Bertalanfi, representing the interaction of constant average criteria, the "theory of functional systems" by K. P. Anokhin justifies the continuous mobility of partial significance of interdependent systems in the formation of the final equifinal results obtained with minimal cost to achieve it . In fact, the theory of K. P. Anokhin appeared as a necessary complement to the general theory of systems of L. Bertalanfi. It should be noted that in the "general theory of systems" L. Bertalanffy did not answer the question about the mechanism, which gives rise to the emergence of differentiated structures in the process of forming an integrated system, was formulated by the author as a "development paradox". In turn, in the "theory of functional systems" by K. P. Anokhin, in which the necessity of having a mechanism for observing the variability of the medium and satisfying the need to maintain the equilibrium state of the system was revealed, the source's question remains unclear, which gives rise to its functioning [1; 16].

At the same time, L. A. Zade's "theory of fuzziness" is a kind of apparatus for the analysis and modeling of "humanistic systems", that is, systems in which "man" is involved. His approach is based on the premise that the elements of thinking are not numbers expressing the final result, but elements of some fuzzy sets for which the transition from "belonging", that is, "yes" to "non-belonging", that is, "no" is not abrupt but continuous. In the future, this theory received the definition of "human-machine systems", and in a more general case - the theory of systems" human-control object - environment" [17].

A little later (1977–1978), the theory of synergetic systems appeared. The main point of synergetics is the consistency of interdependent elements of the system in their relations. This new scientific direction was named on the initiative of G. Hagan – synergetics [14]. As a scientific theory, synergetics was aimed at studying systems consisting of many subsystems of various nature. This allowed us to consider the question of how the interaction of such subsystems leads to the emergence of spatio-temporal structures at macroscopic scales. Of particular interest were those situations where the structure arose as a result of self-organization, which made it possible to elucidate the principles of controlling the process of self-organization regardless of the nature of the subsystems [12].

The development of a generalized concept of the system, including the contribution of all the theoretical provisions of the theories considered, has led to a deeper understanding of the category of "norm". From the general presentation of the norm, Hegel (1977–1980) was sufficiently deeply substantiated. The concepts arose: "population norm", "regional norm" and, finally, "individual norm". The concepts of "state of norm" and "norm of state" began to be considered. The norm passed from the imagination of some frozen criterion of quantitative characteristic into the imagination of the dynamic

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process, provides the equilibrium state of the organism, and in the general case the equilibrium state of the system with its environment [5; 11].

The dynamics of the continuous course of the adaptation process of the norm of relations of an object with its environment was disclosed in the works of V. M. Samsonkin [13]. Such an approach made it possible to reveal the speed of the process under consideration, the level of possible complexity of its organization, the reasons for the differentiation of the morphogenesis of organs that determine the viability of a holistic structural formation, which in different areas of life can be characterized as an organism, state, humanistic system, or the "human-control object-environment". The emergence of a need entails the need for its satisfaction as a natural act aimed at maintaining the equilibrium state of the system with the environment. The appearance of this type of differentiated structural and functional areas, such as a response to the action of various environmental factors, give rise to a structure of interdependent relationships that determine the organization of a holistic system. Depending on the degree and plasticity of mutual coordination or synchronization of their interaction, the "norm" of a stable state of integrity of the state of the system is determined. The occurrence of such dynamics of the "norm" of the state requires the presence of a certain tolerance in all structural formations (sectors) to ensure coordinated interaction [11].

So, in each specific time period, we can talk about the "norm of state" and "state of norm." Each differentiated structural and functional component, as well as each of its constituent elements, is a "flow cultivator", which requires the necessary provision for the volume of mass interchange and the speed of their mediation. Maintaining the appropriate state of the system depends on the potential capabilities of such support. Thus, it is necessary to consider the sphere of physical culture as an "open dynamic system". The continuity of the process is necessary, the pleasure of energy exchange and the necessary stream of conversion of brown substances can be realized in special forms of depositing the results of the activities of functional systems to meet emerging needs. This gives rise to the corresponding "triad of relations" between the emerging need, its ability to solve and the degree of satisfaction of existing needs.

The most effective option will be that which is achieved with less energy and mass transfer. The principle of "least action" and the principle of "bottleneck" dichotomous to him are these necessary components of the mechanism for the continuous search for the most economical option for solving the emerging need. An indicator of the success of this process is the degree of satisfaction with the final result. The mechanism of operational adaptation lies in this triad; it proceeds continuously on the basis of the available possibilities of mutual energy-mass transfer, which ensures the possibility of solving the current state. The determining process for the successful course of operational adaptation is the synchronization of the interaction of "connected systems" among themselves in the conditions of changing tolerance of their relations. Adaptation as a whole must be considered as a process and as a phenomenon, as a structure that allows the transformation of environmental conditions into a structure of internal transformations to maintain an equilibrium state [2].

The violation of the synchronization process is based on the nature of the deposit mechanism, which leads to changes in localized needs in interdependent relationships towards a decrease in the differentiated support function and an increase in local tolerance. Establishing an acceptable deposit criterion limits the level of desynchronization of the interaction of system elements. When this process proceeds beyond the limits of noticeable control, the desynchronization that accumulates becomes latent and its change can be described by the method of slowly changing parameter. At the same time, it is necessary to distinguish between two types of deposits: their differentiated result of functional activity as a reserve for unexpected demand in mutual support and the deposit for themselves of products of differentiated activity, security from other interrelated "connected systems". Both forms of deposit are conditions for the regulation of fluctuations in the relationship "request-pleasure" or "need-permission-satisfaction". Each of the forms of escrow requires the expenditure of potential capabilities from its total supply to ensure these types of deposits. In violation of permissible norms, this leads to a decrease in the viability of a holistic system and desynchronization of its components are interdependent life support systems [15].

Depending on the availability of potential security opportunities, their partial use is determined to obtain the final result. The "statistical" principle of the equifinality of its production and the principle of "minimum" determine at each stage of complication of the organization of a holistic system the partial use of those options of a ranked series of structural and functional differentiation of "related education" in which the use of the system's potential capabilities in ensuring the necessary result is achieved with a minimum of costs. The principle of "minimum" allows you to save and deposit the total potential and to redistribute it in mutually dependent relations, to ensure the viability of an integral state, or to form any "industry" that is incomplete as a "connected body". The bottleneck principle signals that there is a weak link in the general organization that requires an active expenditure of potential to strengthen it. The relationship between the principle of "minimum" and the principle of "bottleneck" is described as a "consumer-satisfactory", for which the Volterra-Loka mathematical model of this process is widely used [3].

In the verbal description of the dynamics of the process, significant difficulties arise due to different terminology in each field of knowledge in which this problem is studied. In the theory of synergetic systems, a mathematical apparatus has been developed that allows us to establish a unified nature of the process and to carry out its research using the method of mathematical modeling, which is the only one possible in the analysis of social, environmental and other complex macrosystems, where any experiment is excluded in essence the impossibility of its implementation to establish the truth of the nature of the investigated phenomenon [13].

A significant feature of the use of this method is that it has a great opportunity to solve the tasks that remain unavailable in the classical methods of their consideration. The most important in this regard are the regularities of differences in the levels of systemic organization, and the consequences of assessing the impact of the statistical principle of obtaining the same equifinal result when comparing different levels of its formation. In each case, the imagination of the significance of the contribution of the previous level is based on the average indicator of the "norm", where it acts as a specific number. As

you move away from the average statistical level, this value is perceived completely differently in each section of the distance from the zone of plastic construction of interdependent relationships.

This imposes requirements on the need to establish a ranked series of significance of the obtained equifinal result at the previous level of its provision for its distribution according to rank demand of the highest level. The allocated zone of plastic construction of interdependent relationships represents the highest density of all possible variations in the construction of mutually complementary forms of organization of behavior, the dynamics of which are aimed at maintaining the stability of the equilibrium relationship with the environment. Continuous reproduction of these forms of joint mutually reinforcing behavior proceeds according to clearly determined rules for constructing the norms of the process of conditioning the equilibrium state of system integrity. Such coordination of relations is based on declarations and acts of declarative and recommendatory nature [6; 8].

So, the process of stochastic variation of the environment from which energy consumption is compensated to maintain the stability of a viable system integrity is consistent with the operational adaptation mechanism to ensure the level of energy potential of long-term reliability. This process is carried out as a result of the energy-mass flow entering the whole system from the external environment.

Conclusions / Discussion

It has been established that at the present stage of development of public sports associations, the international sports movement and international sports federations, successful managerial activity can only be based on the position of its construction based on systems theory. Having arisen in relation to one period of time, but in different countries, each of the theories of system organization has revealed important components of the self-organization process, which, being combined into a generalized theory of systems that allow model construction of the self-organization process. It was revealed that L. Bertalanffy's theory of systems reveals the essence of structural morphogenesis of the organogenesis of a system, but does not explain the mechanism of how system elements are formed.

The theory of K. P. Anokhin makes a significant contribution to understanding the functioning of structural morphogenesis or generated industries in the overall functional activity. The emergence of the theory of humanistic systems or systems "man – the control object - the environment" pays attention for the first time to the process of self-organization in fuzzy or tolerant spaces, introduces the concept of permissible error, the introduction of man as a natural component of humanistic systems allowed us to establish not only its significance in the structure of these systems, but also drew attention to the fact that a person in humanistic systems is the weakest link and the main cause of critical situations, which in most cases end in disasters. It is established that the process of formation of interdependent relations is based on the general principles of interaction of the object in question and its environment. It is the interaction of the object and the environment as a whole that acts as one of the determining principles of the observed self-organization, the essence of which is the constant preservation of the equilibrium state in this interaction.

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References

1. Anokhin, K.P. (1974), "The General Theory of Functional Systems of the Body", *Progress v biologicheskoy i meditsinskoy kibernetike*, Moscow, pp. 52-110. (in Russ.)
2. Artemeva, G.P., Pugach, Ya.I. & Druz, V.A. (2014), *Problema adaptatsii u strukture nauchnykh issledovaniy sistemy olimpiyskogo obrazovaniya: monografiya* [The problem of adaptation in the structure of scientific research of the Olympic education system], Kharkiv. (in Russ.)
3. Volterra, V. (1976), *Matematicheskaya teoriya borby za sushchestvovanie* [The mathematical theory of the struggle for existence], Moscow. (in Russ.)
4. Voronov, A.A. (1979), *Ustoychivost, upravlyaemost, nablyudaemost* [Stability, controllability, observability], Moscow. (in Russ.)
5. Gegel, G. (1975), *Nauka logiki* [Science of Logic], Vol. 1, Moscow, pp. 257-263. (in Russ.)
6. Gorban, A.N. & Khlebopros, R.G. (1988), *Demon Darvina. Ideya optimalnosti i estestvennogo otbora* [The Demon of Darwin. The idea of optimality and natural selection], Moscow. (in Russ.)
7. Denisov, A.A. & Kolesnikov, D.N. (1982), *Teoriya bolshikh sistem upravleniya* [Theory of large control systems], Leningrad. (in Russ.)
8. Kalman, R., Falb, P. & Arbir, M. (1971), *Ocherki po matematicheskoy teorii system* [Essays on the mathematical theory of systems], Moscow. (in Russ.)
9. Ketle, L.A. (1911), *Sotsialnaya fizika* [Social Physics], Sankt-Peterburg. (in Russ.)
10. Kukhtenko, A.I. (1969), "Overview of the main directions of development of the general theory of systems", *Materialy koordinatsionnogo soveshchaniya sektsii tekhnicheskoy kibernetiki Nauchnogo soveta po kibernetike ANUSSR*, Kiev. (in Russ.)
11. Plakhov, V.D. (1985), *Sotsialnye normy. Filosofskie osnovy obshchey teorii* [Social norms. Philosophical foundations of the general theory], Moscow. (in Russ.)
12. Prigozhin, I. (1985), *Ot sushchestvuyushchego k vozmozhnomu* [From the Existing to the Possible], Moscow. (in Russ.)
13. Samsonkin, V.N., Druz, V.A. & Fedorovich, Ye.S. (2010), *Modelirovanie v samoorganizuyushchikhsya sistemakh* [Modeling in self-organizing systems], Donetsk. (in Russ.)
14. Khagan, G. (1985), *Sinergetika ierarkhii neustoychivostey u samoorganizuyushchikhsya sistemakh i ustroystvakh* [Synergetics of the hierarchy of instabilities in self-organizing systems and devices], Moscow. (in Russ.)
15. Eshbi, U.R. (1966), Printsipy samoorganizatsii, Moscow, pp. 314-343. (in Russ.)
16. Bertalanffy, L. (1965), *General system theory*, New York.
17. Zadeh, L.A. (1965), "Fuzzy sets", *Information & Control*, No. 12. pp. 94–102.

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Features of the tactical training of gymnasts performing in group exercises

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Purpose: *to analyze the experience of trainers regarding the features of the use of tactical techniques in the construction of modern compositions of group exercises in rhythmic gymnastics.*

Materials & Methods: *41 rhythmic gymnastics trainers with a working experience of 1 to 40 years participated in the questionnaire, among whom were 3 honored trainers of rhythmic gymnastics in Ukraine. The trainers were asked to fill out a questionnaire, the questions of which concerned the problems of tactical training in rhythmic gymnastics. Methods used: analysis of scientific and methodological literature, questionnaires, methods of mathematical and statistical processing of the obtained data.*

Results: *74% of trainers do not have enough information about tactical training. Only their own observations and the experience of leading trainers are used to choose tactical behavior with gymnasts in the preparation of group exercises 60% of respondents.*

Conclusions: *modern scientific literature does not contain enough information and practical recommendations on the development of tactical thinking and the improvement of tactical training of gymnasts in group exercises of rhythmic gymnastics. Questionnaire results showed that at the present stage of development of rhythmic gymnastics, tactical training is not given due attention, since 55% of trainers do not apply operational control over the effectiveness and speed of tactical decisions of gymnasts, do not take into account the advantages of gymnasts when choosing musical accompaniment, costumes and elements of composition, during training gymnasts to the complex elements of technology prefer only the method of multiple repetition.*

Keywords: *group exercises of rhythmic gymnastics, training methodology, tactical training, tactical techniques, experience of trainers.*

Introduction

Today, group exercises are increasingly attracting the attention of experts and fans of rhythmic gymnastics. Their compositions are distinguished by originality of construction, technical complexity, virtuosity of performance, originality of musical accompaniment, etc. Unlike individual ones, group exercises are more diverse and complex in nature of motor actions. They present overturning objects to each other, elements of bodily contact, which must be performed in the interaction of two or more athletes. The growth of sports achievements in rhythmic gymnastics, as in any sport, associated with the improvement of training means and methods, where the issues of tactical training of gymnasts are of particular importance [3; 4; 7; 8; 10].

An analysis of scientific sources on the problems of tactical training in various groups of sports makes it possible to argue that tactical training in modern conditions of highly competitive competition is a significant reserve for improving performance in complex coordination sports [1; 2; 8]. On this basis, the actualization of the issues of tactical training in rhythmic gymnastics is promising, given its current stage of development, it requires a constant search and application of new original elements in competitive compositions, due to permanent changes in the rules of competitions FIG [6].

Currently, in conditions of fierce competition, it is important for coaches to choose the most successful tactics for the team in group exercises. The main components of a successful performance in group exercises are the coordinated, clear and merged work of the athletes during the performance, the originality and effectiveness of the presented competitive program, the display of the "strengths" of the team, an effective and rational training process and the like. All these components are included in the tactical training of gymnasts in group exercises of rhythmic gymnastics. The lack of scientific and methodological support for tactical training in rhythmic gymnastics causes the trainers to have difficulties in preparing athletes for participation in group exercises of rhythmic gymnastics. This, of course, affects the effectiveness of the training process and the effectiveness of the competitive activity of Ukrainian athletes in general. Indeed, tactically correct behavior will help athletes minimize stress during the competition, make the right decision and achieve a high final result. However, the criteria for tactical training are not sufficiently developed for group exercises of rhythmic gymnastics and require further improvement, which led to the relevance of this work [4; 6; 12; 14].

Purpose of the study: to study the practical experience of tactical training of group exercises in rhythmic gymnastics and to assess the level of implementation of tactical actions of Ukrainian trainers in the construction of modern compositions of group exercises for participation in competitions.

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Material and Methods of the research

A questionnaire survey was conducted among trainers in order to collect information about the importance of tactical training in training and competitive processes, about the peculiarities of introducing a methodology for training athletes in tactics in modern conditions, about the modern tactical behavior of trainers in preparing athletes for participation in competitions in group rhythmic gymnastics exercises, about the presence of and the availability of scientific and methodological sources of information about this type of training in rhythmic gymnastics. The questionnaire was attended by 41 rhythmic gymnastics trainers with work experience from 1 to 40 years. Among them are 3 Honored Coaches of Ukraine in rhythmic gymnastics. According to the teaching experience, all respondents were divided into two groups: the first group included trainers with a teaching experience of 1 to 10 years, and the second group - with a teaching experience of 11 to 21 years or more.

Research methods: analysis of scientific and methodological literature, questionnaires, methods of mathematical and statistical processing of the obtained data.

Results of the research

The current state of rhythmic gymnastics requires a constant search and application of new original elements in competitive compositions in combination with the work of the subject, "risks", "skill", "dance steps", which is due to recent changes in the rules of FIG competitions [6; 10]. In connection with the need to improve stability and reliability of competitive exercises [7; 9] the importance and need to justify tactical training as a new way to improve the training system in rhythmic gymnastics, which is associated with the formation of tactical thinking, increases the adoption of optimal decisions in competitive activity, as well as with the construction of compositions in accordance with the level of training and individual characteristics of gymnasts [13; 14].

According to the regulatory framework for tactical training in rhythmic gymnastics, its main tasks are: the effective distribution of complexity elements, basic and specific movements in the composition on the principle of preventing the actions of rivals; development of tactics of activity in competitive conditions, that is, a special daily routine, options for warm-up, training and behavior in the competition places; ensuring the variability of tactical decisions should be made by the gymnast under the influence of interference factors in the conditions of competitive activity [1; 5; 11].

In order to assess the level of implementation of the tactical actions of Ukrainian coaches in the construction of modern compositions of group exercises and training athletes to participate in competitions, a questionnaire method was used. So, trainers were asked to determine the significance of various types of training for rhythmic gymnastics. In the first place in importance, coaches in various pedagogical experience put physical preparedness (*W*=0,48, *W*=0,69) (Figure 1).

The most important, 20% of trainers from the first group and 20% – from the second, consider technical training. Tactical training was put in third place by 50% of the coaches of the first group and 43% of the second group. Psychological training, in the opinion of 40% of the coaches of the first group and

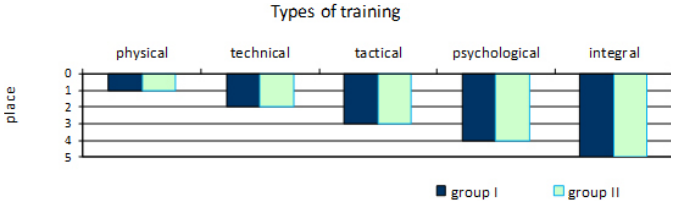

Fig. 1. Thoughts of trainers on the importance of training in rhythmic gymnastics (*n*=41)

38% of the second, takes fourth place. On the 5th place, 47% of the coaches from the first group and 67% from the second group put integral training.

It is advisable to introduce tactical exercises into the training of gymnasts of the 1st category – 85% of trainers think. In the opinion of all respondents, it is impractical to introduce tactical training with sportswomen as masters of sports, and only three trainers believe that it is optimal to start training with the CMS (Figure 2).

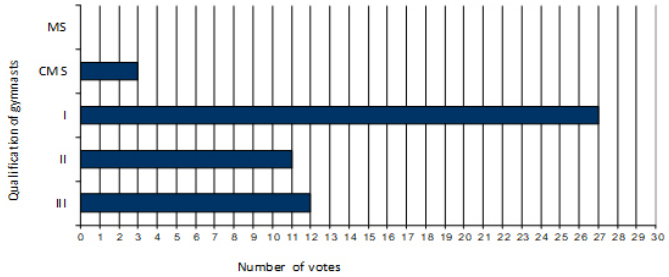

Fig. 2. Respondents' opinions on the need for tactical exercises in the training of gymnasts of various qualifications (*n*=41)

When choosing tactical behavior, 58% of coaches of the first group and 60% of coaches of the second group first take into account the age of the gymnast, then 25% of coaches of the first group and 30% of the second take into account her temperament, 13% of coaches of the first group and 8% of coaches of the second group are guided by technical and physical training, and last but not least 4% of coaches of the first group and 2% of coaches of the second group take into account goals and objectives in specific competitions (Figure 3). Such a choice of trainers, in our opinion, is explained by an insufficient number of information sources. If respondents believed that a well-chosen tactic would improve results, they would choose tactical behavior depending on the goals of the competitive activity.

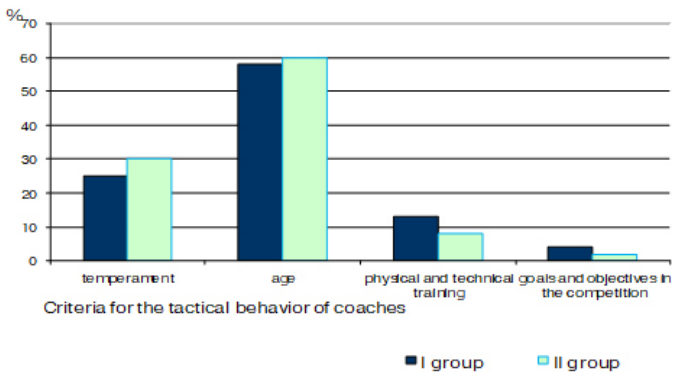

Fig. 3. Significance of factors determining the choice of tactical behavior model for trainers with gymnasts (*n*=41)

According to respondents, when choosing a model of their tactical behavior, 60% of coaches are guided by their own observations in competitions and the experience of leading trainers and athletes. Respondents noted that video recordings and specialized literature are either inaccessible sources or do not contain the information they need. Enough course on tactical training consider themselves 30% of the coaches of the first group and 23% of the second group (Figure 4). This, in our opinion, is due to the fact that in rhythmic gymnastics there are a limited number of available sources about the problems of tactical training. Most respondents who have recently graduated consider themselves to be more informed than more experienced coaches. This indicates that today, in the preparation of trainers and teachers, more attention has been paid to studying the section of tactical training issues.

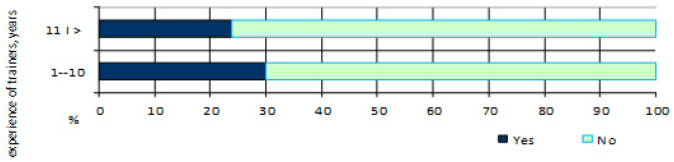

Fig. 4. Dynamics of changes in the indicator of awareness of tactical trainers (*n*=41)

It was found that creative tasks for the development of tactical thinking in the training process are not used only by 5% of trainers with experience of 11 years or more. Among coaches with less work experience, creative tasks are ignored in 15% of coaches (Figure 5).

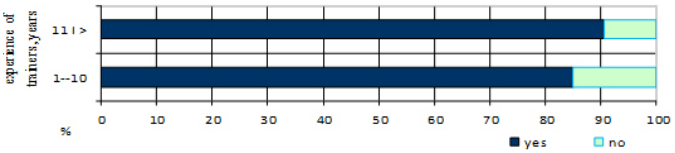

Fig. 5. Dynamics of changes in the rate of application of creative tasks for the development of tactical thinking in the educational process of gymnasts (*n*=41)

Operational control of the effectiveness and speed of tactical decisions by gymnasts during training sessions and competitions is used by 57% of coaches of the 2nd group and 55% of coaches of the 1st group.

All trainers belonging to the first group and 91% of their colleagues with a long experience of work set a task for gymnasts for every competition.

It was found that 92% of the coaches of the second group and absolutely all coaches of the first group are involved in the active participation in the composition of the gymnasts, thereby providing higher speed and greater effectiveness of the tactical decisions of the athletes in the competitive process. Gymnasts who took an active part in composing the composition are better oriented and easier to perceive (Figure 6).

When choosing musical accompaniment, preferences of young gymnasts are taken into account by 60% of trainers with work experience from 1 to 10 years. Only 38% with great experience take into account the wishes of the gymnasts and 62% choose the musical accompaniment on their own. Only 7,7% of trainers with experience of more than 11 years choose musical accompaniment for older gymnasts themselves, and

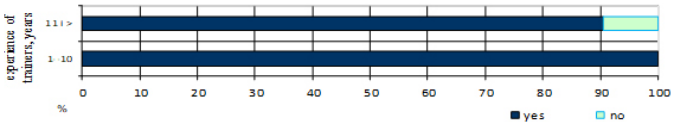

Fig. 6. Respondents' opinions regarding the level of need for gymnasts to actively participate in the composition (*n*=41)

all the rest are guided by the choice and preferences of gymnasts.

When choosing compositional elements, more experienced trainers more often take into account the wishes of younger gymnasts than their colleagues with less work experience (Figure 7).

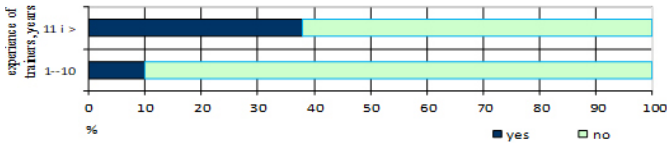

Fig. 7. Significance level of the wishes of young gymnasts when choosing elements of composition (*n*=41)

Only 10% of trainers with experience from 1 to 10 years and 38% over 11 years take into account the wishes of young gymnasts when choosing composition elements. Although most coaches consider this question not important enough, however, it can positively affect the tactical decisions of the gymnast. By inventing or choosing elements, the gymnast immediately thinks up options for her actions in case of unsuccessful implementation. If the trainer himself puts the exercises to the gymnast, then she expects tactical instructions from him.

When choosing composition elements for senior athletes, the thoughts of the trainers for different work experience coincided. Only 5% of respondents make up compositions without the participation of gymnasts.

When choosing a costume, the wishes of young gymnasts are taken into account by 70% less experienced coaches and 71,5% of their colleagues with an experience of more than 11 years. When choosing a costume, the preferences of older gymnasts are not taken into account by 5% of respondents with an experience of 1 to 10 years and 9,5% with an experience of more than 11 years, determining the style and appearance of the gymnast on their own, at their discretion.

85% of less experienced coaches and 85,8% of their colleagues with experience of more than 11 years introduce gymnasts with the competitors 'capabilities, conditions and rules of future competitions. Trainers believe that lack of awareness can cause situational problems, adversely affect the tactical decisions of gymnasts.

The most popular methodology for improving competitive programs and complex elements of technology in gymnasts is repeated repetition (34% – the first trainers and 45% - the second group of trainers). Self-analysis, which is used by 33% of respondents, takes the second place in frequency of use. This once again underlines the lack of awareness of tactical trainers. In third place is a methodological technique for vary-

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ing conditions, which coaches consider the least effective. Only two respondents suggested other methods: game and explanations (Figure 8).

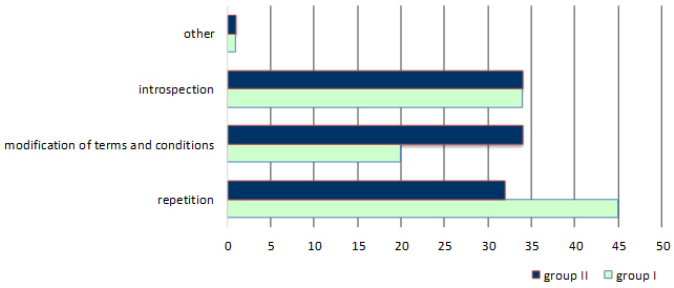

Fig. 8. Ratio of teaching methods used by trainers in the process of improving the technique of complex elements in gymnasts (*n*=41)

All respondents believe that the development of creative imagination at the initial training stage positively affects the formation of tactical thinking in gymnasts in the future.

Conclusions / Discussion

An analysis of the scientific and methodological literature on the problem of tactical training in rhythmic gymnastics showed that at the present stage of development of rhythmic gymnastics tactical training is the least studied type of training. It is necessary for all sports, since the rational use of their capabilities requires athletes to calculate the most effective, rational and economic actions. In rhythmic gymnastics, in particular in group exercises, ceteris paribus and data, tactical training can be a decisive factor for athletes in achieving results.

Based on the analysis of the practical experience of tactical training of respondents (n=41), it was found that coaches do not consider tactical training to be the main for achieving high results, putting it in 3rd place with 5 types of training (W=0.4). According to 27 respondents (66%), tactical exercises should be started from the II category. All trainers believe that the development of creative imagination at the initial training stage further affects the formation of tactical thinking among gymnasts. The main source of information about tactical training when choosing a model of tactical behavior with gymnasts is their own observations in competitions and the experience of leading trainers and female athletes (60% of respondents). 70% of coaches with a pedagogical experience of up to 10 years and 77% of coaches with experience of 11 or more years consider themselves insufficiently informed about tactical training. Creative tasks for the development of tactical thinking in the training process are not used only by 5% of trainers with experience of 11 years or more. Operational control of the effectiveness and speed of tactical decisions of gymnasts during training sessions and competitions is used by 57% of respondents with long experience and 55% with experience of up to 10 years. The pedagogical tasks for gymnasts at every competition are set by all the coaches of the first group and 91% of their colleagues with long experience. 92% of the coaches of the second group and all coaches of the second group and all coaches of the first group are involved in active participation in the preparation of compositions, thereby providing higher speed and effectiveness of tactical decisions of athletes in the competitive process. The most popular methodic for training gymnasts in the complex elements of technology is, according to 34% of respondents, multiple repetition. The second place in frequency of use is taken by self-analysis, which is used by 33% of trainers.

Thus, the results of the survey showed that at the present stage of development of rhythmic gymnastics tactical training is not given due attention. Considering that tactical training in modern conditions of highly competitive competition is a significant reserve for increasing the effectiveness of competitive activity and in connection with the identified scientific and applied problem of inconsistency of the existing level of knowledge about tactical training in rhythmic gymnastics with the modern needs of practice, certain theoretical and methodological provisions for tactical training in various sports can be extrapolated to the tactical training technique in rhythmic gymnastics.

Prospects for further research. Further research will be aimed at analyzing the tactical criteria for individual tactics of athletes specializing in group exercises of rhythmic gymnastics, and determining the effectiveness of tactical techniques for choosing originality components and the external design of group exercises compositions for teams of various qualifications.

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References

1. Bystrova, I.V. (2008), *Psikhologo-pedagogicheskaya tekhnologiya upravleniya adaptatsiey gimnastok k sportivnoy deyatelnosti (na primere gruppovykh uprazhneniy): avtoref. diss. kand. psikh. nauk: spets. 13.00.04* [Psychological and pedagogical technology for managing the adaptation of gymnasts to sports activities (for example, group exercises): PhD thesis abstract], SPbGUFK im. Lesgafta, 22 p. (in Russ.)
2. Habrylchuk, I. & Perederii, A. (2016), "Structure and content of tactical training in rhythmic gymnastics", *Moloda sportyvna nauka Ukrainy: zb. nauk. prats*, Lviv, Vol. 1. pp. 36-41. (in Ukr.)
3. Karpenko, L.A. (2014), *Khudozhestvennaya gimnastika: ucheb. dlya trenerov, prepodavateley i studentov fiz. Kultury* [Rhythmic gymnastics: textbook. for trainers, teachers and physical students Culture], Sovetskiy sport, Moscow. (in Russ.)
4. Kozhanova, O.S. (2013), "Compatibility of female athletes in the selection of teams in the group exercises of rhythmic gymnastics taking into account their technical and special physical fitness", *Pedahohika, psykholohiia ta medyko-biolohichni problemy fizychnoho vykhovannia i sportu*, No. 2, pp. 34-37. (in Ukr.)
5. Topol, H.A. (2017), *Kompleksna otsinka pidhotovlenosti kvalifikovanykh sportsmenok u khudozhnii himnastytsi: avtoref. dys. kand. nauk z fiz. vykhovannia i sportu: spets. 24.00.01 Olimpiiskyi ta profesiinyi sport* [Comprehensive assessment of preparedness of skilled female athletes in rhythmic gymnastics: PhD thesis abstract], Nat. University of Phys. education and sport of Ukraine, Kyiv, pp. 24. (in Ukr.)
6. FIG (2017), Rhythmic gymnastics: competition rules for 2017–2020, Geneva, available at: http://www.fig-gymnastics.com/publicdir/rules/files/rg/RG_CoP%202017-2020_updated%20with%20Errata_February%202017_r_V2.pdf. (in Russ.)
7. Shinkaruk, O.A. & Sivash, I.S. (2016), *Khudozhestvennaya gimnastika: otbor i orientatsiya podgotovki sportsmenok v gruppovykh uprazh-*

neniyakh: Monografiya [Rhythmic gymnastics: selection and orientation of training athletes in group exercises], Olimpiyska literatura, Kyiv. (in Russ.)
8. Avila-Carvalho, L., Klentrou, P. & Levre, E. (2013), "Handling, throws, catches and collaborations in elite group rhythmic gymnastics", *Sci. Gymnastics J.*, No. 4, pp. 37-47.
9. Bobo-Arce, M. & Rial, Belia (2013), "Determinants of competitive performance in rhythmic gymnastics. A review", *Journal of Human Sport and Exercise*, availible at: https://www.researchgate.net/publication/262010011_Determinants_of_competitive_performance_in_rhythmic_gymnastics_A_review.
10. Нцkelmann, A., Breitkreutz, T. & Livioty, G. (2012), "Changes in performance structure during group competitions in rhythmic gymnastics", *Abstracts of the World Congress of the Performance Analysis of Sport IX*, M. Peters and P. O. Donoghue (eds), University of Worcester, Worcester.
11. Leandro, C., Evila-Carvalho, L., Sierra-Palmeiro, E. & Bobo Arce, M. (2017), "Judging in rhythmic gymnastics at diferente levels of performance", *J. Hum. Kinet.*, No. 60, pp. 159-165, doi: 10.1515/hukin-2017-0099.
12. Sierra-Palmeiro, E., Bobo-Arce, M., Pйrez-Ferreirys, A. & Fernбndez-Villarino, M.A. (2019), "Longitudinal Study of Individual Exercises in Elite Rhythmic Gymnastics", availible at: https://www.frontiersin.org/articles/10.3389/fpsyg.2019.01496/full
13. Purenovic-Ivanovic, T., Popović, R., Stanković, D. & Bubanj, S. (2016), "The importance of motor coordination abilities for performance in rhythmic gymnastics", *Facta Universitatis Series Physical Education and Sport*, pp. 63-74, availible at: https://www.researchgate.net/publication/310477945_The_importance_of_motor_coordination_abilities_for_performance_in_rhythmic_gymnastics
14. Tsopani, D., Dallas, G., Tasika, N. & Tinto, A. (2012), "The effect of different teaching system in learning rhythmic gymnastics apparatus motor skills", *Sci. Gymnastics J.*, No. 4, pp. 55-62.

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Performance indicators of the technical and tactical actions of young football players of 13–14 years of various game roles

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Purpose: *to determine the quality of the indicators of technical and tactical actions of young football players 13–14 years of different playing roles during the competitive activity.*

Material & Methods: *the study was conducted during a football competition. The study involved 11 football players 13–14 years of the football team Arsenal. The quality of the performance of technical and tactical actions was analyzed during 10 games in the championship competitions of the city of Kharkov in football. The analysis of literary sources, pedagogical observation and methods of mathematical statistics were used.*

Results: *the performance indicators for the technical and tactical actions of young football players 13–14 years during 10 games depending on the game role were determined.*

Conclusions: *the conducted studies show that the quality of the performance of technical and tactical actions among young football players 13–14 years old is not the same for players of different game roles. The results obtained indicate the need to determine model characteristics for players of each game role, compare them with existing ones, and develop special exercises to eliminate differences between them.*

Keywords: *quality of performance, technical and tactical actions, young football players, competitive activity.*

Introduction

In solving the tasks of technical and tactical training of young football players, the continuity of the development and improvement of individual elements, the use of which is specific in the quantity and quality of the performance of technical and tactical actions, is not fully taken into account. Various scientific works have been devoted to various questions of the preparedness of young football players: physical training [1; 4; 10], technical training [4; 8; 11], accounting for game roles during training [12], training of young football players [6; 7] and others.

In the training of football players, two groups of exercises are used aimed at developing physical qualities: non-specific (running, jumping, exercises on power simulators) and specific (tactical and technical). Exercises of the first group contribute to the development of basic physical qualities (endurance and strength), while exercises of the second group turn these basic qualities into specific [3; 13].

The technical and tactical preparedness of young football players has always been in the field of vision of scientists and coaches [1; 3; 7]. At the same time, in the works of these authors the questions of the dependence of the level of technical and tactical preparedness of young football players on the level of special physical preparedness are not completely disclosed.

In scientific papers [1; 8], age-related volumes of performing technical and tactical actions of football players of different nature and conditions are given, as well as complexes of technical and tactical actions with a subsequent analysis of the consequences of the effectiveness of their implementation [4; 9].

In addition, football players who have the same level of technical and tactical preparedness can use different techniques and their connections in different ways, so it is very important to identify the level of creativity of football players of different game roles.

The quality of the performance of technical and tactical actions is the key to success in football, which allows you to control the game activity, contributes to the creation of scoring chances and ultimately win.

Thus, determining the quality of the performance of technical and tactical actions of football players of different roles and developing complex training tasks for further sports improvement determines the relevance of this study.

Purpose of the study: to determine the quality of the indicators of technical and tactical actions of young football players of 13–14 years of different playing roles during the competitive activity.

Material and Methods of the research

The study was conducted during a football competition, in which 11 football players 13–14 years old of the Arsenal football team took part. The quality of the performance of technical and tactical actions was analyzed during 10 games in the championship of the Kharkov football championship. The analysis of literary sources, pedagogical observation and methods of mathematical statistics were used.

Results of the research

The studies carried out during the annual macrocycle in order

to establish the quality indicators of the technical and tactical actions of young football players aged 13–14, during 10 games, indicate different qualitative indicators depending on the game role. It was found that the quality of their performance on average per game is (22,0%) (Table 1).

According to the results, central and extreme midfielders (23,7%, 23,8%) perform better quality of play, mainly due to short (32,1% and 31,6%) and medium (27,6% and 28,2%) of passes, dribbling (24,1% and 25,2%), tackles (34,0% and 20,1%), stopping the ball (25,8% and 30,2%) and kicks into the goal (26,0% and 32,0%).

In turn, central defenders have low performance in long passes (10,1%), groundmoves (15,1%) and tackles (16,0%).

The highest quality field players perform short and medium passes (31,9% and 26,0%), worse long passes, only 10,5% of them are high-quality.

At the same time, goalkeepers (37,1%) perform better short passes, which is due to the absence of predominantly counteraction to their implementation (Table 2), and worse – forwards (28,8%), since they are under close opposition.

The most difficult to accomplish are long ball passes, the quality of which is 10,5%, which are worse than other players by the attackers (9,1%), which is associated with technical and tactical actions that are not inherent to them (Table 2).

The average command indicator of the "stroke" is 14,8%, which for the attackers is positively performed in 20,1% of cases, significantly better than the wing back ($t=5,15$; $p<0,001$) and central ($t=4,62$; $p<0,001$) defenders and wing back ($t=5,61$; $p<0.001$) and central ($t=4,85$; $p<0,001$) midfielders (Table 3).

Field players equally possess the techniques of "dribbling

Table 1

Quality indicators of the performance of technical and tactical actions during the game of young football players 13–14 years of different game roles (according to the calculations of 10 games, %)

No. i/o	Technical and tactical actions	Playing roles 1 $\bar{X}_1 \pm m_1$	2 $\bar{X}_2 \pm m_2$	3 $\bar{X}_3 \pm m_3$	4 $\bar{X}_4 \pm m_4$	5 $\bar{X}_5 \pm m_5$	6 $\bar{X}_6 \pm m_6$	Total amount Σ, %	$\bar{X}$, %
1.	Short passes	37,1±2,03	31,2±1,24	30,8±1,22	32,1±1,24	31,6±1,30	28,8±1,28	191,4	31,9
2.	Medium passes	22,5±1,47	28,1±1,24	25,2±1,28	27,6±1,19	28,2±1,24	24,4±1,17	156,0	26,0
3.	Long passes	12,3±0,51	9,6±0,42	10,1±0,44	10,2±0,44	11,4±0,47	9,1±0,51	62,7	10,5
4.	Groundmoves	11,4±1,18	14,0±0,58	15,1±0,59	13,7±0,46	14,6±0,48	20,1±1,04	88,9	14,8
5.	Dribbling	20,3±1,05	26,2±1,03	25,8±1,17	24,1±1,17	25,2±1,19	24,8±1,02	146,4	24,4
6.	Slide tackle	–	30,0±1,58	16,0±1,26	34,0±1,59	20,1±1,21	15,0±1,19	115,1	23,0
7.	Ball stop	21,6±1,42	24,2±1,15	26,2±1,18	25,8±1,17	30,2±1,21	23,6±1,11	151,6	25,3
8.	Kicks to the goal	–	25,0±1,08	25,0±1,08	26,0±1,09	32,0±1,24	29,0±1,07	137,0	22,8
9.	Headshot	10,6±1,04	20,3±1,05	20,8±1,07	20,6±1,05	20,6±1,05	21,1±1,06	114,0	19,0
	Σ, %	135,8	208,6	195,0	214,1	213,9	195,9	1163,1	–
	X, %	19,4	23,2	21,7	23,8	23,7	21,8	–	22,3

Remark. *1 – goalkeepers (n=10); 2 – wing back defenders (n=20); 3 – central defenders (n=20); 4 – wing back midfielders (n=20); 5 – central midfielders (n=20); 6 – forwards (n=20).*

Table 2

Matrix as indicators of the performance of "short", "medium" and "long" passes during the game by young football players of 13–14 years of different game roles (according to the calculations of 10 games, %)

No. i/o	Game roles	Motor actions	1	2	3	4	5	6
1.	Goalkeepers (n=10)	a		2,48	2,66	2,07	2,28	4,32
		b		2,92	1,44	2,70	3,03	1,17
		c		4,09	3,28	3,13	0,43	4,44
2.	Wing back defenders (n=20)	a			1,51	0,27	0,05	2,16
		b			1,70	0,68	0,03	2,18
		c			0,82	0,98	2,86	0,81
3.	Central defenders (n=20)	a				1,43	1,75	0,87
		b				1,44	1,75	0,84
		c				0,11	2,03	1,52
4.	Wing back midfielders (n=20)	a					0,36	1,93
		b					0,76	1,79
		c					1,88	1,67
5.	Central midfielders (n=20)	a						1,53
		b						2,24
		c						3,19
6.	Forwards (n=20)	a						
		b						
		c						

Remark. *a – short passes; b – medium passes; c – long passes.*

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the ball", the performance indicator of which is 24,1–26,2% (p<0,05) (Table 3).

Performing "tackles" is one of the most complex element of football technique and is used by all field players, but their quality of execution is not the same. So, the most successful "tackles" are performed by wing back midfielders (34,0%) and wing back defenders (30,0%), which is significantly better than central defenders (p<0,05–0,001) and attackers (p<0,01–0,001) (Table 4).

"Stopping the ball" is used by all players, and its quality provides for the possibility of further implementation of technical and tactical actions. In our studies, the central midfielders (30,2%) most successfully stop the ball compared to goalkeepers (t=4,62; p<0,001), wing back and central midfielders (t=3,59; p<0,01; t=2,37; p <0,05) and forwards (t=2,62; p<0,05) (Table 4).

Higher quality exercise kicks into the goal (ie, get on goal) central midfielders (32,0%), which was significantly better than the wing back and central defenders (t=4,27; p<0,001) and winger (t=3,64; p<0,01) (Table 5).

The indicators of the positive performance of "head kicks" for both the player of his team and the goal kick for young field players 13–14 years old do not have a significant difference (p<0,05) and are in the range (20,3–21,1%).

Conclusions / Discussion

The technical and tactical preparedness of young football players has been considered in many scientific works [2; 8, etc.], in the works of which the issues of the dependence of the level of technical and tactical preparedness on the level of special physical fitness are disclosed to a certain extent. Along with this, it is very important to determine the influence of quantitative indicators on the implementation of technical and tactical actions, since the quality of their implementation is the key to success in football, which allows you to control game activity, helps to create goals and, ultimately, win. Therefore, the quality of the implementation of various technical and tactical actions by players of different game roles to a greater extent determines the success of the whole team [12].

The technical and tactical preparedness of young football players has been considered in many scientific works [2; 8, etc.], in the works of which the issues of the dependence of the level of technical and tactical preparedness on the level of special physical preparedness are disclosed to a certain extent. Along with this, it is very important to determine the influence of quantitative indicators on the implementation of

Table 3

Matrix as indicators of the performance of the "groundmoves" and "dribble" during the game by young football players of 13–14 years of different game roles (according to the calculation of 10 games, %)

No. i/o	Game roles	Motor actions	1	2	3	4	5	6
1.	Goalkeepers (n=10)	a		1,98	2,94	1,81	2,04	7,31
		b		4,04	3,50	2,39	3,36	2,87
2.	Wing back defenders (n=20)	a			1,33	0,41	0,80	5,13
		b			0,26	1,35	0,63	0,87
3.	Central defenders (n=20)	a				1,87	6,58	4,62
		b				1,02	0,45	0,63
4.	Wing back midfielders (n=20)	a					0,76	5,61
		b					0,66	0,42
5.	Central midfielders (n=20)	a						4,83
		b						0,24
6.	Forwards (n=20)	a						
		b						

Remark. *a – tackles; b – dribble.*

Table 5

Matrix as indicators of the performance of "kicks in the goal" and "head kicks" during the game by young football players 13-14 years of different game roles (according to the calculation of 10 games, %)

No. i/o	Game roles	Motor actions	1	2	3	4	5	6
1.	Goalkeepers (n=10)	a						
		b		6,55	6,85	6,71	6,68	7,05
2.	Wing back defenders (n=20)	a			0	0,65	4,27	2,63
		b			0,37	0,39	0,39	0,71
3.	Central defenders (n=20)	a				0,65	4,27	4,24
		b				0,28	0,28	0,31
4.	Wing back midfielders (n=20)	a					3,64	1,97
		b					0	0,42
5.	Central midfielders (n=20)	a						1,83
		b						0,39
6.	Forwards (n=20)	a						
		b						

Remark. *a – kicks in the goal; b – head kicks.*

Table 4

Matrix as indicators of the performance of "tackles" and "stopping the ball" during the game by young football players 13–14 years of different game roles (according to the calculation of 10 games, %)

No. i/o	Game roles	Motor actions	1	2	3	4	5	6
1.	Goalkeepers (n = 10)	a						
		b		1,42	2,49	2,26	4,62	1,11
2.	Wing back defenders (n = 20)	a			6,93	1,79	4,98	10,56
		b			1,21	0,98	3,59	0,38
3.	Central defenders (n = 20)	a				8,87	2,34	0,58
		b				0,24	2,37	1,61
4.	Wing back midfielders (n = 20)	a					6,95	9,55
		b					2,62	1,37
5.	Central midfielders (n = 20)	a						3,00
		b						4,02
6.	Forwards (n=20)	a						
		b						

Remark. *a – takles; b – stopping the ball.*

technical and tactical actions, since the quality of their implementation is the key to success in football, which allows you to control game activity, helps to create goals and, ultimately, win. Therefore, the quality of the implementation of various technical and tactical actions by players of different game roles to a greater extent determines the success of the whole team (26,2%; 25,8%). Wing back midfielders were better at "tackling" (34,0%), short (32,1%) and medium (27,6%) passes. Central midfielders have the best indicators of their actions in the "stop" (30,2%) and kicking the ball (32,0%), short and medium passes (31,6%; 28,2%). The attackers to a greater extent of all technical and tactical actions qualitatively perform kicks into the goal (29,0%) and short passes of the ball (28,8%).

Obtained results indicate the need to determine the normative (model) characteristics for players of each game role, comparing them with those available, and developing special exercises to resolve differences between them.

Prospects for further research. Prospects for further research include the establishment of a correlation dependence of the quality of the performance of technical and tactical actions on the number of motor actions of young players of different game roles.

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References

1.Aramyan, A.G. (2018), "Features of the Technical, Tactical and Physical Training of Young Football Players", *Studencheskaya nauka i XXI vek*, Vol. 15, No. 1 (16), P. 2, pp. 19-21. (in Russ.)
2.Godik, M.A. (2006), *Fizicheskaya podgotovka futbolistov* [Physical training of football players], Terra-Sport, Olimpiya Press, Moscow. (in Russ.)
3.Zhurid, S.M. (2007), *Udoskonalennia tekhniko-taktychnoi pidhotovky futbolistiv 15-17 rokiv z vykorystanniam kompleksiv trenuvalnykh zavdan: avtoref. dys. kand. nauk, Khark. derzh. akad. fiz. Kultury* [Improvement of technical and tactical training of football players of 15-17 years using complexes of training tasks: PhD thesis abstract], Kharkiv, 20 p. (in Ukr.)
4.Zhurid, S.M., Lebediev, S.I. & Sleman, Rebaz (2015), "Analysis of indicators of competitive activity and special technical readiness of players of 10-12 years", *Slobozans`kij naukovo-sportivnij visnik*, No. 5(49), pp. 52-56. (in Ukr.)
5.Lapshin, O.B. (2010), *Teoriya i metodika podgotovki yunykh futbolistov: metodicheskoe posobie* [Theory and Methods of Training Young Soccer Players], Chelovek, Moscow. (in Russ.)
6.Lebedev, S.I. (2012), "Study of the individual technical and tactical actions of football players 10-11 years old taking into account the game role", *Slobozans`kij naukovo-sportivnij visnik*, No. 5 (2), pp. 48-52. (in Russ.)
7.Lisenchuk, G.A. (2003), "On the Problem of Individualization of the Training Process of Young Soccer Players", *Pedagogika, psikhologiya ta med.-biol. probl. fiz. vikhovannya i sportu*, No. 5, pp. 102-109. (in Russ.)
8.Nikolaienko, V.V. (2014), "Technology of improving tactical and technical skills at the stages of long-term training of football players", *Molodizhnyi naukovyi visnyk (Fizychne vykhovannia i sport)*, Vyp. 13, pp. 59-63. (in Ukr.)
9.Pertsukhov, A.A. (2009), "Assessment of reliability of performance of technical and tactical actions by football players of 17-19 years of different playing fields", *Slobozans`kij naukovo-sportivnij visnik*, No. 3, pp. 123-126. (in Ukr.)
10. Pertsukhov, A.A. (2013), "Comparative characteristics of special preparedness indicators for central and extreme defenders 17–19 years old", *Slobozans`kij naukovo-sportivnij visnik*, No. 2, pp. 62-66. (in Russ.)
11. Shevchenko, A.Yu. & Boichenko, S.V. (2014), "Struktura i zmist protsesu pidhotovky yunykh futbolistiv na etapi pochatkovoi pidhotovky", *Naukovyi chasopys NPU imeni M.P. Drahomanova*, Vypusk 6 (49), pp. 147-155. (in Ukr.)
12. Bolotin, A. & Bakayev, V. (2017), "Pedagogical conditions required to improve the speed-strength training of young football players", *Journal of Physical Education and Sport*, No. 17(2), pp. 638-642.

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Kraynik, Ya., Mulik, V. & Lebediev, S. (2019), "Performance indicators of the technical and tactical actions of young football players of 13–14 years of various game roles", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 5(73), pp. 48-52, doi: 10.5281/zenodo.3596563

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Analysis of performances of European Championship participants among women's wrestling cadets

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Purpose: *to analyze the sports achievements of the participants of the European Championships among cadets in women's wrestling for the national team of Ukraine.*

Material & Methods: *analyzed the sports careers of 74 athletes of the Ukrainian team, who took part in the European Championship among cadets from 2000 to 2010, and their further performances to date.*

Results: *the following indicators are considered: the results of the athletes 'performances at the European Championship among cadets; the number of athletes who continued their careers separately in junior and adult years; results of the performance of athletes in junior and adulthood at international competitions.*

Conclusions: *the general trends of the future career and achievements of the athletes of the national team of Ukraine who participated in the European Championships among cadets from 2000 to 2010 are revealed. For athletes established the relationship of their own results at all stages of a sports career. Quantitative data and distribution of characteristics for all 74 participants of the competition are given: 56.8% of female athletes continued their career among adults, and 24.3% took prizes in European and world championships. An outstanding result is emphasized - five athletes managed to take part in the Olympic Games.*

Keywords: *analysis of competitions, sports result, wrestling, cadets, women.*

Introduction

Successful and effective management of sports training is impossible without sound forecasting, adequate to modern scientific knowledge. Forecasting creates the necessary prerequisites for making the right managerial decisions by athletes, coaches, and administration. Forecasting is aimed at designing, planning and, ultimately, at achieving set promising goals (V. Tkachuk, 2005; T. O. Bompa, 2009; O. A. Shinkaruk, 2011; V. N. Platonov, 2015). The main priority goal of training highly qualified athletes is success in international competitions among adults - European Championship (EC), World Championship (WC) and the Olympic Games (OG). The identification of talented athletes (Talent Identification) and ways to improve them is one of the most discussed and popular areas in training athletes (R. Vaeyens, 2008; J. Gulbin, 2013; V. M. Kostyukevich, 2014; G. F. Vasiliev, 2016; V. Issurin, 2017).

A retrospective and perspective analysis of a sports career is distinguished (K. Johnston, 2018). A prospective analysis allows you to track the future career of young talented athletes; find out how important early athletic achievement is to good adult performance (J. Brouwers, 2012; L. Bruce, 2013). A retrospective analysis of a sports career reveals the relationship between the results at all stages of the sports career of elite adult athletes who have achieved results (M. Latyshev, 2016; P. Li, 2018).

These types of analyzes are carried out for different types of varieties and levels of athletes: from a candidate for national teams (J. Barreiros, 2012) to Olympic champions (L. Bruce, 2013; H. Tunnemann, 2016; M. Latyshev, 2020). Such studies were carried out in freestyle wrestling (S. Latyshev, 2009; B. I. Tarakanov, 2013), Greco-Roman wrestling (Yu. Tropin, 2013; M. Baic, 2014), taekwondo (P. Li, 2018). However, we did not find scientific papers on women's wrestling and analysis of the sports career of athletes in a particular country.

Purpose of the study: to analyze the further sports achievements of the participants of the European Championships among cadets in women's wrestling for the national team of Ukraine from 2000 to 2010.

Material and Methods of the research

All the performances of the athletes who participated in the European Championships among cadets from 2000 to 2010, and their further performances to date (August 2019), are analyzed. In general, the sports careers of 74 athletes of the Ukrainian team were analyzed, who took part in 780 competitions in the international arena during their careers. All data is taken from the official site "United World Wrestling" (unitedworldwrestling.org, 2019).

The following indicators are considered:

– the results of the performances of athletes at the European Championships among cadets;
– the number of athletes who continued their careers separately in the cadet and junior age;

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– the results of the performance of athletes in junior and adulthood at international competitions – EC, WC and OG

All athletes were divided into two groups: participants in the European Championships and prize-winners (athletes who took from 1 to 3 places inclusive). For both groups, all indicators listed above were considered.

For data analysis, all results were summarized in a single table (DataFrame). Statistical processing was performed using the Python 3.7 programming language, and visualization of the results using MS Excel.

Results of the research

The first part of the study discusses the general trends of the women's national team of Ukraine at the European Championships among cadets in the period from 2000 to 2010 and during the further careers of all athletes.

Table 1 presents data on the number of athletes, participants and prize-winners of the competition, depending on the European Championship year and age group (cadets, juniors and adults).

Considering the general trends, it is worth noting that medals were won at all European Championships for the analyzed period. The distribution of the number of won medals (prize-winners) for each year ranges from 2 (22,2%) in 2004 to 9 (90,0%) in 2010. The number of athletes who continued their careers at a junior age ranged from 3 (37,5%) in 2005 to 8 (80,0%) in 2009 and 2010. However, there are much fewer prizes: from 1 (10,0%) medals to 6 (60,0%) in 2006 and 2010.

The number of athletes who have continued their careers among adults is declining, but not significantly, which indicates a high degree of training and an early transition from junior wrestling to adult wrestling among women. However, various trends are visible here: in 2000, 2001, 2002, 2007 the number of athletes who continued their careers was reduced; in 2003, 2004 and 2010 – it remains unchanged, and in the remaining years it rises (some athletes did not take part in the junior competitions, but continued to perform in adulthood).

Figure 1 shows the total number of athletes who participated and won prizes in the European Championship among cadets; the number of athletes who continued their careers and achieved results in junior and adulthood.

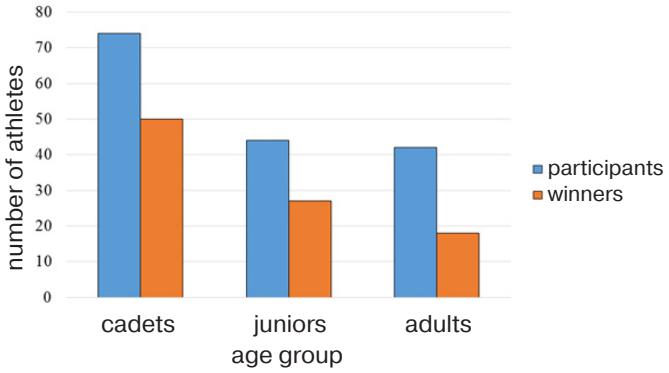

Fig. 1. Distribution of the number of participants and prize-winners of competitions depending on age group

In general, during 2000–2010, 74 athletes took part in the European Championships at the cadet age, of which 50 (67,6%) athletes became prize winners. Further career in junior age was continued by 44 athletes (59,5%) and only 27 (36,5%) of them won prizes in international competitions (European Championship or World Championship). A significant reduction in the number of female athletes in junior age is a natural process for selecting the most promising and talented female athletes. The most important successes of athletes are achievements in an adult career. Almost all athletes who took part in competitions at a junior age continued their career among adults 42 (56,8%). However, only 18 (24,3%) athletes achieved a result (prizes at the European Championship or World Championship) in adult competitions.

The analysis showed that 8 (10,8%) athletes changed their citizenship and continued to act as representatives of other countries. They all continued their performances until an adult career and 5 (62,5%) athletes achieved significant results. The processes of emigration and immigration of athletes must be considered comprehensively; This direction of research is relevant and requires further in-depth study (R. Sushko, 2016).

The second part of the work deals with the performances of only winners of the cadet championships of Europe. These data represent important information in the preparation of

Table 1

The distribution of the number of participants and winners of the competition by year

Indicators	Year of the European Championships										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
The number of participants in the European Championship among the cadets	10	8	10	10	9	8	10	9	10	10	10
The number of athletes who won prizes at the European Championship among cadets	4	5	7	5	2	7	6	7	5	5	9
The number of participants who continued their careers and took part in competitions among juniors	7	6	4	5	6	3	7	7	5	8	8
The number of athletes who won prizes in competitions * among juniors	3	3	1	5	5	2	6	5	3	4	6
The number of participants who continued their careers and took part in competitions among adults	5	3	4	5	6	4	8	6	6	9	8
The number of athletes who won prizes in competitions * among adults	2	3	2	3	4	0	2	3	2	4	5

Remark. ** – only winners of European and World Championships are considered.*

Table 2

Distribution of the number of European Championship winners among cadets by year and their further achievements

Indicators	Year of the European Championships										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
The number of athletes who won prizes at the European Championship among cadets	4	5	7	5	2	7	6	7	5	5	9
The number of athletes who won the European Championship among cadets	1	3	3	5	2	3	4	4	2	3	4
The number of participants who continued their careers and took part in competitions among juniors	4	4	3	3	3	2	7	7	5	8	8
The number of athletes who won prizes in competitions * among juniors	3	3	1	3	3	1	5	5	3	4	6
The number of participants who continued their careers and took part in competitions among adults	4	3	3	4	4	3	7	6	6	7	8
The number of athletes who won prizes in competitions * among adults	2	3	2	3	3	0	2	3	2	4	5

Remark. ** – only winners of European and World Championships are considered.*

a long-term plan for training athletes: how significant is the achievement of the result in cadet competitions, rather than simply participating in them. Table 2 shows the distribution by year of the number of European winners among the cadets; the number of participants and prize-winners in junior and adulthood.

As the analysis of the table shows, for more than 10 years every year, athletes won gold medals at the Cadet European Championships, which indicates a high level of training for the young generation from 2000 to 2010. The general trend is that a significant part of the medalists of the cadet competitions continued their careers at a junior age, and then in adulthood. It is worth noting that the distribution by year is uneven. For example, in 2005, out of 7 prize-winners (of which three are champions of the competition), only 2 continued their careers in junior age, 3 in adulthood, and did not win a single medal throughout their adult careers. While in 2010, out of 9 athletes, 8 continued their careers in adulthood and 5 athletes achieved results in an adult career.

In total, from 2000 to 2010, 50 female athletes won medals at the European Championship among cadets (17 of them won a gold medal), of which 34 (68,0%) continued their careers at a junior age and 33 (66,0%) – in an adult career. Of the athletes' data, 24 (48,0%) athletes achieved results in junior age and only 17 (34.0 – in adults they won medals.

It is worth noting that of all the participants, five athletes managed to take part in the Olympic Games, and one athlete (Stadnik, Mariya) won prizes in competitions of the highest level.

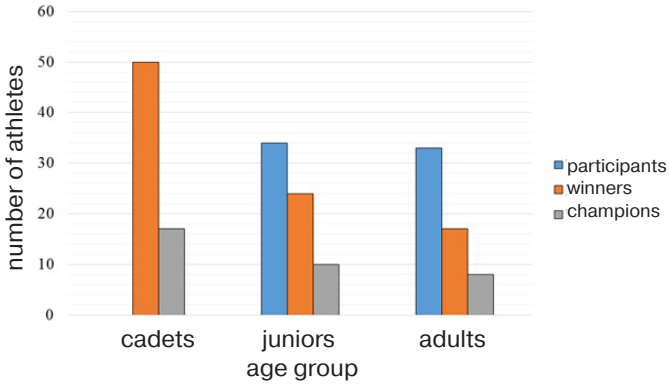

Fig. 2. The number of athletes who won prizes in the European Championship among cadets, and their further achievements in the junior and adult careers

Conclusions / Discussion

The significance of early sports achievements for high results in an adult career is revealed; for elite athletes, interconnected results at all stages of their own sports career.

An analysis of the subsequent sporting achievements of the participants of the European Championships among women's cadets in women's wrestling, who played for the Ukrainian team from 2000 to 2010, showed that 67,6% of the athletes became winners, and 22,9% were champions of the European Championships among cadets.

Of the 74 competitors, 42 (56,8%) athletes continued their career among adults, and 18 (24,3%) athletes achieved high results (won prizes in the European Championship or World Championship) in adult competitions. Among the 50 winners of the competition, 33 (66,0%) continued their careers in adulthood and 17 (34,0%) athletes achieved high results, five athletes managed to take part in the Olympic Games, and one athlete (Stadnik, Mariya) won prizes in top level competitions.

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References

1. Vasilev, G.F., Novikov, A.A., Krupnik, Ye.Ya. & Tiunova, O.V. (2016), "Evaluation of competitive activity as the basis for predicting results in martial arts", *Vestnik sportivnoy nauki*, No. 5, pp. 3-7. (in Russ.)

Latyshev, M., Rybak, L., Holovach, I., Korolov, B., Liashenko, O. & Kvasnytsya, O. (2019), "Analysis of performances of European Championship participants among women's wrestling cadets", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 5(73), pp. 53-56, doi: 10.5281/zenodo.3596608

2. Kostiukevych, V.M. (2014), " Modeling in the High Qualification Athlete Training System", *Fizychna kultura, sport ta zdorov'ia natsii*, No. 18(2), pp. 92-102. (in Ukr.)
3. Latyshev, M.V., Shandryhos, V.I. & Mozeliuk, O.V. (2016), "Analysis of performances and prognosis for future competitions of the national team of Ukraine in free wrestling", *Moloda sportyvna nauka Ukrainy*, No. 1, pp. 102-107. (in Ukr.)
4. Latyshev, S.V. (2009), "The Problem of Selecting and Predicting Sports Results in Freestyle Wrestling", *Pedagogika, psikhologiya ta mediko-biologichni problemi fizichnogo vikhovannya i sportu*, No. 10, pp. 110-113. (in Russ.)
5. Platonov, V.N. (2015), *Sistema podgotovki sportsmenov v olimpiyskom sporte* [The system of training athletes in Olympic sports], Olimpiyskaya literatura, Kiev. (in Russ.)
6. Tkachuk, V., Petrovich, B., Yagello, V., Yagello, M., Oyzhanovski, A., Rakovski, A., Polishchuk, T., Tomchak, M., Zdeshinski, A. & Skovron, Ya. (2005), "On the possibilities and methods of forecasting in relation to sports", *Fizicheskoe vospitanie studentov tvorcheskikh spetsialnostey*, No. 1, pp. 33-48. (in Russ.)
7. Sushko, R. & Doroshenko, E. (2016), "Globalization in the modern world and its impact on the sport of excellence", *Sportyvnyi visnyk Prydniprovia*, No. 2, pp. 140-146. (in Ukr.)
8. Tropin, Yu.N. (2013), "A comparative analysis of the technical and tactical preparedness of Greco-Roman style wrestlers at the 2008 Olympic Games and 2012 Olympic Games", *Fizicheskoe vospitanie studentov*, No. 4, pp. 92-96. (in Russ.)
9. Tarakanov, B.I. & Apoyko, R.N. (2013), "System-historical analysis and development trends of freestyle wrestling in the programs of the Olympic Games", *Uchenye zapiski universiteta imeni P.F. Lesgafta*, No. 4 (98), pp. 160-165. (in Russ.)
10. Shinkaruk, O.A. (2011), *Otbor sportsmenov i orientatsiya ikh podgotovki v protsesse mnogoletnego sovershenstvovaniya* [Selection of athletes and orientation of their training in the process of many years of improvement], Olimpiyskaya literatura, Kiev. (in Russ.)
11. Barreiros, A., Сфтй, J. & Fonseca, A.M. (2012), "From early to adult sport success: Analysing athletes' progression in national squads", *European Journal of Sport Science,* pp. 1-5, doi: 10.1080/17461391.2012.671368.
12. Biac, M., Hrvoje, K. & Sprem, D. (2014), "Beginning age, wrestling experience and wrestling peak performance-trends in period 2002-2012", *Kinesiology,* No. 46 (S-1), pp. 94-100.
13. Bompa, T.O. (2009), *Periodization training: Theory and methodology,* Human Kinetics.
14. Brouwers, J., De Bosscher, V. & Sotiriadou, P. (2012), "An examination of the importance of performances in youth and junior competition as an indicator of later success in tennis", *Sport Management Review,* No. 15(4), pp. 461-475, doi: 10.1016/j.smr.2012.05.002.
15. Bruce, L., Farrow, D. & Raynor, A. (2013), "Performance mile-stones in the development of expertise: Are they critical?", *Journal of Applied Sport Psychology,* No. 25, pp. 281-297, doi: 10.1080/10413200.2012.725704.
16. Johnston, K., Wattie, N., Schorer, J. & Baker, J. (2018), "Talent Identification in Sport: A Systematic Review", *Sports Medicine*, No. 48(1), pp. 97-109, doi: 10.1007/s40279-017-0803-2.
17. Gulbin, J., Weissensteiner, J., Oldenziel, K. & Gagnй, F. (2013), "Patterns of performance development in elite athletes", *European Journal of Sport Science,* No. 13(6), pp. 605-614.
18. Issurin, V. (2017), "Evidence-based prerequisites and precursors of athletic talent: a review", *Sports Medicine*, No. 47(10), pp. 1993-2010, doi: 10.1007/s40279-017-0740-0.
19. Latyshev, M., Latyshev, S., Korobeynikov, G. Kvasnytsya, O., Shandrygos, V. & Dutchak, Y. (2020), "The analysis of the results of the Olympic free-style wrestling champions", *Journal of Human Sport and Ex*ercise, No. 15 (2), doi: 10.14198/jhse.2020.152.14.
20. Li, P., De Bosscher, V., Pion, J., Weissensteiner, J.R. & Vertonghen, J. (2018), "Is international junior success a reliable predictor for international senior success in elite combat sports?", *European journal of sport science,* No. 18(4), pp. 550-559.
21. Tunnemann, H. & Curby, D.G. (2016), "Scoring Analysis of the Wrestling from the 2016 Rio Olympic Games", *International Journal of Wrestling Science*, No. 6(2), pp. 90-116.
22. Vaeyens, R., Lenoir, M., Williams, A.M. & Philippaerts, R.M. (2008), "Talent Identification and Development Programmes in Sport: Current Models and Future Directions", *Sports Medicine*, No. 38(9), pp. 703-714.
23. United World Wrestling. Unitedworldwrestling.org. (2019), available at: https://unitedworldwrestling.org/database. (25 August 2019)

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Features of the classification of acrobatic exercises of group B – "balancing" and their varieties in artistic swimming

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Purpose: *to classify acrobatic exercises of group B according to their level of complexity.*

Material & Methods: *theoretical analysis and synthesis of scientific and methodological literature data, analysis of competition results, pedagogical observations, surveys, questionnaires, video analysis of competitive programs of the finalists of the World and European Championships 2008–2019, system analysis, methods of mathematical statistics.*

Results: *the author's system of classification of acrobatic exercises made it possible to sort in detail and develop a method for determining and calculating the complexity of 130 basic acrobatic exercises of group B.*

Conclusions: *the data obtained became the basis for the development of a single table of the technical value of acrobatic exercises of group B in artistic swimming. Preliminary testing of this system and its discussion at international seminars for specialists, coaches and judges of various qualifications in artistic swimming made it possible to introduce a number of refinements, additions and to improve the development of a system for classifying acrobatic exercises of group B and assessing their complexity.*

Keywords: *acrobatic exercises, artistic swimming, balancing, classification, technical value.*

Introduction

In recent years, judges' special attention in artistic swimming has been paid not only to curly ties, but also to spectacular acrobatic exercises, which occupy 20–25% of the entire performance [9] and very well reflect the level of skill of athletes [2]. Based on statistical data, the greatest surge in the creation of new, previously unknown acrobatic exercises in artistic swimming began in 2013 at the World Synchronized Swimming Championships in Barcelona (Spain), where 17 strongest teams of the world took part.

The greatest variety of acrobatic exercises was shown there compared to 2008–2012. First of all, the exercises of group B were demonstrated – "balancing", where athletes performed acrobatic exercises "without breaking away from the support". The diagram below shows the results of a video analysis of the performances of the finalists of the World Synchronized Swimming Championships in 2013. Where 38% of all the acrobatic exercises demonstrated were group A exercises – "in the air". Only 4% of combined acrobatic exercises were demonstrated and group P acrobatic exercises – "platforms" – 6%. The most performed were exercises of group B – "balancing", with a result of 49%.

On the diagram you can see the variety of acrobatic exercises of both group A and group B. With 49% of the group B belong to "balancing", 19% took ordinary "Lifts", where the entire team of 7 athletes is lifted from the water performer. 13% belong to "paired elevators" – acrobatic exercises, which are the same as "Elevators", but in "paired elevators" 8 athletes are divided into two small groups, each of which has its own performer. 2% – performing the simplest acrobatic exercise, where the performer sits on the shoulders of the middle "support" athlete was performed on. The same result belongs to

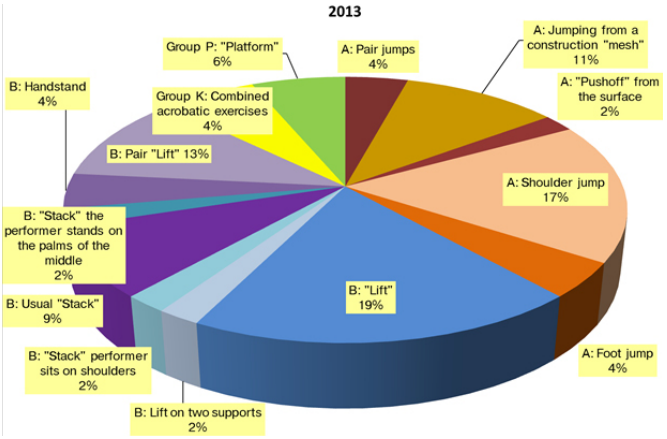

Fig. 1. Percentage of acrobatic exercises performed at the World Synchronized Swimming Championships in 2013

the acrobatic right, where the performer balanced on two average "supporting" athletes. "Stack", where the performer stands on the palms of the average "support" athlete, also amounted to 2%. The usual "Stack" was performed 9% and 4% of the execution was a heavy acrobatic exercise, where the performer demonstrates a stand on her hands, balancing on the palms of the middle "supporting" athlete.

Group A "jumping" – a group where the performer performs acrobatic exercises in the air, did not show such a variety in comparison with group B. In total, the performer jumped from the shoulders of the average "supporting" athlete – 17%. The next most demonstrated acrobatic exercise is the performer's jump from the lattice design – 11%. The least performed acrobatic exercises: "pushing" the performer off the surface – 2% and a jump from the legs of the average "supporting" athlete

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showed only 4%.

Unfortunately, many teams did not receive well-deserved high marks, primarily because in the FINA rules [8; 10] at that time there was no clear classification of acrobatic exercises and criteria for assessing their complexity. In this regard, the need arose for a detailed study of the varieties of acrobatic exercises in artistic swimming, and it was decided to start with group B, which is very close to sports acrobatics, which later made it possible to navigate and rely on the classification and technical values of acrobatic elements in this sport and take them as the basis for developing your own system.

Purpose of the study: to classify acrobatic exercises of group B according to their level of complexity.

Material and Methods of the research

Research methods – theoretical analysis and synthesis of scientific and methodological literature data, analysis of competition results, pedagogical observations, surveys, questionnaires, video analysis of competitive programs of the finalists of the World and European Championships 2008–2019, system analysis, methods of mathematical statistics.

Results of the research

In a previous publication [5], two varieties of acrobatic exercises of group B were identified. Based on the principles of identifying structural groups in spectacular sports [4; 6; 7], the exercises of this group were divided into two subgroups: Lifts – from the English. lift – lift and Stak – the term according to CODE OF POINTS [6] and means acrobatic exercises, where the athlete "performer" is located on the "middle" (or supporting) athlete, which under water contains six athletes.

It is believed that the Lifts group is the easiest, because it does not require special coordination skills and special ability to work together from female athletes due to the fact that this subgroup consists only of a "performer" and sportswomen who lift it.

Between themselves, these acrobatic exercises differ only in the level of flexibility that the "performer" demonstrates, provided that the same number of "athlete-lifters" are the same. Very rarely, athletes perform an acrobatic exercise, when the "athlete-lifts" simultaneously move parallel to each other, due to which the position of the "performer" changes. This type is called an acrobatic exercise on a "moving" structure (Figure 2).

The next and most is the Stak group. The most important factor affecting the complexity and at the same time the technical value of the acrobatic exercise is the area of the support on which the athlete balances.

The area of support provided by the average (support) athlete is: large, medium, small and very small. A large area of support includes parts of the body of the average athlete, such as the stomach, back, and hips. Shoulders and shoulder blades were assigned to the middle area of the support, feet and head to a small area of the support. Palms (arms) were assigned to a very small area of the support (extreme level).

It is important to note that the complexity depends not only on

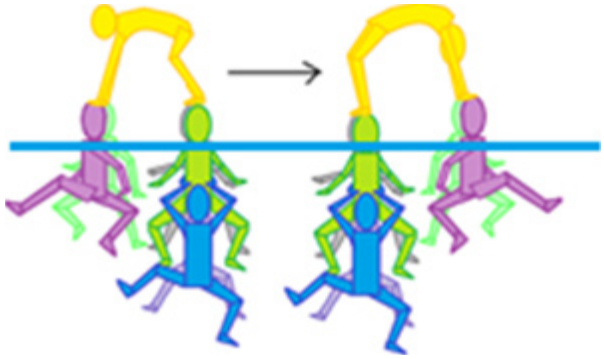

Fig. 2. An example of a "movable" design, where the "athlete-lifts" simultaneously move, thereby changing the position of the "performer"

the area of the support provided by the average athlete, but also on what part of the body the "performer" rests or stands on this plane. That is, if a performer sits with her hips (large area of support) on a very small area of support, then this cannot be evaluated equally with a stable performer (very small area of support), which rests only on the hands of the average athlete (very small area of support). Given these factors, numerical values were assigned to each type of plane (Table 1).

Table 1
Digital values the support area

Plane size	Value
Big	0,1
Average	0,3
Small	0,5
Very small	0,6

The next step was to combine the existing types of acrobatic exercises of group B of the Stak subgroup into a single table, which forms the evaluation criterion "Support area" or "Connection type cost".

To determine the value of each "combination", the value of the area of the support provided by the average athlete is entered in the first column, and in the other column the area of the support on which the "performer" balances. In the third column is the "average" derived from the previous two. Also added another column for "applications and visible". And the last column is the "total cost", which is written in the number derived by adding all the previous numbers.

Subtraction for those exercises where:

- the average athlete holds the performer with both hands (–0.3)
- pushing athletes are not under water, holding the average athlete, but on the surface of the water and provide additional support to the upper athlete (–0.2)
- body center of mass is very close to the support.

Applications:

- acrobatic exercise is performed by the performer, leaning on the head of the average athlete (0.2)
- for the "foot / foot" connection, where there is not a single grab between the average athlete and the performer (0.2)

Table 2

Cost of the type of "connection" of the performer and the average (supporting) athletes

Type	Support area of the average athlete	Support area of the performer	Average	Applications and subtraction	Total cost
Hips on shoulders	0,3	0,1	0,2	–0,1	0,1
Feet on the shoulders	0,5	0,3	0,4	–0,3	0,1
Shoulders on legs (performer is in upside down position)	0,5	0,3	0,4		0,4
Shoulder on the hips	0,3	0,3	0,3	+0,2	0,5
A brush on the head and additional support with one hand for the average athlete	0,5	0,6	0,55	–0,1 +0,2	0,65
Foot / Foot	0,5	0,5	0,5	+0,2	0,7
Brushes / Brushes	0,6	0,6	0,6	+0,4	1

• for compounds where the performer and the average athlete do not see each other – "blind connections" (+0,2)
• to connect the brush / brush 0.4 because the performer is upside down, leaning on a very small support (brushes), which is difficult to balance, given the efforts that the average athlete must make to keep the weight of the performer (which is in an upright position and presses on the average athlete with all the weight) on his hands.

The next factor that affects the technical value of acrobatic exercises of group B of the Stak subgroup is the position that the performer demonstrates.

Based on the assessment of this criterion was taken developed by prof. Medvedeva [3; 7] a system for determining technical value in rhythmic gymnastics. Leg movements were distributed in the following directions: forward, sideways and backward. And depending on what degree the foot / foot rise or fall from the vertical line, the athletes will get 0,1. For example: an assessment starts at 90° and has a value of 0,1 (forward and to the side), 135° has a value of 0,2, and a full twine of 180° is estimated at 0,3 points. With the exception of the backward direction, where the cost is a little more, because physiologically making back deflection is more difficult than raising your leg forward [1].

Among the criteria for evaluating a position, certain "bonuses" were derived:

- If balancing is performed standing on one leg 0,1
- Grip with both hands legs 0,1
- Position performed upside down +0.2

An equally important factor of complexity is the turn of the whole structure, when athletes who are under water push the average athlete and she, together with the performer, rotates around herself. This factor affects the content of the performer of the position and requires special skills from her. Therefore, athletes who demonstrate such acrobatic exercises, as a rule, receive a great rating.

Table 3

Technical value of the turnover of the entire structure in group B

Rotation degree	Technical value
180°	0,1
360°	0,2
540°	0,3
720°	0,4

Conclusions / Discussion

The author's system of classification of acrobatic exercises made it possible to sort and develop in detail the methodology for determining and calculating the complexity of 130 basic acrobatic exercises of group B.

The data obtained became the basis for the development of a single table of technical value of group B acrobatic exercises in artistic swimming.

Previous testing of this system and their discussion at international seminars of specialists, coaches and judges of various qualifications in artistic swimming made it possible to introduce a number of refinements, additions and improve the development of a system for classifying acrobatic exercises of group B and assessing their complexity.

In the future, it is planned to develop a classification system for acrobatic exercises of group A, in which acrobatic exercises are performed by a "performer" in the air.

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References

1. Gaverdovskiy, Yu.K. (2007), *Obuchenie sportivnym uprazhneniyam. Biomekhanika. Metodologiya. Didaktika* [Training in sports exercises. Biomechanics. Methodology. Didactics], Fizkultura i sport, Moscow. (in Russ.)
2. Maksimova, M.N. (2012), *Teoriya i metodika sinkhronnogo plavannya* [Theory and Methods of Synchronized Swimming], Sovetskiy sport, Moscow. (in Russ.)
3. Medvedeva, Ye.N. (2017), *Obektivizatsiya tekhnicheskoy tsennosti elementov strukturnykh grupp khudozhestvennoy gimnastiki: avtoreferat dissertatsii na soiskanie uchenoy stepeni doktora pedagogicheskikh nauk* [Objectification of the technical value of the elements of the structural groups of rhythmic gymnastics: DS thesis abstract], Sankt-Peterburg, 54 p. (in Russ.)

Petrenko, A. & Kamaiev, O. (2019), "Features of the classification of acrobatic exercises of group B – "balancing" and their varieties in artistic swimming", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 5(73), pp. 57-60, doi: 10.5281/zenodo.3596616

4. Somkin, A.A. (2002), *Klassifikatsiya uprazhnenii i osnovnye komponenty podgotovki vysokokvalifitsirovannykh gimnastov v sportivnoy aerobike: avtoreferat dissertatsii na na soiskanie uchenoy stepeni doktora pedagogicheskikh nauk* [Classification of exercise and the main components of the training of highly qualified gymnasts in sports aerobics: DS thesis abstract], Sankt-Peterburg, 34 p. (in Russ.)
5. Petrenko, A.S. (2019), "Classification of acrobatic elements for artistic swimming", *Tezi dopovidey XII Mizhnarodnoï konferentsiï molodikh vchenikh "Molod ta olimpiyskiy rukh"*, 17 travnya 2019 r., Kyiv, pp. 157-158. (in Russ.)
6. FIG (2017), Code of points acrobatic gymnastics tables of difficulty 2017-2020, available at: http://www.fig-gymnastics.com/publicdir/rules/files/en_ACRO%20CoP%202017-2020.pdf.
7. FIG (2013), Code of Points Rhythmic Gymnastics 2013-2016, available at: https://www.scottishgymnastics.org/sites/default/files/imce/disciplines/2012%20-%202016%20Rhythmic%20Code%20of%20Points.pdf.
8. FINA (2017), Synchronised Swimming Manual for Judges, Coaches & Referees 2017–2021, available at: https://www.fina.org/sites/default/files/fina_as_manual_-_updated_august_2018.pdf.
9. Miwako Homma & Haruka Fujishima (2013), "Analysis of team free routine choreography in synchronized swimming", *FINA Synchronised Swimming Worldwide seminar*, 1st – 3rd November 2013, St Petersburg, Russia.
10. Brady, Rachel (2012), "Science and swimming in sync", available at: https://www.theglobeandmail.com/sports/olympics/science-and-swimming-in-sync/article4226132/ (accessed 06.11.2019)

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Correlation of morphological and functional indicators with sports results among qualified athletes specializing in freestyle swimming at distances of various lengths

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Purpose: *determine the degree of correlation between morphological and functional indicators and athletic performance among qualified athletes specializing in freestyle swimming at distances of various lengths.*

Material & Methods: *analysis of literary sources, timekeeping, anthropometric and physiological measurements, methods of mathematical statistics. The contingent of the examined was composed of qualified athletes specializing in freestyle swimming at sprint, middle and stayer distances.*

Results: *the authors formed a morphological and functional profile of qualified athletes specializing in freestyle swimming at distances of various lengths, studied the differences that occur in indicators of the level of morpho-functional development of athletes depending on their distance specialization, determined the degree of correlation between morpho-functional performance and sport result among qualified swimmers specializing in sprinting, middle and stayer distances.*

Conclusions: *determining the degree of relationship between morphological and functional indicators and sports results at different distances in freestyle can be used to improve the selection and orientation of qualified swimmers.*

Keywords: *swimmers, freestyle, distances, morphological and functional indicators, differences, relationship.*

Introduction

The constant growth of competition in sports swimming dictates the need for a continuous search for ways to optimize the training system for swimmers, aimed at achieving an increasingly high level of competitive activity indicators [8; 9 et al.].

It is well known that the swimming speed in various ways and at different distances is determined by the physique, physical and functional preparedness of athletes.

As a result of numerous studies conducted by experts in the field of sports swimming, the practice of sports has been enriched with the characteristics and regulatory requirements of physical development and special preparedness of swimmers of various qualifications and specializations [1; 4; 5; 6; 7, 12; 13 et al.].

However, as modern world practice shows, previously developed model characteristics today require constant correction.

The modern literature contains quite a lot of information regarding the study of the components of the structure of physical, technical, tactical, psychological and integral preparedness that affect the sports result [2; 3; 9; 11; 14; 15 et al.].

At the same time, the study of the relationship between morphological and functional indicators and athletic performance in qualified athletes of various distance specializations does not lose its relevance.

A detailed study of this direction opens up new prospects for improving the training process of swimmers based on the identification of the most significant indicators that affect the result..

Purpose of the study: to determine the degree of relationship between morphological and functional indicators and athletic performance in qualified athletes specializing in freestyle swimming at distances of various lengths.

Objectives of the study:

1. To characterize the morpho-functional profile of qualified athletes specializing in freestyle swimming at distances of various lengths.

2. To study the differences that occur in indicators of the level of morphological and functional development of athletes, depending on their distance specialization.

3. Determine the degree of correlation between morphological and functional indicators and athletic performance in qualified swimmers specializing in sprinting, middle and stayer distances.

Material and Methods of the research

To solve the tasks, the following methods were used: analysis of literature, timekeeping, anthropometric and physiological measurements, methods of mathematical statistics.

The surveyed group consisted of a number of qualified athletes specializing in freestyle swimming at sprint, middle and stayer

Pilipko, O. & Pilipko, A. (2019), "Correlation of morphological and functional indicators with sports results among qualified athletes specializing in freestyle swimming at distances of various lengths", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 5(73), pp. 61-65, doi: 10.5281/zenodo.3596629

distances. All of them were participants in the championships and championships of Ukraine in swimming. The sports qualification of the examined contingent corresponded to the level of Candidate Master of Sports – Master of Sports.

Results of the research

Among the main morphological and functional indicators of athletes specializing in freestyle swimming at distances of various lengths, we determined: body length and weight, VC, arm span, trunk length, shoulder width, pelvis, hands, longitudinal and girth sizes of upper and lower extremities and their segments, girth of the chest at rest, on inhalation, on exhalation, mobility in the shoulder joints, leaning forward.

The obtained digital material allowed us to form a morphological and functional profile of swimmers specializing in sprinting, middle and stayer distances (Fig. 1–3).

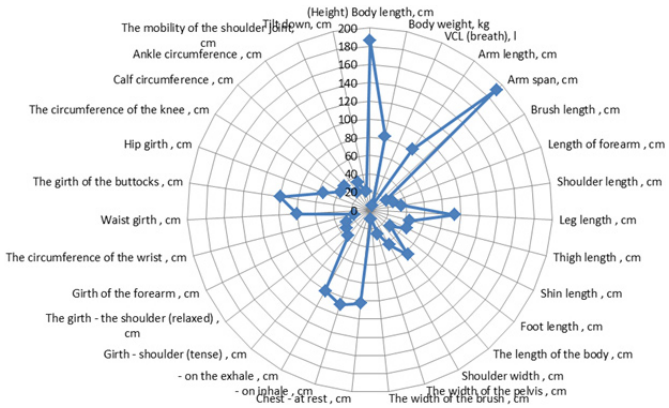

Fig. 1. Morphological and functional profile of qualified athletes specializing in freestyle swimming at sprint distances

As can be seen from Figure 1, sprinter swimmers are characterized by high growth (186,17±6,11 cm), large weight (83,00±8,92 kg), long limbs and their segments, and well-developed muscles.

Significant girth sizes of the chest are noted in them (at rest, the values are at the level of 102,42±6,14 cm, while inspiration and exhalation are 108,58±5,68 cm and 100,83±7,08 cm, respectively).

They are also distinguished by the large among representatives of other remote specializations the value of the circumference of the shoulder (36,42±2,42 cm in tension, 32,42±2,46 cm in relaxed state), hips (54,67±1,60 cm) and waist (80,00±4,05 cm).

Athletes who specialize in middle-distance freestyle swimming have high values for body length (188,33±3,67 cm), weight (82,33±4,55 kg), chest girth (alone – 101,00±5,18 cm, on inspiration – 107,75±5,74 cm, on exhalation – 98,92±6,97 cm) and limbs (arm lengths are 84,65±2,52 cm, legs – 98,00±5,10 cm) (Figure 2).

Stayer swimmers are characterized by the smallest in comparison with the fins, acting at short and medium distances, height (184,71±6,21 cm) and weight (74,14±8,28 kg).

They are also distinguished by small circumferential sizes

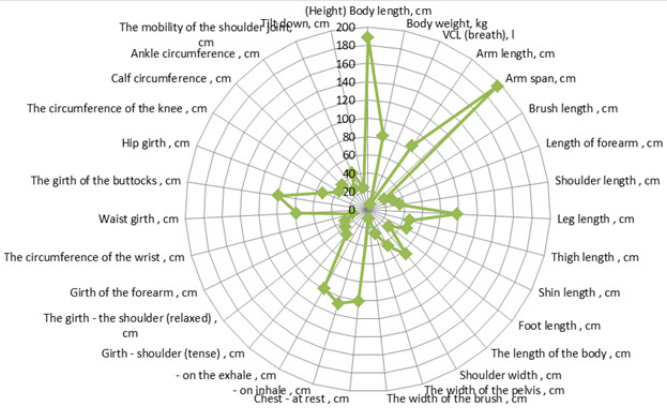

Fig. 2. Morphological and functional profile of qualified athletes specializing in freestyle swimming at s middle distances

(chest circumference at rest – 99,50±6,90 cm, on inspiration – 105,21±6,10 cm, on exhalation – 97,64±6,56 cm; circumference of the shoulder in strained and relaxed: 33,64±2,73 cm and 29,86±2,63 cm, respectively; waist – 77,07±7,31 cm, lower legs – 35,93±2,98 cm, ankles – 23,57±2,35 cm, etc.) (Fig. 3).

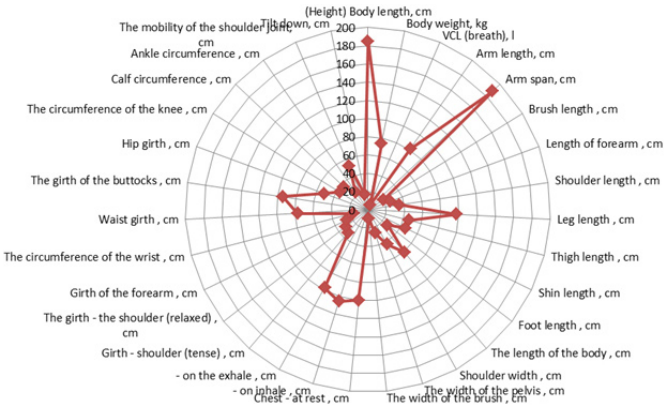

Fig. 3. Morphological and functional profile of qualified athletes specializing in freestyle swimming at stayer distances

Having examined the differences in the level of morphological and functional development of athletes depending on their distance specialization, we got the following picture.

Athletes specializing in middle-distance swimming are ahead of sprinters and styers in all longitudinal body sizes (values of body length, arm span, linear dimensions of the hand, forearm, shoulder, leg, thigh, lower leg, foot and trunk). Also, swimmers of this distance specialization have the largest transverse dimensions (width of the shoulders, pelvis, and hand).

In turn, sprinters are heavier compared to styers and middle (their weight averages 83,00±8,92 kg), they also have large absolute values of girth sizes, because in comparison with representatives of other distance specializations they are more muscular mass due to the performance of work requiring maximum manifestation of muscle effort.

The advantage of mid-size athletes in terms of the circumferential size of the lower leg and ankle is due to the significant requirements that apply to leg work at distances of a given

length.

It is worth noting that as the distance increases, the absolute values of the circumferential dimensions of the body decrease. This is due to significant requirements for hydrodynamic performance swimmers-styers.

Representatives of stayer swimming have the most developed mobility in the shoulder joints.

Such an indicator of functional development, as VC, is large in absolute values among athletes specializing in swimming at medium distances.

Thus, distance specialization leaves its mark on the absolute values of the indicators of the morphological and functional development of swimmers.

The correlation analysis revealed that the following parameters are most related to sports results for sprinters: hip circumference (R=0,62), thigh length (R=0,58) and forearm (R=0,58), shoulder girth in stress (R=0,54), mobility in the shoulder joints (R=0,45).

In middle-aged swimmers, they most affect the athletic performance: hip circumference (R=0,96), height (R=0,95), lower leg (R=0,95), wrist circumference (R = 0,95), hand length (R=0,89), arm length (R=0,86), weight (R=0,86), forearm length (R=0,84), foot length (R=0,70), arm span (R=0,50).

Among the significant morphological and functional indicators for the styers are: the length and width of the hand (R is 0,84 and 0,70, respectively), the circumference of the chest at rest (R=0,56), the width of the shoulders (R=0,55) and wrist girth (R=0,52).

Mobility in the shoulder joints is important for all athletes who specialize in freestyle swimming, regardless of distance specialization.

Summarizing the obtained data, we determined the parameters that can be used as important for rabbit swimmers when choosing the length of the competitive distance for further narrow specialization. These are: height, weight, leg length, length and width of the hand, forearm length, length and circumference of the thigh Figures 4-10 show the values of the correlation coefficients of these indicators with the sports result at distances in sprinting, styer swimming and at medium distances.

Thus, the index of the length of the forearm is most significant for demonstrating high results at medium distances (R=0,84), it affects the performance of sprinters to a lesser extent (R=0,58), the smallest coefficient R is fixed in styers (Figure 4).

The length of the thigh most affects the result in sprinters (R=0,58), its significance in the middle-distance is slightly less (R=0.31). In styers, the correlation coefficient is 0,26 (Fig. 5).

It is noteworthy that with the increase in the length of the competitive distance, the influence of this indicator on the performance of swimmers decreases.

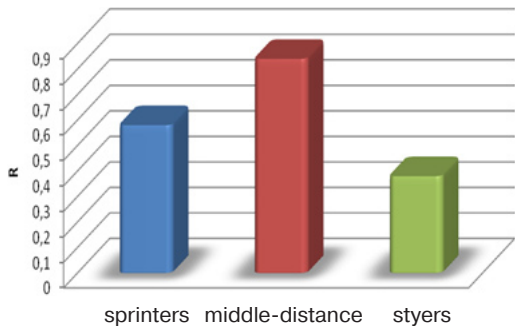

Fig 4. Degree of correlation between the indicator "length of the forearm" and sports results for sprinting, middle and stayer distances in freestyle swimming

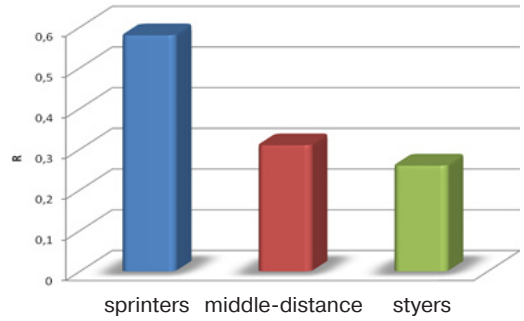

Fig. 5. Degree of correlation of the indicator "hip length" with sports results at sprinting, middle and stayer distances in freestyle swimming

Mobility in the shoulder joints prevails in importance in the styers (R=0,54). To a lesser extent, it affects the athletic performance of sprinters and middle-distance (R is 0,45 and 0,43, respectively) (Figure 6).

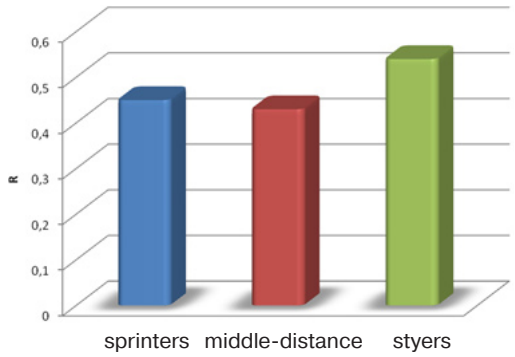

Fig. 6. Degree of correlation of the indicator "mobility in the shoulder joints" with sports results for sprinting, middle and stayer distances in freestyle swimming

The significance of growth indicators for the effective overcoming of average distances is at the level of R=0,95. In turn, in sprinter and styer swimming this dependence is not significant (R is 0,36 and 0,07, respectively) (Figure 7).

The same tendency also occurs with an indicator of the tibia length (R for and middle-distance, sprinters, and styers is 0,95, 0,13, and 0,06, respectively) (Figure 8).

When swimming at medium and long distances, the length of the hand has a significant effect on sports results (R is between 0,89 and 0,84) (Figure 9).

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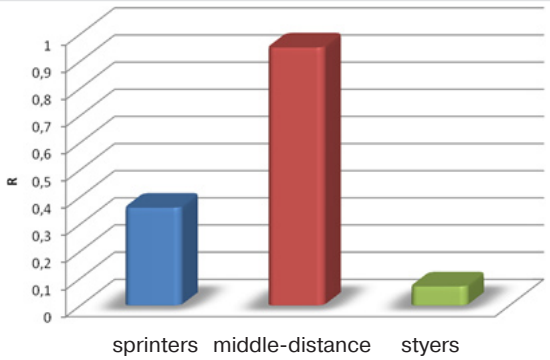

Fig. 7. Degree of correlation between the indicator "body length" with sports results for sprinting, middle and stayer distances in freestyle swimming

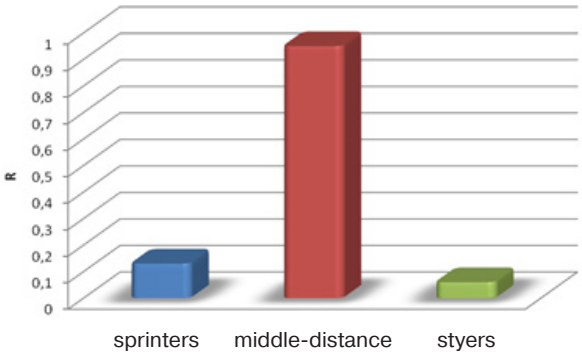

Fig. 8. Degree of correlation between the "length of the tibia" indicator and sports results for sprinting, middle and stayer distances in freestyle swimming

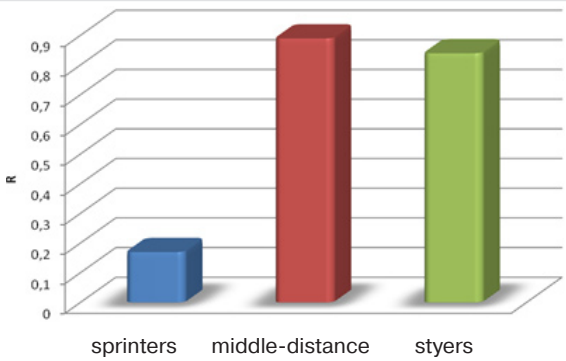

Fig. 9. Degree of correlation of the indicator "brush length" with sports results for sprinting, middle and stayer distances in freestyle swimming

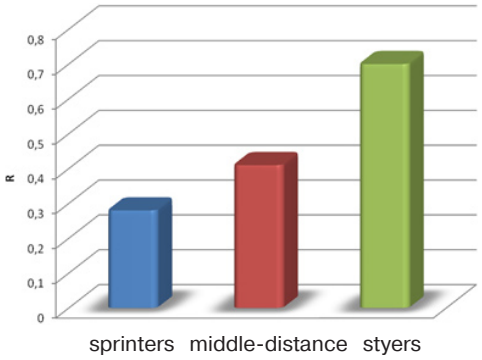

Fig. 10. Degree of correlation between the indicator "width of the brush" with sports results for sprinting, middle and stayer distances in freestyle swimming

Significant for styers such an indicator as the "width of the brush" (R=0,7). To a lesser extent, the influence of this parameter is felt in the middle-distance (R=0,41) and sprinters (R=0,28) (Figure 10).

It is noteworthy that with an increase in the length of the competitive distance, the relationship of this indicator with sports results is growing.

Thus, the analysis made it possible to obtain information on the degree of correlation between morphological and functional indicators and sports results at various distances in freestyle, which can be used to improve the selection and orientation of qualified swimmers.

Conclusions / Discussion

The results of the behavioral research confirm the prevailing opinion that the morphological and functional profile of qualified swimmers has features depending on distance specialization. The results obtained allowed us to conclude that the most informative guidelines for selection and specialization in the method of swimming crawl on the chest are: height, weight, leg length, length and width of the hand, forearm length, length and circumference of the thigh, mobility in the shoulder joints.

We found that in sprinters the following indicators are most interconnected with sports results: forearm length (R=0,58), hip length and girth (R values are between 0,58 and 0,62), shoulder girth in tension (R=0,54). For athletes who specialize in swimming at medium distances, the most affecting sports results are: height (R=0,95), weight (R=0,86), arm length (R=0,86), arm span (R=0,50), the length of the hand, forearm, lower leg and foot (R is 0,89, 0,84, 0,95, 0,70, respectively), the circumference of the wrist and thigh (R values are 0,95 and 0,96). Among the significant indicators of morphological and functional development for sportsmen-styers, one can single out: the length and width of the hand (R is 0,84 and 0,70), the circumference of the chest at rest (R=0.56), and the width of the shoulders (R=0,55), wrist girth (R=0,52).

Thus, the determination of distance specialization in the method of swimming the crawl on the chest should be carried out taking into account the indicators of the morphological and functional profile that are most interconnected with the end result.

Prospect of further research is to study the degree of correlation of morphological and functional indicators with sports results in qualified athletes specializing in back crawl swimming at distances of various lengths.

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References

1. Bulgakova N.Zh. (1997), *Problema otbora v processe mnogoletnej podgotovki (na materiale plavaniya): avtoref. dis. d-ra ped. nauk* [The problem of selecting from many years of preparation (based on swimming): DS thesis abstract], Moscow, 65 p. (in Russ.).
2. Volkov L.V. (1997), *Teoriya sportivnogo otbora: sposobnosti, odarennost, talent* [Theory of sports selection: abilities, endowments, talent], Kiev. (in Russ.).
3. Ganchar I.L. (2006), *Metodika prepodavaniya plavaniya: tehnologii obucheniya i sovershenstvovaniya: uchebnik,* [Methodology of teaching swimming: technology and learning improvement: a tutorial], Odessa, P. II. (in Russ.).
4. Davydov, V.Yu. & Avdienko, V.B. (2012), *Otbor i orientaciya plovcov po pokazatelyam teloslozheniya v sisteme mnogoletnej pidgotovki (Teoreticheskie i prakticheskie aspekty)* [Selection and orientation of swimmers in terms of physique in the years of preparation (Theoretical and practical aspects)], Volgograd. (in Russ.).
5. Pilipko, O.A. (2014), "Modeling the profile of highly skilled athletes, who specialize in front crawl swimming", *Nauchnyj zhurnal "Science Rise"*, No. 3/1 (3), pp. 78-86. (in Russ.)
6. Pilipko, O.A. & Druzhininskaya, E.A. (2015), "Modeling of the morpho-functional profile of highly skilled athletes, who specialize in swimming breaststroke at distances of varying lengths", *Pedagogika, psihologiya ta mediko-biologichni problemi fizichnogo vihovannya i sportu*, No. 12, pp. 74-81. (in Russ.)
7. Pilipko, O.A. & Pilipko, A. (2017), "Modeling of the morpho-functional profile of highly skilled athletes, who specialize in swimming butterfly at distances of different lengths", *Slobozans`kij naukovo-sportivnij visnik*, No. 1 (57), pp. 88-93. (in Russ.)
8. Platonov, V.N. (2000), *Plavanie* [Swimming], Kyiv. (in Russ.)
9. Platonov, V.N. (2012), *Sportivnoe plavanie: put k uspekhu: v 2 kn.* [Sports swimming: the path to success: in two books], Kiev. (in Russ.)
10. Popov, O.I. & Partyka, L.I. (2001), "The evolution of technology training, the morphological profile of the strongest swimmers and world records in competitive swimming during the twentieth century", *Nauka v olimpijskom sporte*, No. 1, pp. 43-48. (in Russ.)
11. Sergiyenko, L.P. (2009), *Sportivnij vidbir: teoriya ta praktika. u 2 kn. Teoretichni osnovi sportivnogo vidboru: pidruchnik.* [Sports selection: theory and practice], Ternopil. (in Ukr.)
12. Solomatin, V.R. (2009), "Modeling characteristics and regulatory requirements of special performance of highly skilled swimmers", *Vestnik sportivnoj nauki*. No. 3, pp. 17-20. (in Russ.)
13. Filimonova, I.E. (1997), *Morfofunkcionalnye osobennosti plovcov vysokogo klassa i ih znachenie dlya otbora i dalnejshego sportivnogo sovershenstvovaniya: avtoref. dis. kand. ped. nauk* [Morphofunctional features of swimmers of high class and their importance for selection and further sports improvement: PhD thesis abstract], Moscow, 25 p. (in Russ.)
14. Shinkaruk, O.A. (2011), *Otbor sportsmenov i orientaciya ih podgotovki v processe mnogoletnego sovershenstvovaniya (na materiale olimpijskih vidov sporta)* [Selection of sportsmen and orientation of their training in the process of long-term perfection (on material of Olympic types of sport)], Kiev. (in Russ.)
15. Shustin, B.N. (1995), *Modelirovanie v sporte vysshih dostizhenij* [Modelling in high performance sport], Moscow. (in Russ.)

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Comparative analysis of the health status of students of II and IV courses during their studies at universities

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Purpose: *to study the health status of students during their studies at universities.*

Material & Methods: *141 students of the Faculty of Economics (age 18–23 years) of a technical university took part in the study. The survey was carried out on each year of study from 1 to 5 courses using methods: study management problems; traditional methods; a complex of pedagogical, sociological, psychological, psychophysiological and medical-functional methods; methods of mathematical statistics.*

Results*: research materials revealed factors negatively affecting the health status of students. A comparative analysis of the results of the study of students of II and IV courses revealed a deterioration in the health status of students in 4 year.*

Conclusions: *the abolition of physical education classes for fourth-year students, a high level of neuro-emotional tension during the session, a significant decrease in physical activity and other stress factors negatively affect the health status of students and require the restoration of physical education classes in senior courses.*

Keywords: *state of health, physical education, training, fatigue, working capacity.*

Introduction

According to WHO experts, in Ukraine, mortality due to cardiovascular diseases of individuals is about 420–430 thousand people per year [4]. As the leading cardiac surgeon of Ukraine, director of the National Institute of Cardiovascular Surgery named after N. M. Amosov, academician of the NAMSU Professor Vasily Lazorishinets, a similar situation was in the USA in 1980. Thanks to the developed program, over 20 years, mortality due to cardiovascular diseases decreased from 44% to 29%. Such indicators are today civilized countries of the world. In Ukraine, every year there is an increase in the number of people with these diseases [11]. But most often they die due to coronary heart disease. In different countries, despite the development of civilization, this reason is observed in 50% of cases [5].

Cardiovascular mortality rates in Ukraine are among the highest in the world. For two years, the country loses the population equal to the population of such cities as Lviv or Dnipro. Most often, young people of working age die. Under such conditions, the problem of prevention of cardiovascular diseases becomes relevant. The factors of the development of cardiovascular diseases are, first of all, the state of ecology, lifestyle, unhealthy diet, sedentary lifestyle, bad habits.

Particular attention must be paid to students. The development of our country and the future of our society depend on the level of his health, intellectual abilities and professional skills.

However, in recent years there has been an increase in the number of students with a disease of the cardiovascular system (CVS) [1–3; 10]. Therefore, one of the most important components of the quality of life in a technogenic environment is the optimization of tools that improve mental activity and preserve the health of the student. It is necessary to introduce new health-saving technologies in the process of their study and rest in order to continue creative longevity and the prevention of diseases, especially blood circulation organs.

In such conditions, the use of sports and recreational activities positively affects the working capacity and human health [9]. But their use without individual and reasonable data may not give the planned result. Therefore, the urgent problem is the study of changes that occur in the state of health and activity of the circulatory system, central nervous system (CNS) and higher mental functions during the educational process (examination session). You should also determine the attitude of students to the use of innovative technologies associated with means of physical culture, recreation and health-improving education. This will help to develop and effectively implement physical culture, recreational and other health-saving technologies in the life of students.

Purpose of the study: to study the health status of students of II and IV courses during the period of study at the university.

Objectives of the study:

1. To identify factors affecting the health status of students of II and IV courses and their attitude to physical-recreational and health-improving measures during the period of study at the university.

2. Conduct a comparative analysis of the health of students of II and IV courses and establish how their state of health changes in the process of studying at a university.

Material and Methods of the research

Over the course of 5 years, 141 students of the Faculty of

Economics (aged 18–23 years) of a technical university became under supervision. After each year of study, from 1 to 5 courses, they were examined using: methods for studying the management problem (general scientific methods of cognition, methods of working hypotheses and expert assessments); traditional methods (theoretical analysis and synthesis of literary evidence, registration of diseases and state of health, medical examination and analysis of diseases); a complex of pedagogical, psychological, psychophysiological, sociological and medical methods; methods of mathematical statistics.

In 10918 students aged 18 to 23 years, a disease analysis was carried out. Also, for two years, students in the main medical group II (25 people) and IV (23 people) of the courses of the Faculty of Economics measured in the process and in the near recovery period after the exam (30–50 min) indicators that characterize the activity of the central nervous system (CNS)), circulatory organs and higher mental functions. At the same time, according to a specially developed questionnaire, a survey was conducted, stress factors affecting the students' body turned out to be studied, working capacity and subjective assessment of the condition, their attitude to the use of physical-recreational and recreational and preventive measures during the period of study at the university were studied.

A comparative analysis of the state of health and indicators characterizing the functional state and factors affecting the body of students was carried out according to the results of surveys of students of II and IV courses.

Results of the research

The analysis of certificates on the condition of the subjects revealed the largest number of students with respiratory diseases, students of II and IV courses also indicated (75 and 88%, respectively). Further, taking into account the number of students and nosological units, there were diseases of the gastrointestinal tract, circulatory organs, vision, and the genitourinary system.

Analysis of the medical examination of students of the II and IV courses determined that in the IV year the number of persons assigned to the main medical group decreased 1,47 times, and in the preparatory course it increased 1,75 times compared with the results of their medical examination conducted in II course (Table 1).

The decrease in the number of students in a special medical group and exempted from classes due to health reasons is explained by the fact that students with certain deviations in health status are enrolled in the specified faculty. Some of them were exempted from classes due to health reasons, while others, taking into account their state of health, switched to extramural studies, provided academic and maternity leave, and were expelled from the university.

Table 1

Results of a medical examination of students of the Faculty of Economics, %

Course	Groups			Released from lesson for health reasons
	Basic	Preparatory	Special	
II	19,51	31,71	47,16	1,63
IV	14,29	55,36	30,36	0

A previous analysis of the diseases of 10918 students found that ten years ago the students' health was much better and there were significantly fewer students with circulatory diseases (previously it was in the sixth, now in fourth place in the overall structure of the diseases). In recent years, their number in the main medical group decreased by 33%, in the preparatory and special - increased by 37% and 50%, respectively [10].

Under such conditions, there is a need to establish what health-saving technologies students use to restore their condition. Numerous studies have proved the feasibility of using various types of physical exercises during and after mental exertion. But in the second year, 19% of them are independently engaged in physical education and sports in their free time, and 50% preferred taking vitamins. In the fourth year, 25% and 50% of students, respectively. Most students do not know what health-saving technologies are, therefore, the need to train students in these technologies in physical education classes is being updated.

At the same time, physical education classes were held twice a week with second-year students, and fourth-year students did not have such classes, and this was during that period of life when the health status of students was being intensively formed. Significantly reduced the amount of physical activity is an important factor in the deterioration of physical qualities and health. Most likely, this is one of the main factors in reducing their numbers in the main medical group, as evidenced by the data of self-medication (Table 2).

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A significant negative impact of stress factors, which acts on the central nervous system and the circulatory system of students, has a high level of mental stress during the session (Table 2). They exceed the capabilities of the body, noted the majority of respondents II and IV courses (82 and 69%). In such conditions, it becomes necessary to study the functional state of the nervous system and the higher mental functions of students.

One of the indicators that characterizes the activity of the central nervous system is the auditory-motor reaction. The measurement during the session showed that after passing the exam the time of a simple auditory-motor reaction decreases in students of the II and IV courses by 21,9% ($p<0,01$) and 22,8% ($p<0.01$), respectively. To some extent, this may indicate a high level of excitement, which worsens well-being from 5,6±0,26 to 4,6±0,41 points (17,9%; $p<0,05$) and from 5,2±0,38 to 4,1±0,29 points (21,2%; $p<0,05$) and increases the level of fatigue, noted students of II and IV courses (81 and 93%, respectively). This situation significantly increases the

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Table 2
Factors affecting student health, %

Courses	Health care	Rest: active / passive	Doing exercise and sports / taking vitamins	Self-medication	Mental stress during the session
II	69	13/50	19/50	38	82
IV	94	6/38	25/50	79	69

number of errors when performing the Malkov test by 35,7% ($p<0,005$) and 37,9% ($p<0,01$), and in the majority of the subjects (60% and 65%) it worsens concentration and switching of attention.

Given the increase in recent years in the number of students with diseases of the circulatory system and the fact that these diseases are most often found in people with mental labor, we studied the performance indicators of students' CVS. The results obtained made it possible to determine the level of neuro-emotional tension (NET), fatigue and performance during the semester and session. It should be noted that in the near recovery period after the exam, an increase in heart rate (HR) in respondents of the II and IV courses from 76,0±1,8 to 95,0±2,1 beats per minutes (25,0%; $p<0,001$) and 78,0±2,1 to 93,0±2,5 beats in minutes (19,2%; $p<0,01$), respectively. There was also an increase in diastolic blood pressure (DBP) from 68,2±2,5 to 74,3±1,9 (8,8%; $p<0.05$) and 67,5±2,7 to 77,3±1,8 (13,2%; $p<0.05$) mmHg. At the same time, systolic blood pressure was increased respectively in 50% and 53% of students of II and IV courses. It is necessary to indicate a significant increase in both systolic and diastolic blood pressure before exams. In some students, systolic blood pressure increased to 170–180 mmHg, and HR – to 120–150 beats per minutes [2; 10].

The above may indicate that some students begin to develop a disease associated with a violation of the autonomic regulation of CVS. This requires planning in the educational process, training and the use of new physical education, recreational and health-improving technologies in physical education classes.

An increase in heart rate, blood pressure and a change in reaction time indicates an increased level of the excitation process, to a certain extent, indicates an increase in nervous tension and the degree of fatigue. This negatively affects performance. This situation, formed during the session, is not restored during the semester and is felt even after classes by respondents 19 and 50% of the courses indicated (Table 3). As can be seen, a significant increase in the number of students with an increased level of fatigue, lethargy and drowsiness during the session and reduced working capacity on weekdays was revealed in the fourth year. This negatively affects the body and, possibly, is one of the factors of the disease.

It should be noted that students of II and IV courses, respectively 56 and 25%, seeking to better prepare for exams and tests, sleep during the session from 3 to 5:00 a day. Therefore, 44% of them experience lethargy and drowsiness during the semester (Table 3). In some students, nervous tension affects the effectiveness of sleep and manifests itself in its disorder. For excellent health and effective transfer of information from operational to long-term memory, you need to sleep 8:00 a day.

It is necessary to indicate one of the main stress factors that affects the health status of students – a balanced diet. Along with unbalanced, inadequate, poor-quality nutrition, they eat 1–2 times a day, morning and evening (Table 3).

As can be seen from the table. 3, in the fourth year, the largest number of students are worried about health, are independently engaged in physical education and sports, eat rationally, spend more time for sleep and feel much less mental stress during the session, but reluctance to engage in physical education and negative stress factors on I, II and III courses significantly affect the body and lead to poor health, and students (63% and 83%) noted in their profiles (Table 3).

Currently, in some universities, I–IV courses plan and conduct physical education classes at 2:00 a week. Both domestic and foreign scientists have proved that the best healing effect is achieved during classes at least three times a week [6–8]. Such classes will positively affect the body if students will independently engage in physical exercises twice a week. As mentioned above, only 19% and 25% of students independently engage in physical education and sports in II and IV courses. The use of various types of physical exercises in the classroom once a week does not give a healing effect [7–9].

Conclusions / Discussion

The abolition of physical education classes for fourth-year students, the high level of nervous and emotional tension during the session, the non-use of physical culture and recreational activities negatively affect the health status of students and needs to be restored to physical education classes for senior students.

A high level of neuro-emotional stress during the examination leads to a significant acceleration of the pulse rate and an in-

Table 3
Factors affecting student health, %

Courses	SH deterioration	Meals 1–2 times (session – weekdays – weekends)	Meals 1–2 times (session-weekdays-weekends)	Lethargy and drowsiness (weekdays / session)	Fatigue and performance
II	63	82 – 75 – 44	56	44 / 0	19
IV	83	32 – 32 – 13	25	44 / 19	50

crease in blood pressure, negatively affects the activity of the circulatory system.

The study provides an opportunity to recommend such measures:

• to educate students the desire to consciously maintain their health and, above all, to plan and independently engage in physical education;

• schedule more time for physical education classes;

• plan in the educational process and train students in physical education classes in various physical-recreational and health-improving technologies for their independent use.

Prospects for further research will be based on the study of the impact of various types of physical exercises on the body and the health status of students in the process of self-study.

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References

1. Vakarchuk, I.O. (2008), "State, problems, prospects of development of physical education and sports in universities of Ukraine (concept of the Ministry of Education and Science of Ukraine)", *Fizychne vykhovannia i sportyvne vdoskonalennia studentiv: suchasni innovatsiini tekhnolohii*, R.T. Raievskyi (red.), Nauka i tekhnika, Odesa, pp. 21-23. (in Ukr.)
2. Virovskyi, L.P. (2008), "Physical activity of university students as a means of overcoming exam stresses", *Fizychne vykhovannia i sportyvne vdoskonalennia studentiv: suchasni innovatsiini tekhnolohii*, R.T. Raievskyi (red.), Nauka i tekhnika, Odesa, pp. 105-109. (in Ukr.)
3. Volieva, N.P. (2011), "Morbidity of university students belonging to special medical groups", *Sportyvna nauka Ukrainy : elektron. nauk. fakh. vyd.*, No. 6, pp. 3-11, available at: http://www.nbuv.gov.ua/e-journals/SNU/2011-6/11vnptsg.pdf. (in Ukr.)
4. Lazoryshynets, V. (2019), "Heart disease in Ukraine kills big city population - expert every two years", *Ukrinform*, available at: https://www.ukrinform.ua/rubric-culture/2565152-sercevi-hvorobi-v-ukraini-sodva-roki-vbivaut-naselenna-velikogo-mista-kardiohirurg.html (accessed 02.09.2019). (in Ukr.)
5. Kovalenko, V. (2019), "In Ukraine, death rates due to heart disease are among the highest in the world", *Ukrinform*, available at: https://www.ukrinform.ua/rubric-culture/2544198-v-ukraini-pokazniki-smertnosti-cerez-hvorobi-serca-e-odnimi-z-najvisih-u-sviti.html (accessed 02.09.2019). (in Ukr.)
6. Kuper, K. (1989), *Aerobika dlya khoroshego samochuvstviya* [Aerobics for well-being], translated from English, Fizkultura i sport, Moscow. (in Russ.)
7. Nifontova, L.N. (1994), Fizicheskaya kultura kak sredstvo zdravostroeniya, professionalnoy adaptatsii i reabilitatsii trudyashchikhsya [Physical Culture as a Means of Healthcare, Professional Adaptation and Rehabilitation of Workers], Moscow. (in Russ.)
8. Pirogova, Ye.A., Ivashchenko, L.Ya. & Strapko, N.P. (1988), *Vliyanie fizicheskikh uprazhneniy na rabotosposobnost i zdorove cheloveka* [The Impact of Exercise on Human Performance and Health], Zdorov'ya, Kiev. (in Russ.)
9. Seymuk, A.A. (2012), *Pomogi sebe sam. Zapovedi dlya zdorovya i dushi* [Help yourself. Commandments for health and soul], RIA Dnipro-VAL, Dnepropetrovsk. (in Russ.)
10. Seimuk, A.A. & Khadzhynov, V.A. (2014), *Psykhichna rehuliatsiia ta fizychni vpravy v protsesi napruzhenoi rozumovoi diialnosti* [Mental regulation and exercise in the process of intense mental activity], Zhurfond, Dnepropetrovsk. (in Ukr.)
11. Fedchyshyn, N.Ye. (2013), "Diseases of the circulatory system: the dynamics of prevalence in Ukraine and the Ternopil region", *Visnyk sotsialnoi hihiieny ta orhanizatsii okhorony zdorov'ia Ukrainy*, No. 1(55), pp. 53-55. (in Ukr.)

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