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2. Improving the training of athletes of different qualification.
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**EFFECTIVENESS OF PHYSICAL TRAINING OF TENNIS PLAYERS
FOR COMPETITIONS USING ELEMENTS OF ATHLETICS**

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Purpose: determination of the effectiveness of physical training of tennis players for competitions using elements of athletics exercises.

Material and methods: analysis of scientific and methodological sources; observation; measurements and accounting; instrumental techniques; statistical and mathematical. The test group consisted of 10 young tennis players at the age of 9-12 years old, who were practicing on the basis of one tennis club and had an experience of regular tennis lessons (at least three trainings per week) from 1 year.

Results: the main feature of the period of participation in tournaments is the need to maintain a specific level of special performance. Therefore, the specificity of physical training has an applied functional nature to high-level loads. Its purpose is to ensure maximum special fitness and maintain its level, as well as to maintain general fitness. Based on the results of the ascertaining experiment, methodological complexes have been developed for use in physical training of young tennis players during the period of participation in competitions. The effectiveness of their application has been determined. The developed complexes

of exercises were effective for ensuring the development of speed and speed-strength abilities of the tennis players of the test group. However, their effectiveness was not significant for increasing the pace of strikes, as well as increasing the strength of the legs and shoulder girdle.

Conclusions: the adaptation of the methodology of physical training of young tennis players involves considering both the peculiarities of physical fitness in relation to the effectiveness in competitions, and its influence on the process of technical and tactical improvement of the players. The obtained data partly testify in favor of the use of the developed methodological complexes for the physical training of young players during the competition. Thus, the presented complexes are promising for use in the process of physical training of tennis players during participation in competitions, however, they require more thorough testing.

Keywords: young tennis players, physical and technical training, target accuracy.

Introduction

Training of young tennis players involves regular participation in matches of various levels [4]. The percentage of competitive practice in tennis is constantly increasing, which affects the change in the structure of training activities of young tennis players. However, the body of young players is not yet adapted to long intense games and is in the process of active biological development [5]. Therefore, there is a decrease in time for different types of training. As a result, there may be a situation where the technical skills, the results of the games have little or no negative dynamics due to insufficient time spent on physical training. This is especially true during the period of preparation and participation in competitions. Therefore, there is a need to develop the issue of physical training of young tennis players in preparation for competitions.

Analysis of recent research and publications. There is no doubt that there is a relationship between sports equipment in tennis and the physical training of the player. Moreover, it is believed that the appropriate level of physical fitness is the

basis for the formation of a rational complementary and affect each other [9]. This combination acquires the greatest importance during the periods of preparation and participation in competitions.

The essence of competitive activity is the manifestation of personality traits, in a complex of motor skills acquired in the process of preparation and participation in games [8, 12]. It is worth noting that from the age of twelve young tennis players begin to actively participate in official tournaments, the number of which increases from year to year, while their age characteristics are characterized by rapid physical development [10, 11]. However, some authors note that indicators of the level of speed and strength abilities, as well as speed endurance can be used as an assessment of compliance with the criteria of competitiveness [1, 2]. Of course, when planning physical training in the period of training and participation in competitions of young players should consider a set of specific personal, psychophysiological abilities and sports fitness.

When developing a set of physical training exercises for young tennis players should be guided by the peculiarities of the game motor actions performed by players. At the same time, leading experts already at the initial stages of training of young athletes recommend focusing on the features of the technique of adult tennis players [6, 7, 12]. To play successfully, a tennis player must have such abilities as starting speed, reaction speed, speed endurance, speed, explosive power, strength endurance, feeling the ball, etc.

The tennis player's game activities involve the involvement of all major muscle groups in the body. The leading role in these actions is played by the high-speed dynamic efforts caused by high speed of movements. However, during strikes, high static forces are essential, so the strength training of a tennis player should be versatile and develop muscle strength in different modes of operation. Modern tennis players perform a significant number of strokes in the unsupported position [10]. Therefore, to stabilize the stability and control of movements during repulsion are necessary: exercises that develop the strength of the muscles of the torso and shoulder girdle, exercises that stabilize the position of the body at the

time of impact; exercises for rigid fixation of the body (in the process of moving the body on the ball contribute to better work of the arm muscles and maintaining stability); special exercises to repay the recoil forces on impact (help increase the stability of children).

Studies have shown that in the training of tennis players more attention should be focused on educating the ability to quickly increase running speed, the frequency of steps when running the ball in game situations, as well as the ability to reach maximum speed in the first 2-3 seconds when performing starting jerks [1]. In tennis, the following elementary forms of manifestation of speed are important: speed of motor reaction; speed of unloaded movement (single); frequency of movements. An example of the manifestation of the speed of motor reaction is the actions of a tennis player when receiving the opponent's serve or when playing on the fly near the net. The speed of unloaded movement is manifested, for example, in a sharp turn of the shoulders in the impact. The frequency of unloaded movements is manifested in the characteristic small "step" of a tennis player when approaching a ball that is flying close (before the last wide step). In many other cases, these elementary forms of speed are manifested along with other physical qualities. Yes, fast acceleration of a tennis player to the ball is possible only due to the high speed strength of the leg muscles and coordination of movements, and its performance against the background of fatigue requires good anaerobic endurance.

According to the presented features of motor activity of tennis players it is necessary to form the program of physical training. Therefore, **the purpose of the work** is to determine the effectiveness of physical training of tennis players for competitions using various elements of motor actions. According to her, **the hypothesis of the study** was that the relationship between physical and technical fitness of young tennis players allows during the period of participation in competitions effectively to learn the parameters of the technical elements of the game of young athletes through the use of physical training exercises.

Material and Methods of research

Objects. The test group consisted of 10 young tennis players aged 9-12, who played on the basis of one tennis club and had experience of regular tennis lessons (at least three training sessions per week) from 1 year.

Research program. In the process of ascertaining experiment, the current level of physical and technical fitness of young tennis players was determined a week before the start of the tournaments. In the process of formative experiment, the effectiveness of the developed set of physical training exercises was determined, which was used directly during the participation of young tennis players in tennis tournaments, which had a training (simulation) character and were held on the club and with representatives of other clubs.

Testing. To determine the level of physical and technical fitness of the participants, tests were selected that characterize the level of special qualities of tennis players. The test session was held for two days at the beginning of training sessions according to the coach's schedule after two days of rest. Tennis players were advised not to eat two hours before testing. Before testing, participants performed a warm-up for 5-10 minutes (light jogging, side shifts, dynamic stretching and jumping) at the level of heart rate = 100-130 beats/min.

Selected test exercises: long jump from a place (m); triple jump from a place (m); running from a high start at 18 m (s); «American fan» – 3 points (c); bending of arms in an emphasis lying down (times); throwing a stuffed ball (1 kg) from behind the head with one hand.

Intervention. After analyzing the results of the observational experiment, a range of exercises was identified that would help maintain competitiveness and develop the physical abilities of young tennis players during participation in tournaments (only 2 weeks). From the selected exercises, which are elements of athletic exercises or preparatory exercises from the arsenal of athletics, performed in a manner consistent with the characteristics of motor activity of tennis players, were formed methodological complexes for physical training of tennis players

during competitions with a predominant focus on speed (Complex 1) and complex strength abilities (Complex 2):

Complex 1

1. Jumping rope on two legs. Dosage: 3 x 25 s (rest 10 s). Methodical instructions: maximum speed of execution.

2. Jumping rope on one leg for. Dosage: 3 x 20 s on one leg and then 20 s on the other leg for 20 s. (rest 15 seconds after the end of the cycle for both legs). Methodical instructions: maximum speed of execution.

3. Cross steps. Dosage: 2 x 20 m with cuff loading on the distal ends of the lower extremities (0,2 kg), then 2 x 20 m without cuffs (rest between approaches 10 s) Methodical instructions: maximum intensity of execution.

4. Running with a high rise of the thigh. Dosage: 2 x 10 m with cuff loading on the distal ends of the lower extremities (0,2 kg), then 2 x 10 m without cuffs (rest between approaches 10 s) Methodical instructions: maximum intensity with a small advance.

5. Running with fast changes of direction. Dosage: 1 time with cuff loading on the distal ends of the lower extremities (0.2 kg), then 1 time without cuffs (rest between approaches for 25 seconds) Guidelines: 5 control points located on different court lines, after reaching each return to starting position.

The complex was used two days before the series of games.

Complex 2

Method of execution: in a circle. Dosage: each exercise was performed for 15 s (rest between exercises – 45 s; between circles - 3-5 min); in total – 3 circles.

Exercises:

Jumping on a hill (25 cm) on the right / left leg.

Imitation of a blow on the right / left with a dumbbell (0.5-1 kg) or a weighted racket.

Jumping «frog».

From the starting position - lying on your back at the same time raise your legs and torso. Jumps to the side with the imitation of blows to the right and left of the fly.

Imitation of a blow over the head from a position in which the arm with a dumbbell (0,5-1 kg) or a weighted racket is lowered behind the back

From the starting position - lying on your stomach, arms outstretched, bend, while taking the legs and torso back.

Flexion and extension of the arms at rest lying on the floor.

From the starting position, lying on your back, arms with a stuffed ball (1 kg) stretched forward, raise and lower your arms.

The complex was applied a day after the end of a series of games.

Tools. The rate of tennis strokes in the draw was determined automatically using the device Babolat POP (2018) [3, 6]. The results recorded by the device were analyzed using the Babolat POP application (2019), which was installed on the iPad Air 3 tablet (2019). The device was paired with a tablet computer after testing via the Bluetooth 5 wireless system (2019). To control the pace, shots to the right of the rebound during the two-sided draw were chosen [7].

Statistics. Statistical analysis was performed using Statistica 15 (2019) software for Windows. Statistically significant was considered $p < 0,05$. *Descriptive statistics: mean*, standard deviation. The normality of the distribution of test results was determined by calculating the Kolmogorov-Smirnov criterion. The results obtained for all tests did not comply with the law of normal distribution, so the non-parametric criterion Sing test (comparing two dependent samples; one group) was used to compare the experimental characteristics, and Spearman rank Correlation was used to determine correlations. the p-level of significance for all test scores was 0,05.

Results of the research

The object of the study was the personal achievements of young tennis players in test exercises, which reflect a number of physical and tactical qualities

necessary for a successful game of tennis. The results of the study are contained in Table 1.

Table 1

The results of monitoring the training of young tennis players (n = 10)

Test	Control ($\bar{X} \pm \sigma$)		Z (p)
	Inc.	Out.	
18 m running (s)	4,00±0,22	3,94±0,20	2,04 (<0,04)*
«American Fan» 3 points (s)	9,81±0,51	9,73±0,47	2,47 (<0,01)*
Throwing a medicine ball (1 kg) (m)	12,24±1,72	13,15±2,11	2,04 (<0,04)*
Long jump (m)	1,47±0,10	1,55±0,10	1,77 (>0,05)
Triple jump (m)	5,38±0,24	5,50±0,16	2,04 (<0,04)*
Push-ups (sum)	28,14±5,43	29,50±4,06	1,77 (>0,05)
Pace (beats / min)	18,70±1,64	19,40±1,17	1,50 (>0,05)

Explanation: * - the results differ significantly at the level of <0.05

Table 2 presents the results of correlation analysis, which included indicators obtained during the observational experiment.

Table 2

Relationship between young tennis players' training indicators (n = 10)

№	Test	1	2	3	4	5	6	7
1	18 m running (s)	1	0,83*	0,40	- 0,04	0,87*	0,60	- 0,78*
2	«American Fan» 3 points (s)	0,83*	1	0,75*	- 0,09	0,92*	0,72*	- 0,73*
3	Throwing a medicine ball (1 kg) (m)	0,40	0,75*	1	0,07	0,54	0,60	0,54
4	Long jump (m)	-0,04	-0,09	0,07	1	-0,16	-0,37	-0,13
5	Triple jump (m)	0,87*	0,92*	0,54	- 0,16	1	0,66*	0,55
6	Push-ups (sum)	0,60	0,72*	0,60	- 0,37	0,66*	1	0,70*
7	Pace (beats / min)	- 0,78*	- 0,73*	0,54	- 0,13	0,55	0,70*	1

Explanation: * – significant correlation

Conclusions / Discussion

The analysis of the obtained results allowed to state that in the test "American Fan" the indicators of the athletes of the test group are closely correlated with the indicators of complex manifestation of strength training (throwing a stuffed ball, triple jump, bending and unbending the arms while lying

down), speed (running 18 m) and special abilities (rate of blows). Therefore, strength training exercises for young tennis players in the competitive period should include running exercises (various jerks) and jumping exercises, which in the conditions of the appropriate level of development of technical and tactical skills will help to improve the percussion technique. The rate of strokes also had a significant correlation with the strength of the shoulder girdle, which indicates the need to use the extension of the arm extension in the supine position for physical training in the competitive period of young players.

Of all the test exercises, only the results of the long jump did not have significant correlations. Obviously, this test is not informative to characterize the physical fitness of a group of young tennis players who participated in the study.

The recorded relationships have determined the direction of the choice of exercises for training young tennis players during the competition, in order to form methodological complexes aimed at improving their physical fitness.

The "high start" run test reflects the ability of young players to produce the maximum speed of movement from a place, which is an imitation of a jerk to the ball to perform a blow. The results of this test significantly increased at the end of the study (Table 1).

Speed endurance when moving to different play areas is determined by the type of shuttle run "American 3-point fan". The results of this test significantly increased at the end of the study.

The tests of "throwing a stuffed ball", "bending the arms at a stop", "jumping from a place" and "triple jump" reflect a complex manifestation of the strength abilities of young tennis players, which determines the quality of performance and some other technical elements. Only the results of the triple jump and throwing the stuffed ball significantly improved at the end of the study.

The pace of the blows is a complex characteristic of the sports readiness of young tennis players for intense playing activities. The results of the rate measurement did not change significantly during the study.

Adaptation of methods of physical training of young tennis players involves considering both the peculiarities of physical fitness in relation to performance in competitions, and its impact on the process of technical and tactical improvement of players. The obtained data partially testify in favor of application of the developed methodical complexes for physical training of young players during competitions. Requires a more detailed study of the selection of test exercises to assess young tennis players during participation in competitions. The application of the developed complexes only partially affected the dynamics of the strength abilities of the legs and shoulder girdle. The rate of blows also did not change significantly, but the complexes did not contain specific exercises to improve it. Thus, the presented sets of exercises with the use of elements of athletics are promising for use for physical training of tennis players during participation in competitions, but require more thorough testing.

Prospects for further exploration. Further research will be aimed at creating other options for methodological sets of exercises using elements of athletics for the physical training of young tennis players, in order to implement them in the pre-competition period and during competitive periods of varying duration.

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**FEATURES OF THE USE OF DISTANCE LEARNING TOOLS IN
HIGHER EDUCATIONAL INSTITUTIONS OF PHYSICAL CULTURE IN
THE CONDITIONS OF QUARANTINE RESTRICTIONS**

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Purpose: to analyze the organizational and methodological features of the use of informational means of distance learning in the training of future specialists in physical culture and sports.

Material and methods: for the implementation of this goal, we used the following research methods: analysis of scientific and methodological literature; Internet resources; a survey using Google Forms; analysis, synthesis and generalization of the data obtained; methods of mathematical statistics. 93 students of the first, second and third courses of the daytime department of the Kharkiv State Academy of Physical Culture took part in the survey.

Results: the features of the organization of the educational process in quarantine conditions using distance learning tools in higher educational institutions of physical culture are considered. An online survey of students revealed their attitude to distance, full-time and mixed forms of education; their preferences and the provision of various electronic resources, programs, information communication tools that were used by teachers in the educational

process. Possible difficulties and the significance of the benefits of distance learning for students are analyzed.

Conclusions: the study showed that the academy teachers in a short time and in difficult conditions mastered digital tools, communication resources, and remote platforms that they had not used before. An online survey showed that students' opinions on distance learning, full-time and blended learning were divided. The results of the study confirmed the opinion of other scientists that distance learning as an alternative form of the educational process cannot fully replace the traditional full-time form of education, and the use of distance learning tools makes it possible to diversify the educational process, make it much more interesting and effective.

Keywords: distance learning, students, online classes, distance learning tools, video conferencing software, e-learning tools.

Introduction

The COVID-19 pandemic and quarantine in recent years have affected almost all spheres of life of the population of most countries of the world and taught everyone, without exception, to live in a new way. Such a challenge on a planetary scale began significant social shifts in adaptation to the new reality.

The field of higher education can be safely called one of those that the pandemic has made the greatest impact on a global scale. Although problems arose, she was one of the few prepared to move most of her processes and resources online. For the operational support of the quality of higher education, the teachers of the institutions carried out a huge organizational and methodological work, which, in a limited time, had to not only teach, but also learn by themselves, introduce various innovative educational technologies, in particular, various means of distance learning. The possibilities of distance learning tools in the field of higher education are significant and well-grounded due to the use of electronic technologies that have already been accumulated in information resources for methodological support of various disciplines [1, 5, 6, 10, 11].

In the educational process, students perform not only the role of consumers, but also stakeholders, individuals, whose contribution is the basis for the success of the institution of higher education. They influence his work to a certain extent. This allows the applicant for higher education to be a competent subject of the educational process, including the subject of assessing its quality.

The issue of distance learning, taking into account the experience of teachers and students, who have received an understanding and the ability to compare the features of conducting classes in regular and distance forms are relevant today, require a comprehensive study and active discussion.

Distance education is not a new concept. In recent decades, its scientific and methodological foundations have been rapidly developing. The work of many foreign scientists, such as R. Delling, G. Rambla, D. Keegan, M. Simonson, M. Moore, A. Clarke, M. Thompson and others, and, accordingly, domestic, such as V. Kukharenko, V. Oleinik, V. Rybalko, A. Svezhentseva, A. Andreev, G. Kozlakova, I. Kozubovsky, E. Polat, A. Khutorskoy, I. Vlasenko, G. Datsenko and others. Problems of the theory and distance learning practices in the field of physical culture and sports became the subject of research in the works of V. Shandrigos, V. Ashanin, L. Filenko, A. Tserkovny, V. Muntian, S. Pyatisotskaya, M. Bulatova, A. Osipov, P. Ladyk, N. Kudryavtseva and others [2-5, 9]. But despite a significant amount of scientific research in this direction and, it would seem, higher educational institutions that were ready for remote work, not everyone was able to quickly and efficiently organize the process of online learning. A number of specialists, based on the state of distance education, notes the urgency of the need for effective training, the use of various means of distance learning, taking into account the possible demand for integrated education in the future [6, 7, 8].

Purpose of the study is to analyze the organizational and methodological features of the use of informational means of distance learning in the training of future specialists in physical culture and sports.

Material and Methods of research

To achieve this goal, we used the following research methods: analysis of scientific and methodological literature; Internet resources; a survey using a Google form; analysis, synthesis and generalization of the data obtained; methods of mathematical statistics. The research was carried out on the basis of the Kharkov State Academy of Physical Culture. The survey involved 93 first, second- and third-year full-time students.

Results of the research

Over the past almost two years, during the quarantine period, applicants for higher education from all educational institutions, in particular the Kharkiv State Academy of Physical Culture, studied in various forms of education: distance (photo), full-time (traditionally in the classroom), mixed. But still, more time training was carried out remotely.

O. Korbut defines distance learning as a set of technologies that ensure the delivery of the bulk of educational material to students, interactive interaction of students and teachers in the learning process, providing students with the opportunity to independently work with educational materials and a means of self-assessment. In this regard, and relying on the fact that distance education is an open learning system that provides for active communication between a teacher and a student using modern technologies and multimedia, the use of distance learning tools is an integral part of it.

In order to analyze the features of the use of distance learning tools and the effectiveness of their implementation in the educational process of future specialists in physical culture and sports, an online survey was conducted on the use of the Google-form in which 93 students of the first, second and third courses of the Kharkiv State Academy of Physical Education took part. The attachments and preferences of students to various forms of education, teaching shortcomings and difficulties encountered in the educational process were analyzed.

To conduct classes in a distance form, programs for videoconferences (for conducting lectures, seminars, practical classes) and e-learning tools (tools for

providing discipline materials, performing practical and independent work, feedback, assessment) were used. It should be noted that the teachers themselves were given the opportunity to additionally choose those distance learning tools that would be convenient for them, in addition to the Moodle distance learning system (which is used at the Kharkiv State Academy of Physical Culture as the main means of distance learning).

To conduct online classes in video call mode, teachers used programs such as Zoom, Google Meet, Microsoft Teams, Skype, Webex, BigBlueButton (Fig. 1). But as can be seen from the results obtained, most of the teachers used the Zoom and Google Meet programs (42%, 43%, respectively).

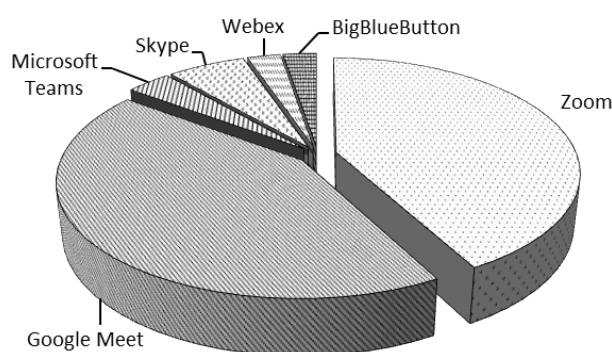


Fig. 1. Programs that were used to conduct online classes via video communication

In the survey, students were asked to rate on a 5-point scale how satisfied they are with the use of these programs in distance learning. In fig. Figure 2 shows that students like Google Meet more (55% of respondents rated it 5 points) than Zoom (5 points - 28%). Despite this, it is possible to recommend that teachers use the Google Meet program for video conferencing so that students feel more comfortable and do not have negative feelings about the educational process online.

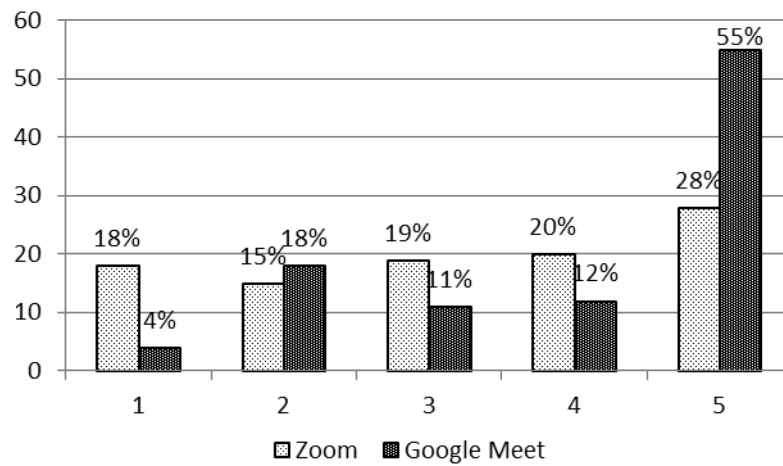


Fig. 2. Assessment of student preferences for Zoom and Google Meet programs on a 5-point scale (1 - not satisfied, 5 - very satisfied)

In addition to videoconferencing programs and the Moodle distance learning system, for a high-quality educational process, providing discipline materials, performing practical and independent work, feedback and assessment, teachers used such web applications and information communication tools as: social networks, e-mail, Google Drive, Google Classroom, and Microsoft Teams (Figure 3).

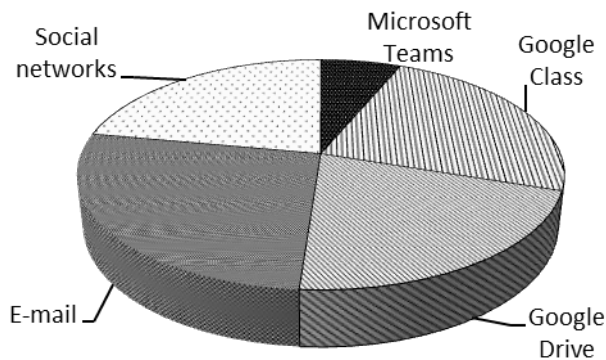


Fig. 3. Web applications and information communication tools that were used in distance learning

Students were asked to express their satisfaction with these programs and rate their use in the educational process on a 5-point scale. In figure 4 it can be seen that students like to work in social networks more (average score 4,1), as the

most comfortable information and communication means of distance learning for young people, for whom communication in social networks is the main part of their everyday life.

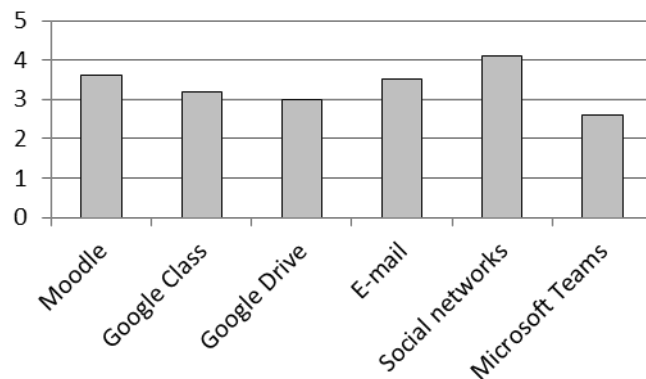


Fig. 4. Average assessment of students' preferences for the use of information communication programs and tools in the educational process on a 5-point scale (1 - not satisfied, 5 - very satisfied)

In Figure 5 presents the answers (in percentage) to the question about the occurrence of possible complications during distance learning. It was found that despite the fact that the majority of students had difficulties with distance learning (62%), communication with teachers (in the teacher-student system) was sufficient (78%) and the majority of students indicated that the workload did not change and did not it became more difficult to perceive educational material (respectively 52%, 53%).

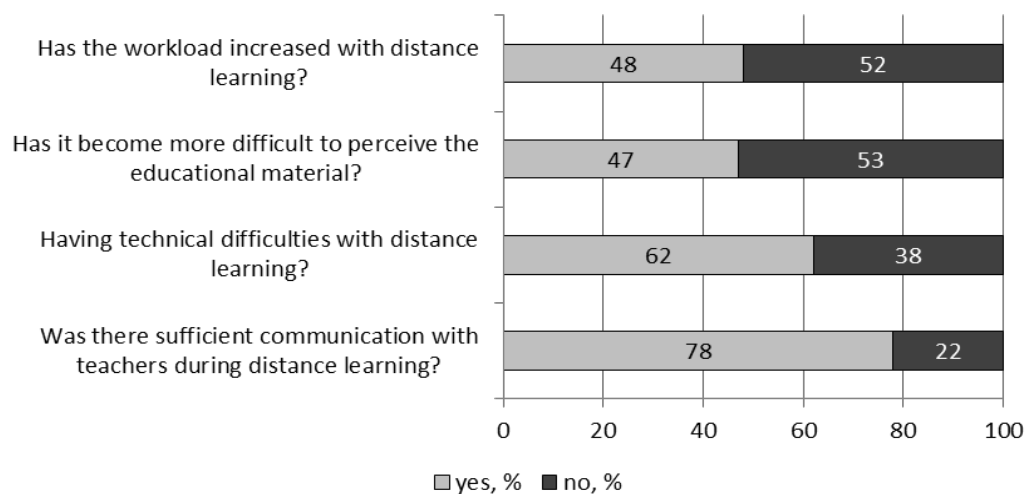


Fig. 5. Answers to the question about possible difficulties during distance learning

It was also revealed that mainly teachers conducted classes in the video communication mode (82%) but did not load students with tasks for independent work (15% of the total workload), and some of them used the elements of Gamification, which increased cognitive activity in disciplines and motivation. to learning.

To the question "In what format was it more convenient for you to take tests and exams?" 53% of students answered - remotely (online) and 47% - full-time (in the classroom).

Studies show that distance learning has a number of advantages and disadvantages [5, 7, 10, 11]. We have highlighted such advantages as: saving time and other resources; the ability to study anywhere and at any time; mobility of communication with the teacher; availability of training materials; the ability to record the lesson; the ability to use additional interactive tools. Students were asked to rate the importance of these benefits of distance learning for them on a 5-point scale (where 1 is not important, 5 is very important).

Figure 6 shows the number of students who rated the importance of these benefits for them by 4 and 5 points. As can be seen from the graph (Fig. 6), the most important thing for students is the opportunity to study anywhere and at any time (78%), which makes it possible to save time and other resources (76%), as well as the availability of teaching materials (66%).

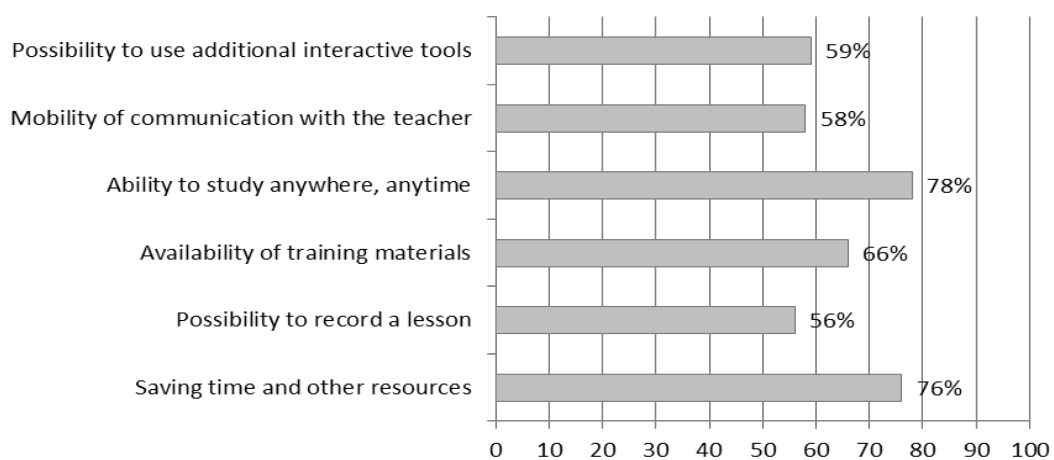


Fig. 6. Number of students (%) who rated 4 and 5 on a 5-point scale the importance for them of the benefits of distance learning

Despite the difficulties that arose in the process of distance learning, most of the students were satisfied (Fig. 7).

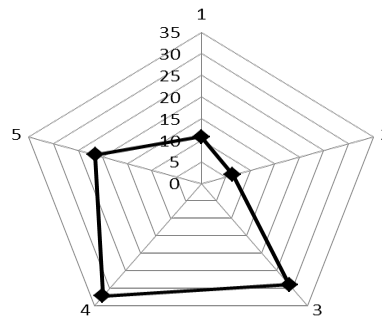


Fig. 7. Satisfaction of students with distance learning on a 5-point scale (1 - not satisfied, 5 - very satisfied)

According to the results of the survey, it was revealed that the views of students regarding their attitude to the forms of the educational process are not unanimous. To the question "What form of education do you like best?" opinions are almost uniform (Fig. 8): 36% chose distance learning, 34% - blended learning, 30% - full-time (traditionally in classrooms).

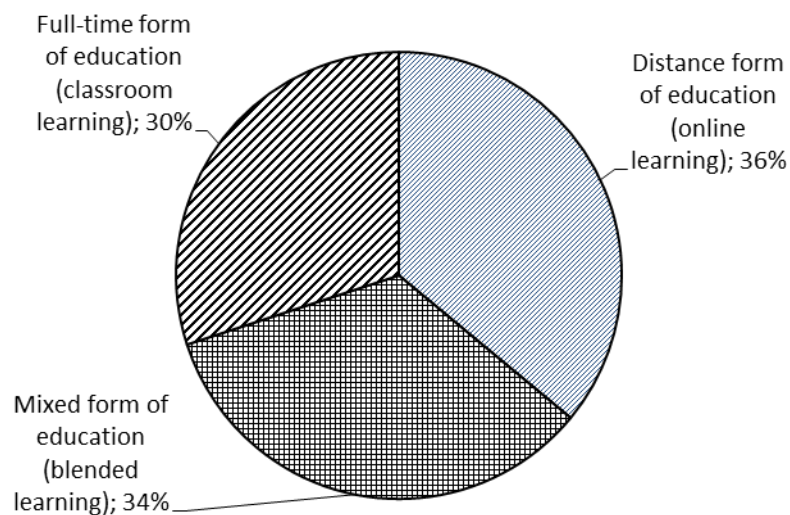


Fig. 8. Students' preferences for various forms of education

The results of the study show that distance education is an effective solution in many life situations, including a global pandemic and quarantine conditions. But it is not the best solution to the educational process. Distance learning can be used

in various cases and most often in institutions of higher education of a physical culture profile where active athletes study are often at sports camps and trainings. But distance learning can be a more effective means of effective education, which complements full-time education and forms a blended one. Distance learning tools provide an opportunity to organize a full-fledged educational process for future specialists in physical culture and sports.

Conclusions / Discussion

It should be noted that many spheres of personal, social and professional life were not only able to resist, but also to adapt to the new reality.

The results of a survey of applicants for higher education in the field of physical culture and sports revealed inconsistency in preferences regarding the forms of education, but indicate the interest of students in distance learning. The analysis of Internet resources and monitoring of the quality of distance education of the Ministry of Education and Science of Ukraine showed a positive trend in assessing the quality of the organization of distance learning in comparison with the last year. This indicates the openness of teachers to advanced training in the field of information technology, improving their digital competence for the effective implementation of distance learning tools in the educational process.

It was revealed that the level of student satisfaction with conducting classes in quarantine conditions directly depends on the interest, responsibility, professionalism of the teacher and active student-teacher feedback. The absence of these components reduces the interest of students in learning and provokes negative consequences. Information and communication technologies and interactivity diversify, interest and motivate students to learn, therefore, teachers try to activate and interest students by introducing various means of distance learning.

Distance education has a number of advantages and disadvantages. It was found that distance learning as an alternative form of the educational process cannot fully replace the traditional full-time education. But the competent use of

distance learning tools allows you to diversify the educational process, make it much more interesting and effective.

Prospects for further research consist in analyzing the effectiveness of using various means of distance learning in the educational process of higher educational institutions of physical culture and developing practical recommendations for their implementation.

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**FEATURES OF STRENGTH TRAINING FOR WOMEN 30-35 YEARS OLD
USING THE "FUNCTIONAL LOOPS TRX" SIMULATOR**

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Purpose: to substantiate the effectiveness of using TRX suspension loops exercises for the development of strength qualities in women 30-35 years old.

Material and methods the study was conducted during the year with a group of women 30-35 years old (10 people), engaged in health fitness. To determine the effectiveness of the use of exercises on TRX suspension loops for the development of strength qualities in women of 30-35 years old, analysis and generalization of literary sources, pedagogical observation, testing, pedagogical experiment, methods of mathematical statistics were used.

Results: the analysis of the results of the study showed that after the experiment, the average group indicators of the strength qualities of women 30-35 years old turned out to be significantly higher compared to the results of the initial testing, their increase was from 4 % to 39 %. Also, a comparative analysis of the results of women in the study group using the Student's test showed reliably the best indicators of strength readiness in almost all tests ($p < 0,05$; the value of t ranges from 2,11 to 2,79), except for the tests "Countermovement jump" and "Standing

long jump" where the result is also better, but it is not statistically significant ($t_p=2,10$; $p>0,05$).

Conclusions: the results obtained showed the effectiveness of using exercises on functional TRX loops for the development of strength qualities in women 30-35 years old.

Keywords: development of strength qualities, fitness program, women 30-35 years old, TRX functional loops simulator, exercises.

Introduction

Public awareness of the importance of human physical health, as one of the fundamental values of human existence, stimulated the development of a whole fitness industry, the pioneer of which, according to E. Le Corre [18], was B. Macfadden (1868-1955), a talented publisher, an active supporter of the athletic direction in the development of physical culture, a specialist in the field of a healthy, physically active lifestyle [13]. Note that every year new fitness technologies appear on the fitness industry market. Their appearance is due to the results of scientific research on the problems of physical activity; the advent of new sports equipment (Pilates rings "Ultra-Fit Circle Mini", plyometric boxes, crossfit ropes, suspension straps "Suspension Training Straps" (TRX-loops), etc.); initiative and creative search of fitness specialists; social demand; fashion, etc. [fourteen]. Analysis of scientific and methodological literature [2, 7, 15] indicates that today it is very popular to use aids in fitness training, in particular functional TRX suspension loops. The existence of various fitness technologies with the use of aids and devices that contribute to an increase in the level of strength readiness of trainees does not yet give grounds to speak of the existence of detailed programs of health-improving trainings using exercises on the TRX Functional Loops simulator for strength training of women 30-35 years old. Thus, the question of the peculiarities of the use of exercises on the TRX simulator in the process of health-improving exercises for women of 30-35 years old is poorly researched, therefore,

it is of interest to scientific research. It is this theoretical and practical collision that determines the problematic situation of this study.

Purpose of the study is to substantiate the effectiveness of the use of exercises on TRX suspension loops for the development of strength qualities in women aged 30-35 years.

Material and Methods of research

The pedagogical experiment, in which 10 people participated, was organized with the aim of increasing the level of strength readiness of women 30-35 years old using exercises on the TRX Functional Loops simulator. A number of scientists Shipunova D., Timokhina N. [15], Golovina V. [5] draw attention to the fact that the full name of exercises with TRX suspension belts is training with its own weight using suspension reconstruction (loops). Their creator is a Marine who created this device in 1990 with the aim of maintaining physical fitness in the absence of any simulators [15]. TRX functional suspension loops are a device consisting of two slings that are connected to each other and have various suspension options at different heights from the floor.

The TRX Functional Loop Trainer (Fig. 1) consists of nylon straps that create resistance using two components: body weight and gravity. After the initial testing of the level of strength readiness, the women trained according to the proposed functional program on TRX loops (Fig. 1). Wellness classes were held 3 times a week for 45-60 minutes. The choice of the volume, intensity and orientation of women's sports activity was determined by their state of health, functional capabilities of the body, the level of physical performance and fitness. [11; 19].



Fig. 1. Exercises on the simulator "Functional loops TRX"

As part of the fitness program with TRX functional suspension loops, strength exercises were performed from various starting positions: *squats* (Squat, Pistol squat, Suspended Lunge, Pistol squat), where the loops are a source of balance and support; *lunges* (Alternative Lunges, Plyo lunge, Cross Floating Lunge, Floating Lunge, Floating Lunge Jump, Side lunge, Suspended Side Lunges); *flexion-extension of the arms (push up)* (Bicep Curl, Tricep extension, Push up, Tricep press, Mountain Climber Pushup, TRX Twist, Dips); *deadlift* (TRX Row, High row, Table Row, Deadlift); *pull up* (Pull up, TRX Twist); *plank* (Plank basic, Plank Up & Down, Ripper, Crisscross climber, Tuck knee, Pike, Forearm Plank, Plank saw, Forearm Plank Climber, Side Plank, Forearm Side Plank, Reverse Suspended abductors, Mountain Climber, Walk Plank); *exercises in the supine position of the leg on TRX loops* (Leg Curl, Bicycle, Bridge, Hip Raise, Suspended adductors, Hamstring Runner) *jumps* (TRX Forg, Wide Jump) and others. Today, there are many exercises, versions and modifications of these simple movements for different parts of the body, therefore, throughout the study, these exercises were performed not only as independent separate exercises for a clearly defined number of times, but also a combination of several exercises was carried out, due to which the level of complexity of that or some other exercise. Since the range of exercises on the TRX loops is very wide, it was not difficult to adjust the intensity of the load. According to scientifically based recommendations [11; 16; 17], when choosing exercises for the development of power qualities of

women 30-35 years old, it was necessary to take into account their suppressive effect on the development of a certain power quality, the possibility of providing local, regional and general effects on the musculoskeletal system and the possibility of accurate dosing of the load. It is important to note that the advantage of doing exercises on the TRX loops, in contrast to traditional strength exercises, was that they were designed to handle every centimeter of the body, because the load was distributed evenly. Thus, exercises on the "Functional loops TRX" simulator integrated strength and balance into a single dynamic format, making it possible to maximize the effectiveness of their implementation.

Results of the research

Analyzing the peculiarities of the use of exercises on the "Functional loops TRX", it is necessary to pay attention to the fact that they are based on a specially displaced center of gravity, which activates the stabilizing muscles (core). In this regard, it should be noted that no matter what exercises are performed, all stabilizers are involved in the work in order to provide the body with balance in the most natural way. It should also be noted that exercises on the "Functional loops TRX" simulator strengthen the stabilizing muscles by performing functional movements and dynamic movements instead of the usual exercises to develop the muscles of the shoulder girdle, back, and abdominals from the starting position. At the same time, a significant load on the stabilizers also occurs during exercises for the muscles of the upper shoulder girdle, chest, back, anterior abdominal wall and muscles of the lower extremities. So, the analysis of the specificity of exercises on the "Functional loops TRX" simulator allows us to make an assumption about their positive influence on the development of strength qualities in women aged 30-35. Therefore, within the framework of the pedagogical experiment to check the effectiveness of the use of TRX suspension loops exercises for the development of power qualities in women aged 30-35, at the end of the study, a final testing was carried out (Table 1).

Table 1

Indicators of strength readiness of women aged 30-35 years during the study (n=10), ($t_{gr}=2,23$ at $p < 0,05$; $t_{gr}=3,17$ at $p < 0,01$)

№ i/ o	Test name	$\bar{X} \pm m$	$\bar{X} \pm m$	t_p	P	Increase in results, %	
		At the beginning of the study	At the end of the study				
1	Flexion and extension of the arms in the supine position (number of times)	8,60±0,62	11,40±0,50	3,52	<0,01	33%	
2	Pull-ups on the crossbar (number of times)	4,17±0,32	5,25±0,22	2,79	<0,05	26%	
3	Lifting the torso from a supine position (number of times)	27,20±1,34	32,70±1,10	3,18	<0,01	20%	
4	Lifting the legs while hanging (number of times)	4,30±0,47	5,70±0,40	2,27	<0,05	32%	
5	Holding the leg forward (s)	rights	25,10±0,85	28,60±0,67	3,24	<0,01	14%
		left	22,10±0,71	25,40±0,85	2,99	<0,05	15%
6	Countermovement jump (cm)	17,83±1,91	21,61±1,88	1,42	>0,05	21%	
7	Standing long jump (cm)	152,6±4,03	158,6±2,60	1,25	>0,05	4%	

As can be seen from the presented materials of Table 1, according to the test "Flexion and extension of the arms in the lying position", the women of the study group showed an average group result of $8,60 \pm 0,62$ times at the beginning of the study and $11,40 \pm 0,50$ times at the end. The difference between these indicators is statistically significant, since $t_p = 3,52 > t_{gr} = 3,17$. This indicates that the use of exercises for the development of strength on the TRX suspension loops contributed to an improvement in the average result by 33% (Table 1). When performing the next test task "Pulling up on the bar"—women 30-35 years old during the study showed the following results: $4,17 \pm 0,32$ times (initial testing) and $5,25 \pm 0,22$ times (repeated testing). The difference between these indicators is statistically significant ($p < 0,05$). This means that the results of the study have objectively improved and their growth was 26% (Table 1). In the course of the study, the average group results shown by women 30-35 years old when performing the test "Raising the trunk from a prone position" also received significant shifts. If at the beginning of the study women were able to lift the trunk $27,20 \pm 1,34$ times, at the end of the study this result increased by 20 % and amounted to $32,70 \pm 1,10$ times.

At the same time, $t_p=3,18 > t_{gr}=3,17$ with a significant difference in the average group results. Thus, such dynamics of changes in strength readiness indices of women aged 30-35 years is associated with the effectiveness of the use of exercises on the "Functional loops TRX" simulator. Improvement of the results of the level of development of strength qualities also occurred in the next test "Raising the legs in the hanging" and amounted to 32 %. Women who exercised on the "Functional loops TRX" showed a result of $4,30 \pm 0,47$ times at the beginning of the study and a result of $5,70 \pm 0,40$ times at the end. According to Student's test, the difference between the average group results in this test is statistically significant, since $t_p > t_{gr}$. So, the positive changes in the development of power qualities in women aged 30-35 years were due to the different aspects of the influence of the proposed exercises (Table 1).

Determination of the development of power qualities in women aged 30-35 years was also carried out using the tests " Holding the leg forward on the right leg" and " Holding the leg forward on the left leg". While holding the right leg, they showed an average group result of $25,10 \pm 0,85$ s at the beginning of the study and $28,60 \pm 0,67$ s at the end. Since $t_p=3,24 > t_{gr}=3,17$, we can conclude that the difference between these indicators is statistically significant. With the holding of the left leg, the women showed an average group result of $22,0 \pm 0,71$ s at the beginning of the study and $25,40 \pm 0,85$ s at the end. The difference between these results is also statistically significant, since $t_p > t_{gr}$. It should be noted that these results allow us to conclude about the effectiveness of using the proposed strength exercises: the improvement in the result on the right leg is 14 %, on the left 15% (Table 1).

In the test "Countermovement jump" women of the study group showed the average group result of initial testing $17,83 \pm 1,91$ cm, and $21,61 \pm 1,88$ cm of repeated testing. The difference between these indicators is not statistically significant, since $t_p=1,42 < t_{gr}=2,23$. However, the obtained indicators of the development of power qualities of women 30-35 years old indicate an improvement in the results in the course of the study by 21 % (Table 1).

When performing the exercise "Standing long jump", the women who took part in the experiment showed a result of $152,6 \pm 4,03$ cm at the beginning of the study and a result of $158,6 \pm 2,60$ cm at the end (the improvement in the result during the study was 4%) (Table 1). According to the Student's test, the difference between the mean group values is not statistically significant ($p > 0,05$).

Conclusions / Discussion

The results of the research carried out supplement the theoretical provisions on the problem of human health, as one of the most difficult complex problems of modern science [3]. The results of our research supplement the data of V. B. Zinchenko, Yu. A. Usachev [8], V. M. Osipov [12] and others about the peculiarities of the use of fitness means in order to increase the physical activity of individuals. We also agree with the statement of experts [1, 13; 14] that the development of the fitness industry contributes to its expansion and requires classification and definition of methodological features that determine the use of appropriate means in fitness programs. Experts [2, 4, 6] emphasize that the use of a variety of special simulators allows you to effectively develop a variety of motor qualities and abilities of those involved, improve their technical skills, skills and physical qualities, and also creates the necessary conditions for precise control and management of the most important parameters load. The data obtained have expanded the knowledge of many specialists that strength training is an important component of health fitness, since a properly structured strength training provides significant functional benefits and improves human health and well-being [9; 10, 20]. But for the first time, we have evaluated the effectiveness of using TRX suspension loops exercises for the development of strength qualities in women aged 30-35. So, according to the results of the study, it was established that the use of exercises on TRX suspension loops in health-improving exercises with women of 30-35 years old has a positive effect on the development of their strength qualities. At the end of the experiment, the average group indicators of the strength qualities of women 30-35 years old turned out to be significantly higher compared to the results of the initial testing, their growth ranged from 4 % to 33 %. Also, a

comparative analysis of the results of women in the study group using the Student's test showed significantly better results of strength readiness in almost all tests ($p < 0,05$; $0,01$), except for the tests "Countermovement jump" and "Standing long jump" where the result is also better, however, it is not statistically significant ($p > 0,05$).

Prospects for further research will be aimed at studying other fitness technologies aimed at increasing the motor activity of women 30-35 years old.

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**GENERALIZATION OF EXPERIENCE IN THE QUESTIONS OF
IMPROVING THE THROWING ELEMENTS WITH THE HOOP OF
YOUNG ATHLETES IN RHYTHMIC GYMNASTICS**

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Purpose: to summarize coaching experience in improving throwing elements with a hoop for gymnasts 7-8 years old.

Material and methods: the study involved one hundred twenty athletes 7-8 years old, training at the Rhythmic Gymnastics School of the city of Kharkov and the city of Szczecin. The level of possession of the throwing movements of the hoop was determined using characteristic motor tests and application video recordings. The assessment of the competitive exercise was carried out by the method expert assessments. The experts were coaches with a referee category in rhythmic gymnastics. The result was determined in accordance with the rules of the competition. The maximum score is 10.0 points.

Results: the level of mastery of the basic throwing elements with a hoop was revealed for gymnasts of 7-8 years old, the method of error correction was substantiated. The gymnasts received the lowest marks in the following tests: “Throwing a hoop lying on the floor with a swing of the foot with rotation around

the diametrical axis of the apparatus on a sideways turnover, catching a jump through the hoop (\bar{X} - 6,2 points); "Throw from a spin in the lateral plane with the left hand" (\bar{X} -7,0 points); "Throw with a swing of a horizontally located hoop, catching in the passage in a sideways flip" (\bar{X} -7,5 points).

Conclusions: the lowest results were obtained when performing the elements of "difficulties", "risks", "skill" and when performing throws with the left hand. The result for performing a competitive exercise with a hoop is 7,2 points. The repeated results of throwing actions with a hoop increased from 7% to 31% and ranged from 8,1 points to 9,5 points. For the performance of a competitive exercise with a hoop, the result increased by 18% and is 8,5 points.

Keywords: hoop, gymnastics, artistic, throws, experience, coach, correction.

Introduction

Rhythmic gymnastics is a complex coordination sport, a competitive program in which gymnasts require a wide range of skills and abilities. It is well known that the distinguishing feature of rhythmic gymnastics as a sport is the performance of exercises with objects. Gymnasts in competitive compositions, in addition to owning their bodies, simultaneously demonstrate a virtuoso technique of performing elements with a ball, rope, ribbon, clubs and hoop [4; 6; 11; 12]. The high complexity of competitive exercises in rhythmic gymnastics determines the search for effective pedagogical approaches in the process of improving the technical training of athletes, including exercises with objects [5; 8, 16]. To achieve mastery, athletes need to learn to perform throws, bounces, reversals, rotations, figure movements and various manipulations with objects. Impressive in performance and difficult to learn are throwing movements, which are performed by all subjects [7; 13]. Assimilation of exercises with subjects young gymnasts begin in the first year of study.

At the age of 7-8 years, young gymnasts add more complex elements to the basic skills that have already been studied [4; 9]. At this stage of preparation, it is important to correct inaccuracies in the acquired basic skills, to prevent possible

mistakes in the development of complex elements, one of which is throwing movements with the hoop.

Connection of research with scientific, practical tasks, plans, programs. The study was conducted in accordance with the initiative topic of research of the Department of Gymnastics, Dance and Choreography KHS AFC: "Theoretical and methodological foundations of development of system-forming components of physical culture (sports, fitness and recreation) for 2020-2025, state registration number 0120U101215.

The purpose of the study: to summarize the coaching experience in improving the throwing elements with a hoop of gymnasts 7-8 years.

The objectives of the study: 1) to identify the level of mastery of throwing elements with a hoop of gymnasts 7-8 years; 2) to develop a method of correction of errors of throwing movements with a hoop

Material and Methods of research

One hundred and twenty athletes aged 7-8, who train at the CYSS in rhythmic gymnastics in Kharkov and Szczecin, took part in the study. The level of mastery of throwing movements of the hoop was determined using characteristic motor tests using video. The evaluation of the competitive exercise was carried out by the method of expert evaluations, the experts were coaches who had a judge's category in rhythmic gymnastics. The maximum score for each test and competitive exercise – 10,0 points, discounts were made in accordance with the requirements for the technique of performing exercises in accordance with the rules of competitions in sports [11; 12; 13].

Results of the research

Gymnasts of the studied group have previously mastered some basic skills of performing elements with a hoop. Learning to throw with a hoop began while learning the basic elements of objects. Currently, young athletes are learning more complex elements, which give the opportunity to get extra points for "difficulties", "risks" and "skill".

To determine the level of readiness of gymnasts, tests with different types of throwing elements with a hoop were identified, which often make up the content of competitive programs and are available for development at this age [2; 3; 12; 13].

The gymnasts were offered eight test tasks in which they performed high hoop throws in different planes, without rotation and with rotation, throwing and catching without visual control and without the help of hands. The first two throws over himself from the rotation in the lateral plane [2; 7; 8; 13], gymnasts performed by rotating the hoop in front on the outward brush, hand forward. In the next two tests, these throws were performed without visual control.

In the next, fifth test exercise, the athletes performed a forward-upward throw of the vertically placed hoop with a wave of the hand, performing a "shene" under the object and catching in a free grip on the lower edge of the hoop in a sideways turn.

The sixth test exercise was throwing a hoop over yourself with rotation around a diametrically horizontal axis and catching without the help of hands in the passage into the hoop. From the starting position - the hoop forward horizontally with two hands from below, the athletes swung a high throw of the hoop with a rotation towards them. Fishing was carried out on the body of the athlete without the help of hands, in the passage into the hoop with his feet in the seat at an angle on the floor, followed by a grip from above with both hands in a roll back.

The seventh exercise was throwing a horizontally placed hoop back and forth with a swing of two hands, "shene" and fishing without the help of hands in the passage into the hoop in a sideways turn. From the starting position - the hoop forward horizontally by grasping with both hands from below: the hoop to the side-to the bottom, swing forward-upward with the subsequent performance of "shene" under the object. Fishing was carried out on the body of the athlete without the help of hands in the passage into the hoop by turning sideways.

Eighth exercise: on the side turn throw a hoop lying on the floor with a swing of the foot with a rotation around the diametrical axis of the object, catching his hands in a jump through the hoop. In the initial position, the hoop rests on the

support leg, the opposite free side of the hoop on the floor. The gymnast steps over the hoop and when performing a coup with the swing of the supporting leg makes a throw of the hoop with rotation around the axis in the plane of the object, fishing is performed with the hands in a jump through the hoop.

Athletes were given three attempts to perform each test, and the best result was recorded. The mean values in the group were calculated. Gymnasts also performed a competitive program with a hoop for evaluation (Table 1).

Table 1

Test results of throwing actions with a hoop (max - 10 points, n-120)

Tests	Average value \bar{X}	Standard deviation σ	Coefficient of variation V
1. Throw with rotation in the lateral plane with the right hand	8,8	1,17	13
2. Throw with rotation in the lateral plane with the left hand	7,8	1,42	18
3. Throw with the right hand with eyes closed, fishing with eyes open	8,6	1,24	14
4. Throw with the left hand with eyes closed, fishing with eyes open	7,0	1,83	26
5. Throw in the side plane, "shene", catching in a sideways coup	8,2	1,12	14
6. Throwing a horizontally placed hoop with rotation to itself, catching without the help of hands in the passage into the hoop with his feet in a roll back	7,9	2,42	31
7. Throwing a horizontally located hoop, "shene", fishing without the help of hands in the passage into the hoop by turning sideways	7,5	1,84	25
8. Throwing a hoop lying on the floor with a swing of the foot with a rotation on the coup sideways, catching his hands in a jump through the hoop	6,2	1,8	29
9. Competitive composition with a hoop	7,2	1,86	26

The test results revealed that the gymnasts made mistakes when performing the exercises. When developing a method of correction of throwing movements with a hoop, attention was paid to error prevention, correction and improvement of exercise techniques.

In throws with rotation in the lateral plane with the right and left hand, it should be noted that the performance of this exercise with the right hand was much

better (8,8 points and 8,6 points) than the left (7,8 points and 7,0 points) even when performing a throw with the right hand without visual control. The method of correction of throwing movements with a hoop necessarily provided for the symmetrical performance of all tasks, as in accordance with the requirements of the sport gymnasts must demonstrate the ability to perform exercises with both hands. In general, in these throws gymnasts often made the following mistakes: inappropriate hoop plane in flight, insufficient height of the object, gymnasts moved from place to place before fishing. The following exercises were included in the method of error correction: 1) simulation of throwing and catching without a subject; 2) performing pre-throw actions with the rotation of the hoop on the palm of the hand; 3) throw the hoop at different heights.

The results of the throw in the side plane, "shene", catching in a sideways turn (-8,2 points; V-14%) indicate the real possibility of mastering the technique of this exercise gymnasts 7-8 years. However, some athletes made the following mistakes: a pause between fishing and a sideways turn, extra steps before fishing, insufficient height of the object, incorrect plane of the hoop in flight, catching the hoop with both hands. The following exercises were included in the method of error correction: 1) simulation of throwing and catching without a subject; 2) throw forward-up, two steps, catching in a turn sideways; 3) catching in a sideways turn after a low throw.

When performing a throw of a horizontally located hoop with rotation to itself, catching without the help of hands in the passage in the hoop with his feet back (-7,9 points; V-31%) gymnasts made the following mistakes: incorrect axis of rotation of the hoop, helping hands when catching, steps before fishing. The following exercises were included in the method of error correction: 1) simulation of throwing and catching without an object; 2) throws of a horizontally located hoop with rotation to itself; 3) fishing in the aisle in the roll back after a low throw.

Performing a throw of a horizontally located hoop, "shene", fishing without the help of hands in the passage into the hoop by turning the side of the young gymnasts is difficult (-7.5 points; V-25%). When performing this exercise, the

athletes made the following mistakes: incorrect plane of the hoop in flight, insufficient throw height, a pause between fishing and performing a sideways coup. To correct errors in the method were included the following exercises: 1) simulation of throwing and catching without a subject; 2) swings with a hoop with the performance of pre-throw actions; 3) throw swing forward and up without performing "shene" and catching in a coup sideways; 4) fishing in the aisle in a sideways turn after a low throw.

The gymnast received the lowest marks for performing a leg throw with rotation around the horizontally located axis of the object on the sideways turn, catching a jump through the hoop (- 6.2 points; V-29%). The gymnasts made the following mistakes when performing the test: the hoop slipped off the leg when performing a sideways throw, the wrong plane of the object in flight, performing a throw with excessive intensity, a large distance between the throw and catching the object. To correct errors, the following exercises were included in the technique: 1) swing a leg with a hoop on the leg from the starting position as when throwing the hoop on the coup sideways; 2) throw a foot on the coup side with a medium height with an emphasis on maintaining the correct plane of the object; 3) ideomotor performance of a holistic exercise.

To correct errors when performing basic elements with a hoop and increase the effectiveness of throws gymnasts performed a variety of holds, rotations, rolls, manipulations, swings and directly different throws with a hoop [1; 2; 3; 13].

Competitive composition with a hoop was the last test, during which it was determined how effectively the above exercises gymnasts perform in their compositions. The average value - 7.2 points, the coefficient of variation - 26% indicates the need to improve the performance of the throwing elements of "difficulties" and "risks".

During the experiment, during the warm-up, gymnasts, under the guidance of the coach, performed a warm-up at an intense, fast pace, thereby reducing it. As a result, 15 minutes were released and the girls performed some additional throws, which amounted to 45 minutes of work per week. The technique was applied for

two months (360 minutes, or 6 hours). During the training with the subject, more attention was paid to those exercises that were the worst evaluated in the test. The gymnasts were explained the key moments of the technique of performing each throwing movement. With the help of video and clearly compared the correct and incorrect performance of exercises. Proper performance was fixed by a large number of repetitions with mandatory conscious control of all parts of the technique and with subsequent control of the exercise. If necessary, the error correction procedure was repeated in the following trainings. Performing exercises before the competitive composition allowed to better prepare gymnasts to work with the subject, they made less losses and technical errors.

After applying the technique, repeated tests were performed, which revealed that the gymnasts significantly increased their level of mastery of the hoop. Repeated results of throwing actions with a hoop make from 8,1 points to 9,2 points.

The best improvements were determined in the test "throwing a foot with a rotation on the coup sideways, catching a jump through the hoop." During the first testing, gymnasts usually tried this exercise, so the result was low and heterogeneous in the group. During the implementation of the method, much attention was paid to eliminating errors and improving the technique of this throw. After applying the technique, the athletes began to perform the exercise with the best technique: without losing the object, with sufficient height and with the correct plane of the object in flight, with good fishing. In re-testing, most gymnasts performed this exercise quite confidently, the average score in the group was 8.1 points, the coefficient of variation decreased from 30% to 15% (fig. 1).

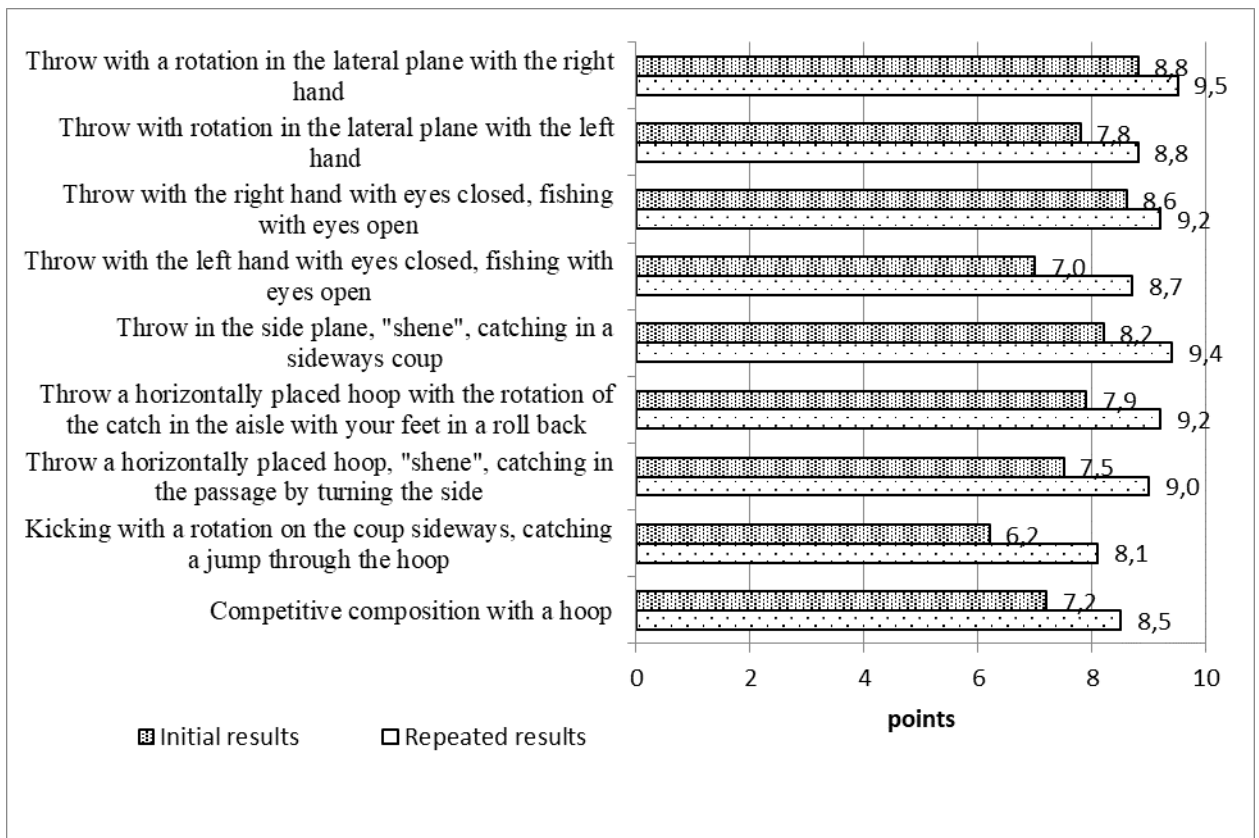


Fig. 1. Changes in the results of throwing actions with the hoop

In the following, problematic for gymnasts, tests: throws with the left hand in the lateral plane with rotation, the result improved from 7,0 points to 8,7 points and from 7,8 points to 8,8 points. Gymnasts after applying the technique began to perform the exercise with a sufficient height of the subject and without unnecessary steps.

In the next, problematic for gymnasts, test "throw a swing of a horizontally located hoop without rotation," shene ", fishing in the aisle in the turn sideways" the result increased from 7,5 points to 9,0 points, which corresponds to an improvement of 20%. Gymnasts after applying the technique began to perform the exercise more confidently and with minimal errors.

The smallest improvement (7% and 8%) was found in throws with rotation in the lateral plane with the right hand. This is due to the fact that in the initial testing during this exercise, the athletes showed a high result, so after applying the method, the athletes increased their level, but with a slight increase.

When performing a competitive composition with a hoop, the result increased by 18%, which confirms the impact of the developed technique on improving the technique of performing elements of "difficulties", "risks", "skill" in gymnasts 7-8 years.

Conclusions / Discussion

The conducted researches confirmed the information of V. Lenyshyn., V. Sosina, G.A. Poplar [6; 12] that one of the features of the development of modern rhythmic gymnastics is the steady growth of technical skills of gymnasts and the difficulties of their competitive programs. At the stage of preliminary basic training, promising ways to improve the result, experts primarily associate with learning elements of increased difficulty, including throwing elements with a hoop [1; 15]. The study confirms the data of Andreieva N, Zhyrnov O. [14], A. Mullagildina, I. Krasova [16], that at this stage of preparation it is important to correct errors in the technique of basic elements and prevent them when learning complex elements, one of which is throwing. movements with a hoop.

Analysis of the results of tests that revealed the level of mastery of throwing movements with a hoop gymnasts 7-8 years, it was determined that at this stage of training, young athletes make mistakes when performing throwing elements with a hoop. The young athletes showed the lowest results when performing elements of "difficulties", "risks", "skill" (-6.2 points; - 7.5 points) and performing throws with the left hand (\bar{X} -7.0 points; - \bar{X} - 7.8 points). . The average result for performing a competitive composition with a hoop - 7.2 points.

We also agree with the statement of experts [1; 6; 7; 10] that at present the volume of throwing elements in competitive combinations of gymnasts has considerably increased, their structural complexity has increased, the amplitude of performance has increased, fishing conditions have become more complicated. This necessitates the search for new ways and opportunities that can better and faster teach gymnasts to control their movements. Taking into account the results of testing athletes, a method of correction of throwing movements with a hoop was developed, as a result of which, athletes began to perform throwing elements at the

best technical level with minimal losses. The result for performing a competitive composition with a hoop improved to 8.5 points.

Confirmed conclusions T.S. Lysytska, L.A. Novikova [7], A.Ya. Mullagildina, K.O. Shevchenko [9], B. R. Agostini., L.A. Novikova [14] and other scientists that the introduction of methods of improving throwing actions in subjects in the educational and training process is one of the most promising areas of technical training of athletes in rhythmic gymnastics.

Prospects for further research in this area are to further determine the methodological approaches to the correction of throwing actions by the subjects of athletes in rhythmic gymnastics.

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**USE OF HIGH-INTENSITY COMPETITIVE EXERCISES AGAINST THE
BACKGROUND OF FATIGUE BY AN ELITE KARATEKA WITH
HEARING IMPAIRMENTS**

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Purpose: to determine the effectiveness of the use of competitive exercises at high speed on the background of fatigue elite karateka with hearing impairments during a four-year cycle.

Materials and methods: the study involved an athlete with hearing impairments, engaged in karate - Deaflympic champion in 2013 and 2017. In the training process, the athlete used high-intensity competitive exercises against the background of fatigue, at the end of the training session. To determine the effectiveness of the program in the study used a number of psychophysiological indicators, such as: work efficiency, mental stability, time of simple reaction to light, reaction to a moving object, tapping test, reaction time of choice, Romberg test, concentration and switching of attention. The number of strikes in different parts of the match was also investigated.

Results: significant improvement of results was observed in the indicator of mental stability ($t=2,02$; $p<0,05$), time of simple reaction to light ($t=2,51$; $p<0,05$), reaction to a moving object ($t=3,79$; $p<0,001$), frequency of movements ($t=3,63$; $p<0,001$), choice reaction time ($t=2,08$; $p<0,05$), Romberg's test ($t=6,96$; $p<0,001$),

switching attention according to the Bourdon's test ($t=2,40$; $p<0,05$). No statistically significant differences were found in the indicator of concentration of attention and efficiency of work on Schulte's tables ($p>0,05$).

Conclusions: there was an improvement in the performance of the athlete when performing offensive actions during the second and third 40 seconds of the fight. This indicates the development of special endurance and increased efficiency against the background of fatigue. The obtained results are confirmed by the improvement of psychophysiological indicators that affect sports performance in karate. The expediency of using competitive exercises against the background of fatigue and their influence on the psychophysiological parameters of the Deaflympic karate champion is proved.

Keywords: karate, psychophysiological indicators, attacking actions, elite female athletes, karate athletes with hearing impairments.

Introduction

Developing training programs for athletes with hearing impairments, one should take into account psychophysiological indicators, the ability to adapt in the social sphere, the ability to cooperate with others [4, 8]. According to scientists, some parameters characterizing physical performance in athletes with hearing impairments are two times lower than in healthy athletes, despite the fact that physical performance correlates with the body's adaptation to performing work at given parameters of speed, duration of work. [2, 9, 12].

The actual psychophysiological indicators in karate are those that are associated with physical properties that are manifested by athletes during a fight and training activity [10, 11]. Motor qualities are closely related to the peculiarities of the human nervous system: strength-weakness, mobility-inertia, balance-imbalance of nervous processes [3]. Each movable quality is provided by several typological features of the nervous system. Also, the rate of onset of fatigue of female athletes during training sessions and competitions depends on the psychophysiological characteristics [5, 6].

It is known that athletes in karate in particular and in martial arts in general, getting tired during the fight, worse maintain balance and fighting stance, the accuracy of striking decreases [7]. This, of course, negatively affects both the conduct of attacking actions and defensive actions. Athletes who better resist fatigue during exercise have an advantage at the end of bouts. Under the influence of training against the background of fatigue, there is an improvement in the support systems for static and dynamic balance during the fight.

Combat athletes with hearing impairments lag behind their healthy colleagues in the development of speed-strength qualities and accuracy of motor actions fulfillment. Athletes with hearing impairments get tired faster when doing physical exercises [1]. When building training programs for athletes with hearing impairments, individual psychophysiological characteristics, functional characteristics and personal characteristics should be taken into account [13].

When analyzing the scientific and methodological literature, we did not reveal studies of the influence of psychophysiological indicators of athletes with hearing impairments on their competitive performance.

Purpose of study - to determine the effectiveness of the use of competitive exercises at a high speed on the background of fatigue elite female karate with impaired hearing for the four-year cycle.

Material and Methods of research

The study involved an female athlete with a hearing impairment, is engaged in karate - deaflympic champion 2013 and 2017. The study was carried out during a four-year cycle of preparation for the 2017 Deaflympics. In the training process, the athlete used high-intensity competitive exercises against the background of fatigue at the end of the training session. The karateka used exercises using the equipment used in karate (exercises with pears and makiwara, wall cushion, practicing punches with a partner).

The study used a number of psychophysiological indicators, namely: work efficiency, mental stability, simple reaction time to light, reaction to a moving object, tapping test, choice reaction time, Romberg's test, concentration and

attention switching. The number of strikes delivered in different parts of the duel was also investigated.

Results of the research

When constructing a four-year cycle of training female athletes for the Deaflympics, its individual indicators were taken into account.

Trainings using speed training against a background of fatigue traditionally consist of three parts - preparatory, main and final. The athlete used means that are generally accepted in karate: practicing the technique of punches and kicks in the upper sector (Chudan), working out blocks and defensive actions, sparring with partners, exercises for developing endurance and stretching exercises (Table 1).

Table 1

Content of the training session for the development of speed qualities against the background of fatigue

Part of the lesson	Training tools	Time, min
Preparatory	Greeting Warm-up	15
Main	A set of exercises for the development of special endurance	10
	A set of exercises for stretching muscles	10
	Practice of kicking and punching techniques in the Chudan sector	15
	Practice of blocks and protective actions	15
	Sparring with partners	15
	<i>Work on bags and makivari with the maximum speed</i>	10
Final	Exercises to restore breathing	3
	Exercises to relax muscles	5
In general, the time of training		98

At the end of the session, the training session included exercises to develop speed against the background of fatigue. The work was carried out on bags and makiwara at the highest possible speed and with the minimum rest time between series. Only technically well-developed exercises and series of exercises were used. The predominant orientation of the work at the end of the lesson was carried out in the range from a mixed zone of aerobic-anaerobic (heart rate - 175-185 beats / min) to anaerobic glycolytic (heart rate - 200 beats / min). Similar exercises were carried out in shock microcycles in the preparatory and competitive periods of training and constituted a large share of all training sessions.

To analyze the changes in the psychophysiological indicators of an elite female athlete with hearing impairments during a four-year cycle, we compared them at the beginning and at the end of training. Each of the indicators has been tested 24 times. The days of the recovery microcycle were selected for testing, when the athlete was in optimal shape and was not tired. A total of 10 indicators were analyzed. The data obtained are presented in Table 2.

Table 2

Comparison of psychophysiological indicators of the Deaflympic champion in karate at the beginning and at the end of a four-year cycle

Indicator	Indicators of an elite female athlete with hearing impairment at the beginning of the study (n=24)			Indicators of an elite female athlete with hearing impairment at the end of the study (n=24)			t	p
	\bar{X}_1	\pm	σ_1	\bar{X}_2	\pm	σ_2		
Efficiency of work on the Schulte test, c.u.	65,0	\pm	1,6	64,1	\pm	0,9	1,47	>0,05
Mental stability according to the Schulte test, c.u.	1,00	\pm	0,05	0,96	\pm	0,04	2,17	<0,05
Time of simple reaction to light, s	0,28	\pm	0,01	0,26	\pm	0,03	2,51	<0,05
Reaction to a moving object, s	0,51	\pm	0,03	0,49	\pm	0,02	3,79	<0,001
Tapping test, frequency of movements c.u.	4,88	\pm	0,19	5,03	\pm	0,12	3,63	<0,001
Selection response time, s	1,17	\pm	0,10	1,12	\pm	0,08	2,21	<0,05
Romberg test, s	10,2	\pm	0,86	12,2	\pm	1,09	6,96	<0,001
Concentration of attention according to the Bourdon test, c.u.	241,9	\pm	8,7	244,9	\pm	5,56	1,46	>0,05
Switching attention according to the Bourdon test, c.u.	32,5	\pm	1,7	31,4	\pm	1,5	2,40	<0,05

A significant improvement in the results was observed in terms of mental stability ($t = 2,17$; $p < 0,05$), time of a simple reaction to light ($t = 2,51$; $p < 0,05$), reaction to a moving object ($t=3,79$; $p<0,001$), frequency of movements ($t=3,63$; $p<0,001$), response time of choice ($t=2,21$; $p<0,05$), Romberg's test ($t=6,96$; $p<0,001$), switching attention with the Bourdon test ($t=2,40$; $p<0,05$). There were

no statistically significant differences in the indicator of concentration of attention and work efficiency on the Schulte tables ($p>0,05$).

To determine the effectiveness of the work of the hearing impaired karate women in different parts of the bout, the number of attacking actions during the first, second and last 40 s of the bout was investigated. The data are presented in Table 3.

Table 3

Indicators of the number of strikes delivered at the beginning, in the middle and at the end of the fight (n fights = 14) at the beginning of the study

Part of the fight	Number of attacking actions			t; p
	\bar{X}	\pm	σ	
First 40 seconds	6,29	\pm	0,66	$t_{I-II} = 3,71$; $p<0,001$ $t_{II-III} = 6,91$; $p<0,001$ $t_{I-III} = 11,04$; $p<0,001$
Second 40 s	5,33	\pm	0,71	
Third 40 s	3,53	\pm	0,65	

Thus, there is a statistically significant decrease in the number of strikes in the middle and at the end of the fight, caused by the athlete's fatigue. During the first 40 seconds the athlete showed the result of $6,29 \pm 0,66$ attacking actions, during the second 40 seconds – $5,33 \pm 0,71$ attacking actions ($t_{I-II} = 3,71$; $p<0,001$).

To study the influence of the author's methodology on the sports performance of athletes with hearing impairments, there was a comparatively number of strikes delivered at the beginning and at the end of the study in different parts of the fight (Table 4).

Table 4

Indicators of the number of strikes delivered at the beginning, in the middle and at the end of the fight (n fights = 14) at the end of the study

Part of the fight	The number of attacking actions at the beginning of the study			The number of attacking actions at the end of the study			t	p
	\bar{X}	\pm	σ	\bar{X}	\pm	σ		
First 40 seconds	6,29	\pm	0,66	6,71	\pm	1,24	1,10	$>0,05$
Second 40 s	5,33	\pm	0,71	6,16	\pm	1,02	3,61	$<0,01$
Third 40 s	3,53	\pm	0,65	5,69	\pm	1,72	4,38	$<0,001$

Thus, statistically significant differences were found in the middle of the fight, during the second 40 s ($t=3,61$; $p<0,01$) and at the end of the fight, during the third 40 s ($t=4,38$; $p<0,001$).

Conclusions / Discussion

During the four-year cycle, progress was found in most indicators of the psychophysiological state of the female athlete with hearing impairments. These indicators have a direct impact on training and competitive activity in karate. The improvement of psychophysiological indicators indicates an increase in the level of the sports form of an elite female athlete and shows that at the end of the four-year cycle she was in an optimal psychological and physiological state.

The results obtained make it possible to expand knowledge on the preparation of athletes with hearing impairments for high-level competitions. The expediency of using competitive exercises against the background of fatigue and their influence on the psychophysiological indicators of the Deaflympic Karate Champion has been proved.

An improvement in the effectiveness of athletes was revealed when performing attacking actions during the second and third 40 s of the fight. This indicates the development of special endurance and increased efficiency against the background of fatigue. The results obtained are confirmed by the improvement of psychophysiological indicators affecting sports performance in karate (mental stability, time of a simple reaction to light, reaction to a moving object, frequency of movements, reaction time of choice, Romberg's test, switching attention with the Bourdon test).

Prospects for further research are to determine the correlation relationship between psychophysiological indicators and indicators of the speed of striking in karate.

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**DEVELOPMENT OF FLEXIBILITY IN THE HIP JOINTS IN CHILDREN
5-8 YEARS OF THE INITIAL GROUP OF SPECIAL PHYSICAL
TRAINING IN RHYTHMIC GYMNASTICS**

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Purpose: to evaluate the effectiveness of the proposed training technique for the development of flexibility in the hip joints in children 5-8 years, engaged in the initial group of special physical training in rhythmic gymnastics.

Material and methods: 16 gymnasts of the initial group of special physical training in rhythmic gymnastics at the age of 5-8 years, MG - 8 gymnasts who were engaged in the author's training method and CG - 8 gymnasts who were engaged in the standard training method took part in the research. Training in both groups was conducted three times a week for 1,5 hours. Assessment of the results of passive and active flexibility in the hip joints was used in both groups at the beginning of the examination and on day 22 of training, using tests "Performing twine from a gymnastic bench" and "Lifting the leg up lying on your back" by L.A. Karpenko, I.A. Wiener, V.A. Savitsky (2007).

Results: for the development of flexibility in the hip joints in children of the main group engaged in the initial group of special physical training in rhythmic gymnastics, the author's training technique was used, which includes exercises to develop passive and active flexibility, motivational part of the technique that

promotes positive emotions. increasing attention and interest in the result of training.

Conclusions: indicators of development of passive and active flexibility in the main group were significantly higher ($p < 0,05$), compared with the control group, which indicates a positive effect of the use of the author's training methods. It helps to improve the indicators of active and passive flexibility in the hip joints by including combined exercises that develop all the components of mobility in the hip joints, dynamic exercises and strength exercises in combination with forced stretching.

Keywords: active and passive flexibility, children, hip joint, rhythmic gymnastics.

Introduction

Professional sports is a field of human activity that is characterized by an increased risk of injury. Observing the dynamics of sports injuries, it is possible to determine that the number of sports injuries is constantly increasing and is now becoming threatening. In different countries of the world, the number of injuries in sports ranges from 10-17% of all injuries. Sports injuries in the United States account for 16% of the total number of traumatic injuries, in Sweden - 10%. Until 40 years ago, sports injuries accounted for only 1,4% of all injuries. In 1970 this figure increased to 5-7%. By the end of the 80s - the beginning of the 90s, the number of sports injuries exceeded 10%, in the mid 90s it was 12-17%, and in the period 2001-2010 it reached 17-20%.

Gymnastics is a kind of historically established form of physical activity, which is a system of specially selected exercises and methods, which, in combination with games, tourism, swimming and other means, effectively affects the value of health and physical development, improvement of human motor abilities, and in sports activity - high achievements in many sports, especially in the art of body control [1].

The stages of sports training is a conditional division of the training process according to the age and the level of preparedness (skill), based on the patterns of age development of the motor analyzer, the motor system of a personality and her abilities in accordance with the requirements of gymnastics.

Stage I - initial sports training (from 5-6 years old to 8 years old). The conditions of sports training are determined at the early stages by the abilities of the gymnast and coach to overcome difficulties and the general desire to achieve the heights of sportsmanship in gymnastics.

In rhythmic gymnastics, the most often injured are the lower limbs (50-65%), the upper limbs (35-50%), the trunk and spine (15-20%). In addition, until recently, at the stage of initial training, they began to engage in gymnastics at the age of 7-9, but according to modern programs, it is allowed to involve children from 5-6 years old, and sometimes from 4 years old [4]. Therefore, today there is a problem of developing a modern approach to the development of flexibility of girls 5-8 years old, engaged in rhythmic gymnastics. It is important to modify the existing training methods, especially in the initial groups of special physical training to preserve the health of children, form the foundations of a healthy lifestyle and promote the popularization of sports among young people. [7; 10].

Purpose of the study: to evaluate the effectiveness of the proposed training methodology for the development of flexibility in the hip joints in children 5-8 years old, engaged in the initial group of special physical training in rhythmic gymnastics.

Material and Methods of research

The research was carried out on the basis of KhDYuSSh № 1, Kharkov. The survey involved 16 gymnasts of the initial group of special physical training in rhythmic gymnastics at the age of 5-8 years, they were randomly divided into two groups: the main group (MG) - 8 gymnasts who were engaged in the author's training method, and the control group (CG) - 8 gymnasts who were engaged in a standard training method. Training in both groups was carried out three times a week for 1,5 hours.

The primary and repeated examination in the MG and CG of the female gymnasts was carried out on the 1st and 22nd days of training.

To determine passive and active flexibility in the hip joints in both groups, we used the test "Split from a gymnastic bench" and "Raising the leg up, lying on the back" by L. Karpenko, I.A. Viner, V.A. Savitsky (2007) [5].

Test 1. "Performing a split from a gymnastic bench" (assessment of passive flexibility in the hip joints). Testing: 1 - from the right leg, 2 - from the left leg, 3 - transverse split. Score: the maximum score of the test is 5 points. Points were awarded in accordance with Table 1.

Table 1

Assessment of passive flexibility in the hip joints according to the results of the test "Split from a gymnastic bench"

Evaluation criteria	Points	Performance level
Execution on the floor, the distance to the floor is 15 cm or more	1	low
Execution on the floor, the distance to the floor is from 15 cm to touching the floor	2	
Perfect execution on the floor	3	average
Firm touch of the floor with the thigh, the middle of the foot is on the bench	4	high
Thigh firm contact with the floor, heel is on the bench	5	

Test 2 "Raising the leg up, lying on the back" (assessment of active flexibility in the hip joints). Carrying out the test: starting position - lying on your back, raise your right (left) leg up, without lifting the pelvis from the floor. Within 3 seconds. Assessment: the distance from the back of the foot to the floor is measured (cm), the maximum test score is 5 points. Points were awarded in accordance with Table 2.

Table 2

Evaluation of active flexibility in the hip joints according to the results of the test "Raising the leg up, lying on the back"

Evaluation criteria (cm)	Points	Performance level
40 or more	1	low
35	2	
30	3	average
25	4	
from 20 to less	5	high

Results of the research

Flexibility is the ability to perform movements with greater amplitude. Distinguish between: active flexibility, achieved by the tension of one's own muscles, and passive, which is carried out due to external forces (body weight, partner efforts, the use of simulators, etc.).

Complex motor activity does not provide individual physical qualities in their pure, isolated form. A combination of various physical qualities is at work almost everywhere. At the stage of initial training for the performance of competitive compositions, it is necessary to master the elements that require the manifestation of various types of flexibility: passive and active [2; 9].

According to M.A. Godik, passive flexibility is determined by the very amplitude that can be achieved due to external force. Its value should be the same for all measurements, only in this case it is possible to obtain an objective assessment of passive flexibility [3]. The value of passive flexibility is determined at the moment when the action of an external force causes a painful sensation. Thus, the indicators of passive flexibility are heterogeneous and depend not so much on the state of the muscular and articular apparatus, but also on the athlete's ability to endure unpleasant sensations for a while. Therefore, it is important to motivate him so that he does not stop the test when the first signs of pain appear.

Much attention is paid to the development of active and passive flexibility in rhythmic gymnastics. Yu.V. Menchen, L.V. Volkov, V.M. Platonov, K.P. Sakhnovsky believe that the load when performing exercises with passive stretching is the same, in static positions it is greater than in swing positions. Therefore, different exercise dosages are needed. [6].

General fatigue during exercise reduces the range of motion, reduces the effectiveness of the exercise. If exercises are performed with weights, its weight should not significantly reduce the speed of swings or springy movements (encumbrances should not exceed 2-3% of the athlete's body weight). The conditions for performing movements are greatly facilitated by the use of a support.

The balance of work aimed at developing active versus passive flexibility within the annual cycle varies. In the early stages of the training year, the means of developing passive flexibility prevail, which is the basis for further work on the development of active flexibility. In the future, the volume of exercises that contribute to the development of active flexibility increases.

The use of exercises for the second stage of the development of flexibility is based on the same methods and the development of strength. The basic principle is the principle of repeated efforts with maximum stress in all operating modes: slow, fast and static. These exercises are much more stressful than passive exercises. Therefore, the number of repetitions and the number of approaches decreases, the duration of rest between sets increases and the content of rest changes.

The use of forced stretching has an undoubted advantage over other methods of developing passive mobility in the joints, however, in the development of an active form of flexibility in all directions, active and mixed training modes are much more effective [8]. At the same time, forced stretching, which provides the greatest (anatomically possible) mobility in the joints, carries both pain and an increased risk of injury.

V.M. Platonov, K.P. Sakhnovsky believe that in order to maintain mobility in the joints, you need to give them "work" every day. A set of exercises that develop active flexibility, as well as active-static strength exercises that require maximum flexibility, are used no more than 3 times a week, exercises that contribute to the development of passive flexibility can be performed daily [6].

Table 3

Results of the primary study of passive and active flexibility in the main and control groups

Test		Surveyed groups		t	p
		MG, n=8	CG, n=8		
Test 1. Assessment of passive flexibility in the hip joints	from the right leg	2,02±0,68	2,07±0,37	0,07	>0,05
	from the left leg	1,83±0,51	1,79±0,69	0,05	>0,05
	transverse twine	1,89±0,91	1,90±1,11	0,09	>0,05
Test 2. Assessment of active flexibility in the hip joints		1,85±0,38	1,89±0,27	0,86	>0,05

According to the results of the primary research, 62,5% of gymnasts had a low level of passive flexibility, 37,5% of gymnasts had an average level of passive flexibility, a low level of active flexibility - 100% of gymnasts (Table 3).

Such results are explained by the development of elasticity of the ligament and muscles in order to maintain themselves in a static position for a certain time, as well as the development of muscle strength in order to maintain the maximum possible range of motion in gymnasts. The psychoemotional sphere of girls aged 5-8 is also not yet able to withstand the load - it is quite difficult for young gymnasts to relax their muscles in order to increase the range of motion.

In order to develop the flexibility of the hip joints of children 5-8 years old, engaged in the initial group of special physical training in rhythmic gymnastics, we proposed an author's training methodology, which included exercises for the development of passive and active flexibility, the motivational part of the methodology, will contribute to the positive emotions of children, increasing attention and interest in the result of training.

Exercises to develop passive flexibility

1. Starting position (s.p.): sitting, legs apart with a tilt, arms up. As you exhale, lower the body to the floor. Return to starting position.
2. S.p.: lying on the left side. Swing with the right leg and left hand simultaneously in front of you: to the side - up to the girth of the lower leg with the hand. Hold positions for 20 s. Repeat on the right side.
3. Split right, left, longitudinal split
4. Splits with an increase in the angle of lifting the leg from the floor - using the first, second rail of the gymnastic wall (depending on the initial level of flexibility) - holding the position: arms up in the hanging for 2 minutes. (Start with 1 minute, gradually increase the exercise time depending on the development of quality).

Exercises to develop active flexibility

1. S.p.: sitting, legs apart, arms in second position. Turning the torso to the right with the right arm to the side, the left arm forward. Touch the floor with your left knee. Return to s.p. Repeat the exercise in the opposite direction.

2. S.p.: sitting, legs apart with a tilt, arms up. Accept the position. The emphasis is sitting down - put your hands on the floor at a distance of 15-20 cm from the socks, transfer your body weight evenly to your arms and legs, keep your head straight. Take the position: standing up, bent over - from the crouching position, tilt the torso forward as much as possible and bring it closer to the hips, legs straight, put your hands on the floor with your palms at the level of the toes, look at the toes. Return to starting position.

3. Perform the exercise in pairs: S.p: positions opposite the partner, sitting, legs apart, alternately leaning backward - tilt the partner forward with spring movements.

4. S.p.: standing at the gymnastic wall, hold on to it with your hand. Swing the leg forward, backward, sideways-up with maximum amplitude. When performing movements, return the foot outward, keep the body and head straight.

5. S.p.: standing at the gymnastic wall, hold on to it with your hand. Movement of the leg forward, backward, side-upward using weights.

6. S.p.: Lying on your back, arms up, lifting the torso, sitting position, legs apart with a tilt, return to s.p. breathing is arbitrary.

Activities aimed at increasing joint mobility should be done every day. To maintain flexibility at the level already achieved, you can reduce the number of sessions to 2-3 per week. At the same time, it is possible to reduce the volume of stretching exercises in each training session. It is advisable to perform all passive movements in 3-4 sets, each of 10-40 repetitions. Static positions are held for 6-10 s in 3-4 approaches. Relaxed hangs are performed for 30 seconds in 2-3 sets. The average pace when performing active exercises is one repetition per 1 s, when performing passive exercises - one repetition per 1-2 s, holding static positions - for 20-30 s. The duration of the lesson is from 20-30 to 45-60 minutes.

In order to increase interest in training in young gymnasts and the acquisition of the first competitive skills, it is advisable to use additional means and methods of training.

Motivational part of the methodology

– *Assessment of the quality of training.* The result of each gymnast's training is assessed by the trainer not by a grading system, but by issuing "stickers" that correspond to the degree of activity in the class: the one who showed himself better in the training session is given the opportunity to choose the sticker first, independently. For those who have shown themselves not obedient and diligent enough, the coach chooses the sticker. It is important to take into account that in the selected group, gymnasts have different levels of flexibility development, at the stage of initial training, technical skills are still poorly developed, therefore, first of all, obedience, efforts of the gymnast are assessed, regardless of the initial level of flexibility. In the group of gymnasts 7-8 years old, instead of stickers, you can include a grading system (1-5), include the first technical skills in the assessment.

– *Selected to demonstrate exercises to the most diligent athletes.* To show each subsequent exercise, the coach chooses a new gymnast, who performs the exercises very diligently, makes every effort. Gives the development of the first competitive skills, the desire of gymnasts to perform exercises with high quality.

– *Learning dance in a group.* To keep the gymnasts interested by the end of the workout (depending on the level of fatigue), the trainer chooses dance moves and music that the children will perform at the end of the lesson.

As a result of a three-week flexibility training, the indicators of active and passive flexibility of athletes of both groups improved significantly, it can be noted that some gymnasts achieved a high level of flexibility, according to the test results, due to the acquisition of the ability to achieve the greatest mobility and elasticity of the ligaments due to relaxation of the thigh muscles. The level of active flexibility increased only to the average level in almost all gymnasts, which is associated with the development of strength qualities. Thus, during the second

study, a statistically significant improvement in the indices of active and passive flexibility was observed in the main group, compared with the primary one. In the control group, we also observed an improvement in the studied parameters during the repeated study, compared with the results of the primary study (Table 4).

Table 4

Results of the primary and repeated study of passive and active flexibility in the main and control groups

Tests		Research periods		t	p
		Primary study	Repeated study		
Main group, (n=8)					
Test 1	from the right leg	2,02±0,68	4,2±0,62	2,37	<0,05
	from the left leg	1,83±0,51	4,0±0,65	2,63	<0,05
	transverse twine	1,89±0,91	4,1±0,90	1,72	>0,05
Test 2	Assessment of active flexibility	1,85±0,38	3,7±0,50	2,95	<0,05
Control group, (n=8)					
Test 1	from the right leg	2,07±0,37	3,1±0,66	1,36	>0,05
	from the left leg	1,79±0,69	2,9±1,12	0,84	>0,05
	transverse twine	1,90±1,11	3,0±1,0	0,74	>0,05
Test 2	Assessment of passive flexibility	1,89±0,27	3,1±0,82	1,55	>0,05

When comparing repeated test results in the MG and CG, we observed statistically significant better results of the study of active and passive flexibility in the hip joints in the main group, compared with the control group, which indicates a more effective effect of the proposed training method on the development of active and passive flexibility ($p < 0,05$) (Table 5).

Table 5

Results of a repeated study of passive and active flexibility in the main and control groups

Tests		Surveyed groups		t	p
		MG, n=8	CG, n=8		
Test 1. Assessment of passive flexibility in the hip joints	from the right leg	4,2±0,62	3,1±0,66	1,19	>0,05
	from the left leg	4,0±0,65	2,9±1,10	0,86	>0,05
	transverse twine	4,1±0,90	3,0±1,0	0,82	>0,05
Test 2. Assessment of active flexibility in the hip joints		3,7±0,50	3,1±0,82	0,63	>0,05

For the development of active flexibility, it is advisable to include in the training methodology combined exercises that develop all components of mobility in the hip joints, as well as exercises of a dynamic nature and strength exercises.

To achieve a high level of quality development, passive exercises are not very effective. A significantly greater effect is achieved when an active mode with weights is used in training, as well as a mixed mode of muscle work. The use of forced stretching has an undoubted advantage over other methods of developing passive mobility in the joints, however, in the development of an active form of flexibility in all directions, active and mixed training modes are much more effective. At the same time, a noticeable improvement occurs when, together with an active regimen, forced stretching is used, which provides the greatest (anatomically possible) mobility in the hip joints by relaxing the muscles and increasing the elasticity of the ligaments. [8].

Conclusions / Discussion

Analysis of literary sources showed that passive exercises are ineffective to achieve a high level of flexibility development. A significantly greater effect is achieved when an active mode with weights is used in training, as well as a mixed mode of muscle work.

For the development of active flexibility, it is advisable to include in the training methodology combined exercises that develop all the components of mobility in the hip joints, exercises of a dynamic nature and strength exercises. In training, it is advisable to use an active mode with weights, as well as a mixed mode of muscle work in combination with forced stretching, which provides the greatest (anatomically possible) mobility in the hip joints. A set of exercises that develop active flexibility, as well as active-static strength exercises that require maximum flexibility, are used no more than 3 times a week, exercises that contribute to the development of passive flexibility can be performed daily.

The motivational part of the methodology stimulates the gymnasts to receive positive feedback from the group, thereby arouses the desire to get the best result and allows to increase the effectiveness of training.

The introduction of the author's training methodology helped to improve the indicators of active and passive flexibility in the hip joints, due to the inclusion of combined exercises that develop all components of mobility in the hip joints, as

well as exercises of a dynamic nature and strength exercises in combination with forced stretching.

Prospects for further research. It is promising to develop preparatory exercises for gymnasts in order to prevent injuries while increasing the flexibility of the hip joint.

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INDICATORS OF TECHNICAL AND TACTICAL ACTIONS (COMBAT SPORTS, TACKLES, INTERCEPTIONS, KICKS) OF THE UKRAINIAN NATIONAL TEAM IN THE GAMES OF 1/8 AND 1/4 OF THE EUROPEAN CHAMPIONSHIP IN 2020-2021

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Purpose: to conduct a comparative analysis of indicators of technical and tactical actions (combat sports, selections, interceptions, kicks on goal) of the national team of Ukraine in 1/8 with the team of Switzerland and in 1/4 with the team of England in the European Championship.

Material and methods: theoretical analysis and generalization of data of scientific and methodical literature, methods of pedagogical observations, methods of mathematical statistics, registration and comparative analysis of technical and tactical actions (combat sports, selections, interceptions, kicks on goal) of the national team of Ukraine in 1/8 with the team Sweden and with the team of England in the 1/4 of the European Championship 2020-2021.

Results: quantitative and qualitative analysis of indicators of technical and tactical actions (combat sports, selections, interceptions, kicks on goal) of the national team of Ukraine in 1/8 with the national team of Sweden and with the team of England in 1/4 of the European Championship 2020-2021.

Conclusions: obtained quantitative and qualitative indicators of TTA (combat sports, selections, interceptions, kicks on goal) of the national team of Ukraine in

1/8 with the team of Sweden and in 1/4 with the team of England at the European Championship 2020-2021, which indicate the fact that the national team of Ukraine had much higher quantitative indicators of TTA, but the quality of these indicators is much worse than rivals. A comparative analysis of the quality indicators of TTA (single combat) of the national team of Ukraine with the national teams of Sweden and England shows that they do not meet the model characteristics, despite the fact that with the Swedish national team the Ukrainian team achieved a positive result.

Keywords: technical and tactical actions, combat sports, football players, defect rate

Introduction

Analysis of the performance of the strongest teams in the world allows us to form the main trends that have emerged in modern football. Football has become faster, tougher, more intense. The significance of each game episode increases, the number of single combats increases, which ultimately leads to an increase in the intensity of meetings. Each fight requires the mobilization of physical strength and moral and volitional qualities [4, 13]. This is evidenced by the last European Championship in 2020-2021.

The development of football determines the rivalry between attack and defense in one time space, priority was given to defensive schemes, in the second - offensive. The head coach of the French national team Didier Deschamps expressed the opinion that the main thing for the team is not to miss the ball in their goal, because during the match there will always be 2-3 moments to score a goal [7].

The structure and criteria for the effectiveness of competitive activities of players of different ages, qualifications and game roles are now well studied [1, 3, 14]. One of the important components of technical and tactical actions of TTA in competitive activity is protective actions. The main defensive actions include: martial arts, selections, interceptions.

One of the features of modern football is the growing importance of each game episode. Martial arts are the most important because the quantity and quality of this indicator largely determines the success of the team. Martial art in a game is a fight for a ball that is controlled by an opponent.

Selection is an action aimed at mastering a ball controlled by an opponent. There are two types of selection: complete and incomplete. With a full selection, the ball is taken by the player or his partner. In case of incomplete selection - the ball is reflected at a certain distance or behind the sideline. Interception is an action aimed at mastering a ball that is not controlled by an opponent [2, 10]. Control of football players' game activity allows to obtain an objective description of TTA in certain episodes of the match and the game as a whole, as well as provides an opportunity to make adjustments to training work individually [5, 6, 12].

Of particular interest to experts is the study of those TTA, which, in their opinion, make the greatest contribution to the outcome of the game. To such TTA experts carry blows on gate [8, 9, 15].

Thus, in a previous study [11], the authors found that high-level teams perform an average of 13,2 kicks on the goal per game. From them: from game - 11,9 kicks, after drawing of standard provisions - 1,3 kicks:

- foot - 11,4 kicks, head - 1,8 headers;
- after the rebound of the ball from the frame of the goal, goalkeeper, or defender - 2,1 kicks,
- after passing the ball from a partner - 9,8 kicks;
- in one touch - 5,0 strokes, the second touch - 3,4 kicks, after the ball - 3,4 kicks;
- from the ground - 10,0 kicks, on a flying ball - 3,2 kicks;
- from the area of the goal area - 0,6 kicks, from the area between the goal area and the penalty spot - 2,7 kicks, from the area of the penalty area and the line of the penalty area - 2,4 kicks, from outside the penalty area - 7,5 kicks.

The purpose of the study is to conduct a partial analysis of indicators of technical and tactical actions (single combats, selections, interceptions and kicks

on goal) of the national team of Ukraine in 1/8 with the team of Sweden and in 1/4 with the team of England in the final part of the European Championship 2020-2021.

Material and Methods of research

Registration and analysis of TTA was carried out in the games of the European Championship 2020-2021 in accordance with the known recommendations. The games in the 1/8 finals with the Swedish national team and in the 1/4 finals with the England national team were analyzed.

Research methods: theoretical analysis and generalization of data of scientific and methodical literature, methods of pedagogical observations, methods of mathematical statistics.

Results of the research

Table 1 shows the quantitative and qualitative indicators of the TTA of the national team of Ukraine in the 1/8 finals with the national team of Sweden and in the 1/4 finals with the national team of England. Thus, with the Swedish national team, the Ukrainian team performed 113 TTA (combat sports, selections, interceptions), 49 of them - with a negative indicator. The defect rate was 41%. In turn, the Swedish national team performed 45 TTA of them with a negative indicator - 11, the defect rate was 14%, which is equal to the model indicators.

Table 1

Quantitative and qualitative indicators of TTA of the national team of Ukraine in 1/8 with the team of Sweden and the team of England in 1/4 of the European Championship 2020-2021

№	Teams	<i>martial arts</i>				<i>selection</i>				<i>interception</i>				<i>Total for the game</i>	
		<i>I half</i>		<i>II half</i>		<i>I half</i>		<i>II half</i>		<i>I half</i>		<i>II half</i>		<i>n. of actions</i>	<i>defect rate</i>
		<i>n. of actions</i>	<i>defect rate</i>	<i>n. of actions</i>	<i>defect rate</i>	<i>n. of actions</i>	<i>defect rate</i>	<i>n. of actions</i>	<i>defect rate</i>	<i>n. of actions</i>	<i>defect rate</i>	<i>n. of actions</i>	<i>defect rate</i>		
<i>1/8 final</i>															
1	Ukraine	16/12	75%	12/4	33%	21/12	57%	15/10	66%	25/5	20%	24/8	33%	113/49	41%
2	Sweden	16/4	25%	11/7	63%	1/0	0%	6/1	16%	7/0	0%	0/0	0%	45/11	24%
<i>1/4 final</i>															
1	Ukraine	5/3	60%	7/5	71%	23/14	61%	14/6	43%	20/5	25%	13/5	38%	82/38	46%
2	England	5/2	40%	7/2	28%	5/2	40%	9/1	11%	14/3	21%	17/1	6%	57/11	19%

The number of TTA of the national team of Ukraine is much higher than that of the national team of Sweden, which indicates that the national team of Ukraine spent more time in defensive actions. Only in single combats in the first and second halves the figures were the same, although the defect rate in the first half of the national team of Ukraine was 75%, and in the second - 33%. At the same time, the performance of the Swedish national team in the first half - 25%, and in the second - 63%. The quality of selections and interceptions is much better in the Swedish national team. The number of TTA (combat sports, selections, hiding) in 1/4 of the national team of Ukraine with the national team of England was - 82, of which with a negative penalty - 38. The defect rate was 46%. The number of TTA (combat sports, selections, interceptions) of the national team of England was - 57, with a negative indicator - 11. The defect rate is 19% which corresponds to the model characteristics.

The number of performances of combat sports in the first and second half of these teams was the same, but the quality of performance is better in the England national team. As for the selections of the national team of Ukraine, in the first half 23 selections were made with a defect rate - 61%, in the second half - 14, of which with a negative result - 6. The defect rate was - 43%. The national team of England made 5 selections in the first half with a negative indicator - 2. The defect rate was 40%, in the second half - 9 selections, a negative indicator - 1. The defect rate - 11%, which is much better than the national team of Ukraine.

The national team of Ukraine performed 20 interceptions in the first half, including 5 with a negative indicator. The defect rate was 25%. In the second half is 13/5. Defect rate is 38%. The England national team made 14 interceptions in the first half, with a negative indicator - 3. The defect rate was - 21%, and in the second half - 17 selections, with a negative indicator - 1, which is significantly better than the results of the Ukrainian national team. Thus, we can conclude that the national team of Ukraine in the games with the national team of Sweden and the national team of England had much higher quantitative indicators of TTA, but the quality of these indicators is much worse than that of rivals.

Analyzing and comparing the quality of TTA martial arts in the games of the national team of Ukraine with the national teams of Sweden and England, we can conclude that they do not meet the model characteristics, despite the fact that with the Swedish national team the team achieved a positive result (Fig. 1).

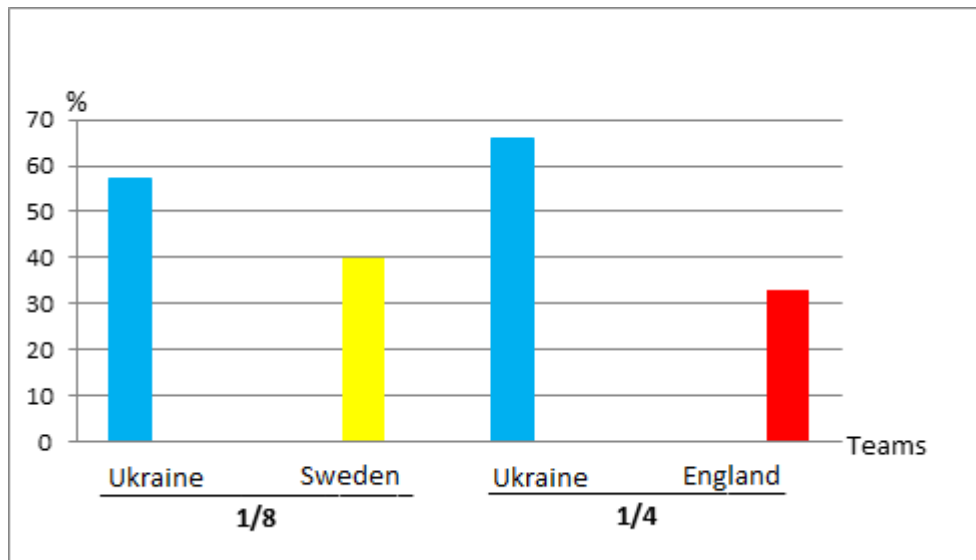


Fig. 1. Indicators of team's defect of combat sports of Ukraine, Sweden and England teams in 1/8, 1/4 of the European Championship 2020-2021

One of the important components of protective actions is selection. The quality of these actions team of Ukraine also differs significantly from the national teams of Sweden and England (Fig. 2).

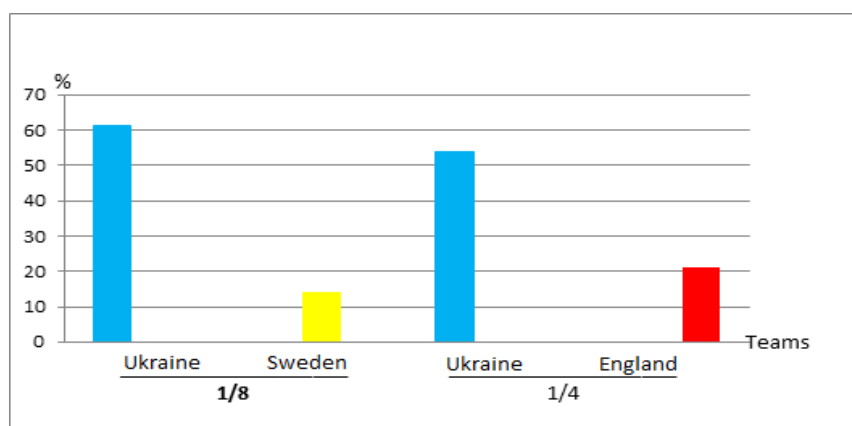


Fig. 2. Indicators of team's defect in the selection of the ball of Ukraine, Sweden and England teams of in 1/8, 1/4 of the European Championship 2020-2021

As for the interceptions of the ball, these indicators of the national team of Ukraine from all TTA (combat sports, selections, interceptions) are the best in quality, but inferior to the indicators of the national teams of Sweden and England (Fig. 3).

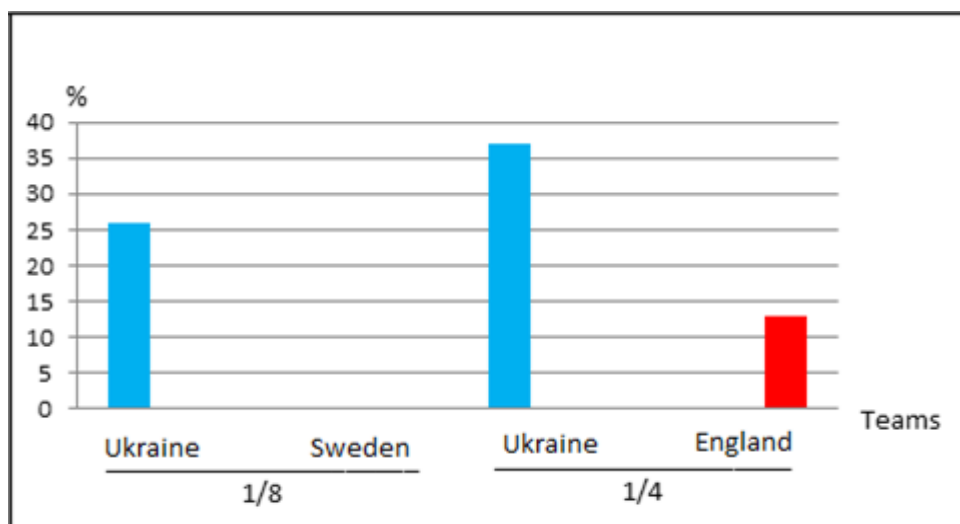


Fig. 3. Indicators in the interception of the ball by Ukraine, Sweden and England teams in the 1/8, 1/4 finals of the European Championship 2020-2021

Table 2 shows the quantitative and qualitative indicators of kicks of the national team of Ukraine with the national team of Sweden in 1/8 and with the national team of England in 1/4 of the European Championship 2020-2021.

Table 2

Quantitative and qualitative indicators of kicks on goal by Ukraine team in 1/8 and 1/4 of the European Championship with the teams of Sweden and England (regular time)

№	Teams	Per match	
		Hits	Defect rate
<i>1/8 final</i>			
1	Ukraine	15/11*	73%
2	Sweden	13/10*	77%
<i>1/4 final</i>			
1	Ukraine	7/5*	71%
2	England	10/4*	40%

* total number of hits / number of kicks that did not hit the goal

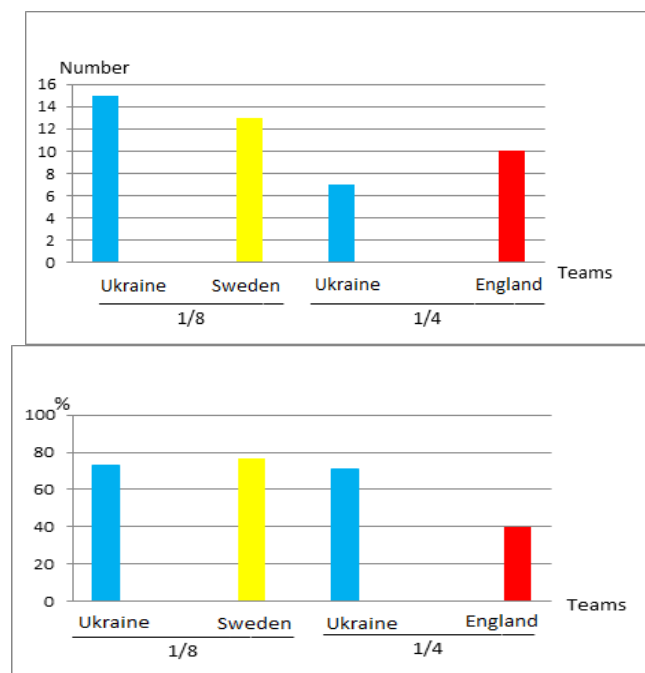
Thus, the national team of Ukraine performed only 15 kicks, of which with a negative indicator - 11. The defect rate was - 73%.

The Swedish national team made only 13 kicks, 10 of them with a negative result. The defect rate was 77%. The obtained results of the number and quality of ball kicks between the teams of Ukraine and Sweden do not differ significantly.

The following indicators were obtained in the match between the national teams of Ukraine and England: the national team of Ukraine performed only 7 kicks, 5 of them - with a negative indicator. The defect rate was - 71%; England - 10 kicks, 4 of them - with a negative result. The defect rate was 40%.

It should be noted that out of 6 kicks on goal, 4 kicks were effective.

In fig. 4 we see that the national team of Ukraine performed the largest number of kicks in the game with the national team of Sweden. The smallest number of kicks was made with the England national team.



a) *quantitative indicators of kicks* b) *qualitative indicators of kicks*

Fig. 4. Quantitative and qualitative indicators of kicks on goal by Ukraine, Sweden and England teams in 1/8, 1/4 of the European Championship 2020-2021

The coefficient of defect of the national team of Ukraine in kicks on goal does not differ significantly, in games with the team of Sweden it was 73%, with the team of England -71%.

Conclusions / Discussion

The analysis of scientific and methodical literature under the control of TTA of highly qualified football players is relevant at the present stage of development of modern football.

The obtained quantitative and qualitative indicators of TTA performance (combat sports, selections, interceptions, shots on goal) of the national team of Ukraine in 1/8 with the team of Sweden and in 1/4 with the team of England at the European Championship in 2020-2021 indicate that The national team of Ukraine had much higher quantitative indicators of TTA, but the quality of these indicators is much worse than that of rivals.

A comparative analysis of the qualitative indicators of the TTA of the Ukrainian national team with the national teams of Sweden and England shows that they do not meet the reference characteristics, despite the fact that the Ukrainian team has achieved a positive result with the Swedish national team.

Prospects for further research. We see prospects for further research in the continuation of pedagogical observations of the competitive activities of highly qualified teams.

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**INDIVIDUAL DIFFERENCES IN THE FORMATION OF SWIMMING
TECHNIQUE OF YOUNG ATHLETES WITH DIFFERENT STRENGTH
OF THE NERVOUS SYSTEM UNDER THE CONDITIONS OF APPLYING
DIFFERENT TEACHING METHODS**

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Purpose: to study the influence of methods of formation of swimming technique among 7–8 year old swimmers and the influence of their individual characteristics of the nervous system on the effectiveness of mastering physical exercises.

Material and methods: The study was conducted over three months with young swimmers (n = 141) who studied sports swimming techniques. They were preliminarily examined for the strength of the nervous system for excitation by three methods: physical activity – the slope type of the curve, tapping test, noise immunity.

Results: the influence of various methods of initial teaching in swimming on the success of the formation of motor skills in children of 7–8 years old with different strength of the nervous system relative to excitement was studied. The reproductive method, problem learning and their combinations were used. The children were divided according to the strength of the nervous system into groups: "strong", "average" and "weak".

Conclusions: according to the research results, it turned out that the most successful exercise training was when using the reproductive method in the first 2–3 lessons, followed by the use of problem learning. In relation to children with different strengths of the nervous system, then, according to the conclusions of many researchers, the average type in number exceeds other types combined and therefore one should focus on them. The training described above turned out to be the most effective for children with an average nervous system.

Keywords: strength of the nervous system, teaching methods, swimming

Introduction

During study, any motor actions must follow the basic principles of teaching, and for faster and better-quality teaching, the didactic proposes to take into account the individual characteristics of a person [1; 3; 5; 10; 14]. The relevance of this study is due to the need to find the most effective forms and methods of teaching movements, which would take into account the individual characteristics of the higher nervous activity of young athletes-swimmers, would contribute to an increase in cognitive activity, independence and the ability to creatively approach solving various problems not only in sports, but also in other fields of activity [2; 8; 10].

The object of the research is the formation of motor skills and abilities in swimmers at the age of 7-8 years.

The subject of the research is the individualization of the process of formation of swimming technique, taking into account the properties of the nervous system of children aged 7-8 years.

The purpose of the research is to investigate the influence of techniques for the formation of swimming technique among 7-8 year old swimmers and the influence of their individual characteristics of the nervous system on the effectiveness of mastering physical exercises..

Objective:

1. To reveal the features of the formation of motor skills in swimmers of 7-8 years old with different strengths of the nervous system and the influence of various teaching methods on the process of formation of motor skills.

2. To determine the effectiveness of the combination of various teaching methods in the process of motor skills formation among young swimmers 7-8 years old with different strength of the nervous system.

Material and Methods of research

The study was carried out over three months with young swimmers ($n = 141$) who studied the technique of sports swimming methods. They were preliminarily examined for the strength of the nervous system for excitation by three methods: motor - the nature of the slope of the curve (SC) [10; 11], tapping test [6; 7], noise immunity [12; 15]. According to the survey results, they were divided into three typological groups: "weak", "medium" and "strong". As in the studies of other authors [7, 10, 12], and in ours, we got the number of "average", which exceeded the "weak" and "strong" combined.

In each group, the mastering of the swimming technique took place according to a separate method. In the first group, the reproductive method was used [3; 5, 8], in the second - problematic [1, 4, 13; 16] and in the third - a combination of these methods in a different sequence.

At the beginning of training and at the end of each lesson, all children performed a control test, which contained all those elements of the technique that were studied in the lesson. The execution of the test was accompanied by measuring the time of its execution, the number of movements (frequency), the number of errors and the assessment for the technique by the method of expert assessment ($n = 4$) according to a previously developed scale.

Results of the research

In the "strong" group, a statistically significant ($p < 0,05$) improvement in the time of the control test took place only in the "reproductive" class (Table 1), and the increase in their score was generally statistically insignificant in all groups

(Table 2). However, one of the reasons for this phenomenon can be considered a small number of subjects with a strong nervous system who took part in the experiment.

In representatives of the weak type, significant changes in time occurred in all groups, except for the "reproductive-problem" group, while the absolutely best time (7,94 s) among all children was shown in the last lesson by the "weak" in the "reproductive" group.

Children with a middle nervous system in all groups had a statistically significant improvement in both time and control test scores. Among all children, the highest score for the technique (12,57 s) was received by the "strong" in the "reproductive-problem" group ($p < 0,05$), and the lowest score (10,20 s) was obtained by the "strong" in the "reproductive" group.

All children, with the exception of the "strong" and "average" children in the "reproductive-problem" group, reduced the number of movements until the end of the training when performing the control test (Table 3). The greatest shifts in the number of movements occurred in the "problem-reproductive" and "problem" groups, but in the first of them statistically significant ($p < 0,05$) changes occurred only in the "average", and in the other - in all children.

Over the entire period of training, children of the strong type still could not achieve a significant improvement in time, although they improved it steadily from the first to the last lesson. Representatives of the average type achieved a significant ($p < 0.05$) result in the fourth lesson and did not worsen it to the end in the future. Subjects with a weak nervous system in the sixth lesson and then in the eighth, achieved a statistically significant ($p < 0,05$) improvement in time. The given data give reason to believe that the use of such a technique is more conducive to success in teaching people of the middle type, but at the same time, relatively good results in the learning process were shown by representatives of other typological groups.

Table 1

Time of execution of the control test at the beginning and at the end of training (s)

Type of nervous system	Terms of registration	GROUP							
		Reproductive-problematic		Problematic-reproductive		Reproductive		Problematic	
		\bar{X}	δ	\bar{X}	δ	\bar{X}	δ	\bar{X}	δ
Strong		(n = 8)		(n = 9)		(n = 8)		(n = 8)	
	Initial	13,00	7,02	12,78	3,09	11,97	1,26	11,30	1,49
	Final	9,60	2,60	10,45	2,72	9,50	1,02	9,13	0,61
	Difference	3,40 (26,15%) p > 0,05		2,33 (18,23%) p > 0,05		2,47 (20,63%) p < 0,05		2,17 (19,20%) P > 0,05	
Average		(n = 14)		(n = 16)		(n = 15)		(n = 15)	
	Initial	12,21	2,49	10,46	2,29	11,11	2,15	10,81	2,12
	Final	9,21	0,74	8,77	1,03	8,25	1,41	7,96	1,21
	Difference	3,00 (24,57%) p < 0,01		1,69 (16,16%) p < 0,05		2,86 (25,74%) p < 0,01		2,85 (28,86%) p < 0,01	
Weak		(n = 14)		(n = 12)		(n = 10)		(n = 12)	
	Initial	11,39	3,40	11,03	1,07	11,96	3,05	11,92	2,36
	Final	9,17	1,72	9,30	0,85	7,94	0,76	8,41	0,68
	Difference	2,22 (19,49%) p > 0,05		1,73 (15,68%) p < 0,01		4,02 (33,61%) p < 0,05		3,51 (29,45%) p < 0,01	

Table 2

Assessment for the technique of performing the control test at the beginning and at the end of training (points)

Type of nervous system	Terms of registration	GROUP							
		Reproductive-problematic		Problematic-reproductive		Reproductive		Problematic	
		\bar{X}	δ	\bar{X}	δ	\bar{X}	δ	\bar{X}	δ
Strong		(n = 8)		(n = 9)		(n = 8)		(n = 8)	
	Initial	9,33	2,90	9,28	1,72	8,13	1,50	8,17	1,99
	Final	12,57	2,75	11,00	2,28	10,20	2,11	11,07	2,91
	Difference	3,24 (34,73%) p > 0,05		1,72 (18,54%) p > 0,05		2,07 (26,46%) p < 0,05		2,90 (35,50%) p > 0,05	
Average		(n = 14)		(n = 16)		(n = 15)		(n = 15)	
	Initial	8,43	1,82	10,38	1,47	9,49	1,85	8,67	1,80
	Final	10,98	1,22	12,29	1,61	11,96	1,87	12,28	3,09
	Difference	2,55 (30,25%) p < 0,01		1,91 (18,40%) p < 0,01		2,47 (26,03%) p < 0,01		3,61 (41,64%) p < 0,01	
Weak		(n = 14)		(n = 12)		(n = 10)		(n = 12)	
	Initial	8,07	1,61	9,37	1,07	8,98	1,21	9,37	1,03
	Final	10,87	2,53	11,76	1,62	11,18	2,14	12,13	1,57
	Difference	2,80 (34,70%) p < 0,05		2,39 (25,51%) p < 0,01		2,20 (24,50%) p > 0,05		2,76 (29,46%) p < 0,01	

Table 3

Number of movements during the control test at the beginning and at the end of training (number of cycles)

Type of nervous system	Terms of registration	GROUP							
		Reproductive-problematic		Problematic-reproductive		Reproductive		Problematic	
		\bar{X}	δ	\bar{X}	δ	\bar{X}	δ	\bar{X}	δ
Strong		(n = 8)		(n = 9)		(n = 8)		(n = 8)	
	Initial	13,33	0,58	21,75	5,19	18,33	2,52	16,67	1,16
	Final	16,00	4,36	16,25	6,55	16,00	0,00	13,00	1,00
	Difference	2,67 (20,03%) p > 0,05		5,50 (25,29%) p > 0,05		2,33 (12,71%) p > 0,05		3,67 (22,02%) p < 0,05	
Average		(n = 14)		(n = 16)		(n = 15)		(n = 15)	
	Initial	14,89	1,62	18,36	4,20	16,20	4,47	16,20	3,39
	Final	15,67	2,20	14,73	2,41	13,80	2,62	12,80	3,28
	Difference	0,78 (5,24%) p > 0,05		3,63 (19,77%) p < 0,05		2,40 (14,81%) p > 0,05		3,40 (20,99%) p < 0,05	
Weak		(n = 14)		(n = 12)		(n = 10)		(n = 10)	
	Initial	14,78	1,79	17,89	3,77	16,00	4,69	17,14	2,48
	Final	12,22	3,15	14,86	1,57	13,80	2,27	13,43	1,99
	Difference	2,56 (17,32%) p < 0,05		3,03 (16,94%) p > 0,05		2,20 (13,75%) p > 0,05		3,71 (21,64%) p < 0,05	

Evidence that this technique provides almost the same effect on the learning success of subjects with different strengths of the nervous system can be found in the fact that in the process of conducting all nine sessions, only in the third was a statistically significant ($p < 0,05$) difference in results between the "mean "and" weak ", and in other cases there was no significance.

There was no significant improvement and assessment among the subjects of the "strong" type, although they showed a fairly high result in the last lesson – 12,57 points (Table 1). It should be noted that during the first seven lessons the swimmers of this group did not have significant changes and only in the eighth and ninth lessons slightly improved ($p < 0,05$) their results. The same situation is observed in the dynamics of the growth of grades in "medium" and "weak", which after the second or third lessons began to show consistently mediocre results until the last lesson.

Still, it is necessary to single out children with a weak nervous system who, from the second session to the last, showed results that significantly exceeded the initial level of assessment. At the same time, swimmers of the intermediate type achieved a significant ($p < 0,05$) improvement in it only in the last lesson. The analysis of marks for the technique of performing the control test emphasizes that the "reproductive-problem" technique did not reveal a clear typologically determined difference in the success of mastering movements by persons with different strengths of the nervous system. This is confirmed by the lack of statistical significance between the indicators of all three groups at each lesson.

Conclusions / Discussion

The results of the study showed that young swimmers of different types of the nervous system perceive the educational material in a different way, as a result of which the formation of motor skills in them occurs in different lengths of time and with peculiarities inherent only for this typological group. So, in the strong type of children, the formation of a skill proceeds more slowly than in others, regardless of the teaching method, it is expressed in a lag of 2-3 lessons in terms of

the time of the control test and the assessment for the technique of its implementation.

The strong type achieves the greatest success in problem-based learning, having an advantage in assessment over similar ones in other learning conditions by 1,91 points ($p < 0,05$) and in the exercise time - by 0,72 s. ($p < 0,05$).

Representatives of the average type equally effectively master motor actions when using any of the methods, but rather achieve a significant improvement in indicators in reproductive and reproductive-problem learning.

Persons of the weak type in 80% of cases master motor actions faster when using the reproductive method in teaching and, to a greater extent than others, react negatively to any abrupt changes in the conditions of the educational process.

The prospect of further research is to study the relationship between the strength of the nervous system and the characteristics of the competitive activity of athletes-swimmers.

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**VERIFICATION OF TRAINING OF FUTURE MASTERS OF
PHYSICAL CULTURE AND SPORTS FOR ACTIVITIES IN THE
CONDITIONS OF THE FITNESS CENTER**

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Purpose: verification of the effectiveness of training future masters in physical culture and sports for professional activity in a fitness center.

Material and methods: questioning, testing; pedagogical experiment; statistical methods, factor analysis. The study involved 34 applicants for the second (master's) level of higher education 1-2 years of study, educational and professional program (EPP) «Physical culture and sports», specialty 017 «Physical culture and sports». In order to determine the effectiveness of training future masters in physical culture and sports for professional activity in a fitness center, a survey was carried out of applicants for the second (master's) level of higher education; the levels of readiness formation of future masters in physical culture and sports for professional activity in a fitness center.

Results: after the completion of the formative stage of the pedagogical experiment, the indicators characterizing a high level of readiness for professional activity in a fitness center increased among applicants in the control group from

7,34% to 11,20%, among applicants in the experimental group from 8,44% to 24,12%. Accordingly, the data characterizing a sufficient level of readiness for professional activity has changed - in the control group from 44,47% to 52,55%, in the experimental group from 49,31% to 68,22%. The data characterizing the elemental level of formation of readiness for professional activity decreased in the control group from 48,19% to 36.25%, in the experimental groups from 42,25% to 7,66%. At the end of the pedagogical experiment, the most significant structural components of readiness were the motivational component; cognitive-reflexive component; personality and activity component.

Conclusions: the effectiveness of training future masters in physical culture and sports for professional activity in a fitness center has been determined and tested; the structure of training future masters in physical culture and sports for professional activity in a fitness center has been improved; the provisions for the development and design of the content of the physical culture and sports for the preparation of future masters of physical culture and sports have been improved; the criteria and levels of the readiness formation of future masters in physical culture and sports for professional activity in the conditions of a fitness center.

Keywords: training, applicants, criteria, levels, physical culture and sports, future masters.

Introduction

The processes of globalization, the rapid growth of supply and demand in the labour market lead to the modernization of higher education as a component of society. Physical culture and sports are areas of successful, promising business in many countries around the world, physical education and sports contribute to the preservation, promotion and development of health. In our country, there is an urgent need for well-trained specialists in the field of physical culture and sports, able to compete in the labour market, ready in the future for qualified professional activity at European standards in the field of fitness, capable of constant creative search, self-education and self-improvement.

The effectiveness of professional training of future specialists in physical culture and sports is reflected in legislation and regulations, in particular in the laws of Ukraine “On Higher Education” (2014); “On Education” (2016); “On physical culture and sports” (2016); in the Concept of development of education of Ukraine for the period 2015 - 2025; in the Strategy of Innovative Development of Ukraine for 2010 - 2020 in the context of globalization challenges (2010); in the National Strategy for the Development of Education in Ukraine until 2021 (2013); in the State target social program for the development of physical culture and sports” (2017).

Of great scientific interest for the study were scientific works on the training of future specialists in physical culture and sports (P. B. Dzhurinsky, 2012; M. V. Danilevich, 2016; E. A. Zakharina, 2015 et al.); theories and methods of physical culture (V. G. Arefiev, 2014; T. Yu. Krutsevich, 2017 et al.) [1; 2; 3; 4; 5; 6]. The formation of future specialists’ readiness for professional activity in health fitness was studied by A. O. Tvelina, 2014; L. A. Chekhovskaya, 2019 et al.; fitness technology was researched by ACSM’s, 2008; P. O. Astrand, 1960; P. W. Darst, 2009; Iris Pahmeier, Corinna Niederbeumer (1999) [7; 8; 9; 10; 11].

The increase in the number of fitness centres in the market of our country has contributed to increased competition and, accordingly, intensified the struggle for the consumer of fitness services. Analysis of scientific sources and training of future masters of physical culture and sports revealed that there is a need for quality training of future masters in physical culture and sports, namely in terms of professional activity in fitness centres.

Connection of the work with scientific programs, plans, themes. The study was conducted in accordance with the Thematic plan of scientific research of the Department of Theory and Methods of Physical Culture and Sports Disciplines of the State Institution “South Ukrainian National Pedagogical University named after K. D. Ushinsky” for 2019-2023 on the topic: “Theoretical and methodological principles of training future teachers and instructors of physical culture, specialists in physical culture and sports, coaches-teachers of the chosen sport for professional

activity with different groups of the population”, registration number: 0119U002020.

The research hypothesis is based on the assumption of the dependence of future physical culture and sports masters' readiness for professional activity in fitness centres on the structure of the educational process, which is logical structural and component composition and personal and professional qualities of the future master of physical culture and sports.

The aim of the study is to test the effectiveness of training future masters in physical culture and sports for professional activities in a fitness centre.

Material and Methods of research

A set of methods was employed: questionnaires for applicants for the second (master's) level of higher education, testing; factor analysis. During the study period, psychological and pedagogical literature, Internet resources were analyzed in order to determine the criteria, indicators and levels of readiness of future masters in physical culture and sports for professional activity in a fitness centre; a survey of applicants for the second (master's) degree of higher education was conducted; the levels of readiness of future masters in physical culture and sports for professional activity in the conditions of fitness centres were determined; the efficiency of professional training for forming future physical culture and sports masters' readiness for professional activity in the conditions of fitness centres was checked.

In order to determine the readiness of future masters in physical culture and sports for professional activity in fitness centres in 2018-2020, a study was conducted, which involved 34 students for the second (master's) level of higher education, 1-2 years of study, EPP Physical culture and sports, specialties 017 Physical culture and sports, State Institution “South Ukrainian National Pedagogical University named after K. D. Ushynsky”. Checking the effectiveness of acquired general, special competencies and program learning outcomes, criteria, levels of future physical culture and sports masters' readiness for professional activity in fitness centres was conducted at the formative stage of the pedagogical

experiment, which involved control (17 people) and experimental (17 people) group of applicants for the second (master's) degree of higher education, 1-2 years of study by EPP “Physical Culture and Sports”, specialty 017 “Physical Culture and Sports” of the State Institution South Ukrainian National Pedagogical University named after K. D. Ushynsky”.

Participants of the control group studied in accordance with the traditional system of training, the experimental group was taught with introduction of a technological concept of training, which was to ensure the formation of general, special competencies, program learning outcomes, methods, tools, criteria and readiness of future masters in physical culture and sports for professional activity in the conditions of fitness centres.

Results of the research

The training of future masters in physical culture and sports took place by the educational and professional program “Physical Culture and Sports” for students of the second (master's) level of higher education, which determined that the main professional competencies of the future master in physical culture and sports in the conditions of fitness centres are: ability to solve tasks of innovative character; ability to act socially responsibly and consciously; ability to adapt and act in a new situation; ability to search, process and analyze information from various sources; ability to identify, pose and solve problems; ability to generate new ideas; ability to develop and manage projects; ability to motivate people and move towards a common goal; ability to work in an international context; ability to continuous self-education; ability to critically comprehend problems in the field of physical culture and sports, original thinking and research; ability to carry out scientific and pedagogical activities; ability to manage work or study processes in the field of physical culture and sports, which are complex, unpredictable and require new strategic approaches; ability to self-education, self-improvement and self-reflection; ability to understand the principles of professional ethics; ability to develop effective practice-oriented programs in the field of physical culture and

sports, taking into account the real and projected results of sports activities and others.

Program learning outcomes must include: the ability to use innovative techniques in professional activity; to develop new programs of sports and physical culture and health orientation; to use educational, sports, health-improving, health-preserving technologies taking into account the modern level of science development; to integrate the acquired knowledge into innovative pedagogical technologies; to know best practices, develop and be able to apply the latest technologies in fitness, recreation and healthy living; to apply the acquired knowledge, skills and abilities in professional activity, to form cultural and axiological aspects of the personality of subordinates (clients of fitness centers); to apply modern methods and technologies, including information, to ensure the quality of the educational and training process; to demonstrate creativity in professional activity, flexible thinking, openness to new knowledge, to be critical and self-critical.

We have determined the criteria and characterized the levels of future physical culture and sports masters' readiness for professional activity in a fitness centre. The motivational criterion determines the degree of motivation to succeed in professional activity and career growth. Epistemological and information criterion determines the degree of mastery of knowledge about the nature and content of future professional activity. The activity-oriented criterion determines the degree of mastering the skills and abilities of students necessary for successful professional activity. Creative criterion determines the degree of students' creativity, which affects the success of professional activity and the ability to function productively. Reflexive criterion determines the degree of formation of reflexive skills in relation to adequate self-esteem, ability to effective professional activity.

At the end of the formative stage of the experiment, the indicators characterizing the high level of readiness for professional activity in fitness centres, increased in the control group from 7,34% to 11,20%, in the experimental

group from 8.44% to 24, 12%. Accordingly, the data characterizing the sufficient level of readiness for professional activity have changed – in the control group from 44,47% to 52,55%, in the experimental group – from 49,31% to 68,22%. The data characterizing the elementary level of readiness for professional activity decreased in the control group from 48,19% to 36,25%, in the experimental group – from 42,25% to 7,66%.

Factor analysis of the structure of future physical culture and sports masters' readiness in the experimental group revealed the main factors that provided 77,57% variance of traits. The most significant structural components of readiness were: motivational component – 31,3%; cognitive and reflexive component – 25.8%; personal and activity-oriented – 20,47% of the total variance of signs.

Thus, the results of the pedagogical experiment showed that changes in the levels of readiness of future masters in physical culture and sports who studied in the experimental group are statistically significant, which confirms the effectiveness of our scientific and methodological implementations in the training process. The analysis of the results confirmed the effectiveness of the program learning outcomes, criteria and levels of readiness.

Ushynsky University has special regulations, normative documents that ensure the quality of higher education for students for the second (master's) level of higher education by EPP “Physical Culture and Sports”. Periodic monitoring of the quality of teaching and evaluation and professional development of teachers is carried out.

Principles and procedures for ensuring the quality of higher education are defined in the Regulation “On internal quality assurance of educational activity and quality of higher education in the State Institution “South Ukrainian National Pedagogical University named after K. D. Ushynsky”, in the Regulation “On the organization of the educational process of the State Institution South Ukrainian National Pedagogical University named after K. D. Ushynsky”, in the Regulation “On the organization of control and evaluation of the quality of education of students in the State Institution “South Ukrainian National Pedagogical University

named after K. D. Ushynsky”, in the regulations on structural units of Ushynsky University.

Monitoring of the quality of training those studying by EPP “Physical Culture and Sports” in the specialty 017 “Physical Culture and Sports”, analysis of the results, if necessary, correction of working curricula, work programs of disciplines is carried out by the department annually. Periodic review of the EPP “Physical Culture and Sports” in the specialty 017 “Physical Culture and Sports” is conducted once for a full course of study in the educational program. The results of the evaluation of the quality of education are regularly published at the meeting of the Academic Council of the Institute, Ushynsky University and on the official website of Ushynsky University.

Assessment of students' academic achievements is carried out on a 100-point ECTS scale and a national scale (excellent, good, satisfactory, unsatisfactory; passed, not passed). The system of assessing learning outcomes includes current, intermediate, final semester, deferred control and certification. Annually, the results of assessing the quality of students' education are discussed at meetings of the department, academic councils of the institute, Ushynsky University and published on the official website of Ushynsky University.

Annual evaluation of scientific and pedagogical workers who provide the educational process for EPP “Physical Culture and Sports” in the specialty 017 “Physical Culture and Sports” is carried out by: Department of Theory and Methods of Physical Culture and Sports, Research Department, Centre for Education Quality, student Council of Ushynsky University through surveys, questionnaires of students, reporting of teachers on the results of educational, scientific, organizational activities. Regular publication of evaluation results takes place at meetings of the Academic Councils of the Institute, Ushynsky University and on the official website of Ushynsky University.

Ushynsky University has a system of professional development of research and teaching staff that provide the educational process for EPP “Physical Culture and Sports” in the specialty 017 “Physical Culture and Sports” in various forms:

courses, internships, trainings, etc. (full-time, distance). They provide control over the implementation of the results of advanced training in the educational process at the level of the Department of Theory and Methods of Physical Culture and Sports of Ushynsky University.

Conclusions / Discussion

The effectiveness of program learning outcomes as components of the educational and professional program (EPP) “Physical Culture and Sports” for training students for the second (master's) level of higher education was determined, theoretically substantiated and experimentally tested, criteria and levels of readiness for professional activity in fitness centres were revealed.

Criteria and levels of future physical culture and sports masters’ readiness for professional activity in the conditions of fitness centres are determined, namely: *motivational criterion* which determines degree of motivation for achieving success in professional activity and career growth; *epistemological and information criterion* that determines the degree of mastery of knowledge about the nature and content of future professional activity; *activity-oriented criterion* that determines the degree of mastery of skills and abilities by students necessary for successful professional activity; *creative criterion* that determines the degree of students’ creativity, which affect the success of professional activity and the ability to function productively; *reflexive criterion* that determines the degree of reflexive skills’ formation in relation to adequate self-esteem, ability to effective professional activity.

The levels of readiness of future masters in physical culture and sports for professional activity in the conditions of fitness centres which have changed during a formative stage of experiment, namely: high, sufficient and elementary are established. Upon completion of checking the effectiveness of program learning outcomes, as components of the educational and professional program (EPP) “Physical Culture and Sports” for training students for the second (master's) degree of higher education, the most significant structural components of readiness that form the factor structure of dispersion were the following: motivational component

– 31,3% of the variance of signs; cognitive and reflexive component – 25,8% of the total variance and personality and activity-oriented component – 20,47% of the total variance.

It was found out that at Ushynsky University there are special provisions, normative documents that ensure the quality of higher education of the second (master's) level of higher education by EPP “Physical Culture and Sports”. Periodic monitoring of the quality of teaching and evaluation and professional development of teachers is carried out. The structure of readiness of future masters in physical culture and sports for professional activity in the conditions of fitness centres has been improved. Provisions for the development and design of the content of the EPP for training future masters in physical culture and sports for professional activity have been further developed.

Prospects for further research are seen in the development of fitness technologies in the training of athletes in complex coordination sports.

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**FEATURES OF THE DYNAMICS OF DIFFICULTY OF
COMPETITIVE ROUTINES AND THE RESULTS OF PERFORMANCES
OF THE STRONGEST TEAMS IN THE WORLD IN ARTISTIC
SWIMMING**

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Purpose: to determine the dynamics of the development of the complexity of the competitive routines of the world's strongest teams in artistic swimming.

Material and methods: theoretical analysis and generalization of scientific and methodological literature data, analysis of competition results, survey, methods of mathematical statistics. The results of performances and competitive routines of the five best performances of the World Championships (2015, 2017, 2019) and the Olympic Games (2008, 2012 and 2021) are analyzed.

Results: comparing the World Championships 2015, 2017, 2019 and the Olympic Games 2008, 2012 and 2021, you can see that every year the athletes of the Ukrainian national team (from 27,7% to 42,5%, that is, by 14,8%) and Italian national team (from 29,4% to 38,3%, that is, by 8,8%) performances grew rapidly, relying on the time that athletes used to demonstrate the figure and elements hybrids. No less important are the data we obtained when comparing the time spent on acrobatic movements in the best countries of the world in artistic swimming. The data obtained allow us to state with confidence that acrobatic exercises play a very important role in artistic swimming. So we can see that from 2008 to 2015

years, the top teams performed a different number of acrobatic exercises and different types of acrobatic exercises, which differ in structure, but since 2017, the top countries began to perform almost the same number of acrobatic exercises from 5 to 6. This enables us to compare the demonstrated times with each other.

Conclusions: the results obtained allow us to state the fact that with the same number of acrobatic exercises, the teams who performed less time (but same number) to demonstrate acrobatic exercises perform them faster than others, since the speed of "set-up and recovery time" (gathering and ungathering of the construction) of an acrobatic movement is also assessed in artistic swimming and is considered by "Execution" and "Difficulty" judges panels, therefore this ability requires special technical skills from the athletes. All teams, leaders of the world artistic swimming, from year to year, significantly complicate the competitive routines due to the greater number and complexity of acrobatic movements performed and the increase in the number of figure and elements hybrids with durable breath holding.

Keywords: artistic swimming, classification, competitive routines, acrobatic movements, figure and elements hybrids, analysis.

Introduction

The modern stage in the development of artistic swimming demonstrates a significant increase in the "saturation" (content) of competitive programs (routines). The variety of elements has grown, which are an integral part of demonstrating the complexity of competitive programs (routines). New complicated combinations, acrobatic movements and elements appear. At the same time, from year to year, the requirements for the elements performed are increasing. The assertion that artistic swimming has reached its limit in its development is erroneous. And every new world championship is a confirmation of this. Only those teams that invent new, original elements, demonstrate a high stability of the complexity of compositions and acrobatic movements, reach the top of the pedestal. It is in this that the main regularity of elite sport is manifested [2,

4].

For the practice of artistic swimming, a global problem is the adequacy of the quantitative determination of the complexity of competitive programs (routines).

Currently, there is no specific information in the FINA artistic swimming competition rules about which element is more difficult than another and objective approach to determining its technical value [6].

To determine the most important components that are highly appreciated by the judges, and to build a balanced, choreographic and at the same time technically difficult, complex "basis of the competitive program" (matrix), it is first necessary to analyze the results of the performances of the best teams in the world and determine the dynamics of the formation of the components of these competitive programs (routines).

The study of highly estimated components of competitive routines, requirements, as well as modern and future requirements of refereeing will allow to develop the basic methodological concepts of training athletes in artistic swimming.

Material and Methods of research

In our study, the following research methods were used: theoretical analysis and generalization of scientific and methodological literature data, analysis of competition results, survey, methods of mathematical statistics. The results of performances and competitive programs (routines) of the five best performances of the World Championships (2015, 2017, 2019) and the Olympic Games (2008, 2012 and 2021) were analyzed using video and timekeeping.

Results of the research

In artistic swimming, it was established that choreography, the "construction" of a competitive routine consists of the following components: acrobatic movements (pair and team), element and figure hybrids, choreographic movements of hands and legs, demonstration of patterns, geometric "planes" on the water surface (patterns) and movement (propulsion) around the pool area.

Movement on land and diving are not scored and evaluated.

Experts who considered the multicomponent and specificity of building competitive routines in artistic swimming noted that acrobatic movements and hybrids are an integral part of the performance of athletes in artistic swimming and every year more and more attention is paid to these elements of competitive routines, as the main factors of the complexity of the performance [1, 3, 4, 7, 8, 9, 10]. In this regard, as the basis of this study, it was decided to investigate precisely these two factors.

According to a study by Yumi Adachi [4], which analyzed the performances of the three strongest countries in the world, the Russian national team, which won first place at the 2015 World Championship (Kazan), used 11.8% of the entire program to perform acrobatic movements (27 s from 227 s), and in 2012 it was 26,7 s (10,9%), while in 2008 it was only 2,7%. The Russian national team used 61,0 s (24,4%) in 2008, 62,76 s (25,5%) in 2012 and 58,49 s in 2015 (25,7%) on the hybrids [4].

The national team of China, which took second place, throughout the performance, which lasted 250 s, used 24 s to perform acrobatic movements, that is, 9,58% of the total performance in 2015, and in 2008 – 13,7% (33,8 s). And in 2012, on the contrary, in the competitive routine of the Chinese national team at the Olympic Games in London, the emphasis was placed on acrobatic movements, where the time spent on their implementation was 39,5 s from 244,6 s, that is, 16,2% of the total performances. At the same time, the hybrids in 2008 took 75,5 s (29,73%) of the entire performance; in 2012 81,1 s (33,19%) and 83,5 s (33,3%) in 2015 [4].

At that time, the Japanese team was ranked 3rd, therefore it was considered one of the leading teams in the world. So, in their performance on acrobatic movements in 2015, 21,62 s were given from 252 s (8,5% of the total performance), 19,5 s (8,0%) in 2012, and in 2008 only 11,63 s with 237,7 (4,8%) of the total performance. Hybrids took 86,33 s (36,3%) in 2008, 92 s (38,3%) in 2012 and 91,8 s (36,3%) in 2015 [4].

In 2008 and 2012, the national team of Ukraine and the national team of Italy did not take part in the team competitions of the Olympic Games. But a study of the video materials of the 2012 European Aquatics Championships (Eindhoven, Netherlands) showed that the Ukrainian national team demonstrated 67 s (27,7%) the hybrids with 241,2 s from the total performance time and 38 s used to demonstrate acrobatic movements (15,7%). In these competitions, the Italian national team demonstrated 73,0 s (29,4%) of hybrids of elements with a total time of 247,8 s, and 35,0 s for demonstrating acrobatic movements (14,1%).

Video analysis of the 2015 World Championship in Kazan (Russia), where the Ukrainian national team fought for the third place (93,70 points) with the Japanese national team (93,90 points), and the Italian team fought for the fourth place (91,46) with the Spanish national team (92,46). At these competition, the Ukrainian national team spent 30 s on acrobatic movements from 247 s (12,1%), which demonstrates the dominance of the Ukrainian national team in time and the number of acrobatic movements, compared to the medalists: teams from Japan, China and Russia. In the performance of 10 hybrids, the Ukrainian national team spent 85 s, that is, 34,4% of the time of the entire performance.

Our research has shown that the Italian national team in 2015 at the World Championships in Kazan performed 7 hybrids of elements with a total duration of 64 s from 247,8 s (25,8%) and 6 acrobatic movements for which they spent 33 s (13,3%). In the competitive program, only 3 hybrids lasting more than 10 s were performed, which, according to the judges and coaches, is insufficient for the team applying for the podium.

According to the research of Miwako Homa, who considered the composition and components of competitive routines from artistic swimming in 2013, taking into account a performance time of 4 minutes, teams that received an assessment from judges in the range of 9,5-9,9 points in their program spent on hybrids 28,4% of the total performance and 8,8% of acrobatic movements. Teams that received a score of 9,0-9,4 spent 23,6% of the total performance on hybrids and 6,3% on acrobatic movements. Teams that received low scores in the range of

8,5-8,9 (rating "very good") demonstrated 8,50% of acrobatic movements and 24,9% for hybrids, focusing their performances on hand movements. Teams of level 8,0-8,5 points (mark "good") performed the number of acrobatic movements at the level with the best athletes – 8,5% and 35% of the hybrids from the entire performance. Despite the "satisfactory" grade of 7,5-7,9 points received from the judges, the teams of this qualification demonstrated 8,3% of acrobatic movements and 27% of hybrids. These studies have clearly demonstrated the importance of acrobatic movements at all levels of team performance and is an integral part of competitive programs. [9].

To obtain an updated and supplemented dynamics of the growth of the complexity of competitive routines of athletes in artistic swimming, we analyzed the performances of the leaders of the World Championship in Budapest in 2017 (Table 1).

Table 1

The number of acrobatic movements, hybrids of elements and the percentage of their implementation to the total performance time

Achieve place	National team	Number of acrobatic movements	Total duration (s)	Total duration as a percentage of total time	Number of "hybrids"	Hybrids with breath holding more than 10 s	Duration of all hybrids (s)	Total duration as a percentage of total time	Duration of the whole routine (s)
1	Russia	5	30	12,55%	6	3	64	26,78%	239
2	China	6	40	16,54%	10	4	89	36,81%	241
3	Ukraine	6	36	15,19%	8	6	90	37,97%	237
4	Japan	6	42	17,5%	7	4	88	36,67%	240
5	Italy	6	33	13,2%	8	3	79	31,6%	250

According to the results of the analysis, each of the teams during their performance at the 2017 World Championship demonstrated 5-6 acrobatic movements and from 6 to 10 hybrids of the elements. The longest time for holding the breath during the hybrids was demonstrated by the national team of Ukraine – 37,9% of the time of the whole performance. The lowest hybrid was shown by the

Russian national team – 26,7%. The Japanese national team spent more time on acrobatic movements with a score of 17,5%. Experts note that this indicator depends on how quickly the athletes get together for the acrobatic movements and leave after it. That is, the long time spent on the acrobatic movement does not yet show the level of the team, and sometimes, on the contrary, it shows that the team spends a lot of time building the construction of the acrobatic movement, and in artistic swimming, according to the rules, quick "assembly and disassembly" of the structure is appreciated.

At the next stage of the research, the performances of the 5 strongest teams participating in the World Artistic Swimming Championships in 2019 (Gwangju city, South Korea) among free routines were analyzed. The analysis results are presented in Table 2.

Table 2

Percentage of the performed elements of the performance of artistic swimming athletes at the 2019 World Championships to the total performance time

Achieve place	National team	Number of acrobatic movements	Total duration (s)	Total duration as a percentage of total time	Number of "hybrids"	Hybrids with breath holding more than 10 s	Duration of all hybrids (s)	Total duration as a percentage of total time	Duration of the whole performance (s)
1	Russia	5	27	11,3%	7	5	72	30,3%	237
2	China	5	35	14,2%	7	4	90	36,5%	246
3	Ukraine	5	28	11,7%	8	6	91	38,1%	238
4	Japan	5	27	10,9%	8	5	88	35,6%	247
5	Italy	5	28	11,3%	9	6	90	36,4%	247

The performed analysis showed that the strongest countries demonstrate many (6) hybrids with significant breath holding - more than 10 s, as well as at least 5 acrobatic movements, clearly demonstrates the intensity and complexity of the competitive routines, which lasts 4 minutes. A demonstration of prolonged breath holding during intensive work on hybrids was demonstrated by the national team of Ukraine – 38,1%, as well as the national teams of China – 36,5% and Italy

– 36,4% of the total performance time. Weaker teams mainly perform a few long hybrids, preferring choreographic arm movements and acrobatic movements, clearly demonstrates the technical level of the athletes.

Particular attention in this study is paid to the analysis of the Olympic Games 2021 (Tokyo, Japan), where the Ukrainian national team took 3rd place in the team competition (Table 3).

Table 3

Percentage of the performed elements of the performance of artistic swimming athletes at the Olympic Games 2021 to the total performance time

Achieve place	National team	Number of acrobatic movements	Total duration (s)	Total duration as a percentage of total time	Number of "hybrids"	Hybrids with breath holding more than 10 s	Duration of all hybrids (s)	Total duration as a percentage of total time	Duration of the whole performance (s)
1	Russia	6	36	15,1%	7	4	68	28,5%	238,2
2	China	6	37	15,2%	7	3	81	33,2%	244,2
3	Ukraine	5	29	11,8%	10	6	105	42,6%	246,6
4	Japan	6	30	12,1%	8	5	89	36,0%	247,2
5	Italy	5	32	12,9%	10	4	95	38,3%	247,8

It was found that the longest (105 s) and record holding of breath over the execution of hybrids was demonstrated by the national team of Ukraine with a result of 42,5% from 246,6 s (Table 3). In general, in all five teams, the time they spent on demonstrating hybrids of the elements increased – 35,7%, compared to 2017 – 33,9% of the total performance time. The best teams demonstrated at least 5 acrobatic movements, on which they spent an average of 13,4% of the whole performance. While in 2017, the time that athletes spent on the execution (from the beginning (“assembly”) to the end, (“disassembly”) of the structure was 14,9%. This indicates an increase in the skills of the world's top teams.

Conclusions / Discussion

Comparing the World Championships 2015, 2017, 2019 and the Olympic Games 2008, 2012 and 2021, you can see that every year the performances of the

athletes of the national team of Ukraine (from 27,7% to 42,5%, that is, 14,8%) and Italy (from 29,4% to 38,3%, that is, 8,9%) grew rapidly, relying on time, athletes used to demonstrate the hybrids of elements. The Japanese national team has increased its performance over the period 2008-2021 by only 2%. The national teams of Russia and China (from 29,7% to 36,6% and decreased to 33,2%), on the contrary, decreased their performance compared to 2019. So, the Russian national team from 2008 to 2019 increased its performance from 24,5% to 30,3% (i.e. 5,9%), but decreased to 28,6% in 2021 (that is, by 1,8% compared to 2019), with an emphasis on choreographic movements of hands and legs on the surface of the water, pair acrobatics and choreographic combination. The data obtained is shown in Figure 1.

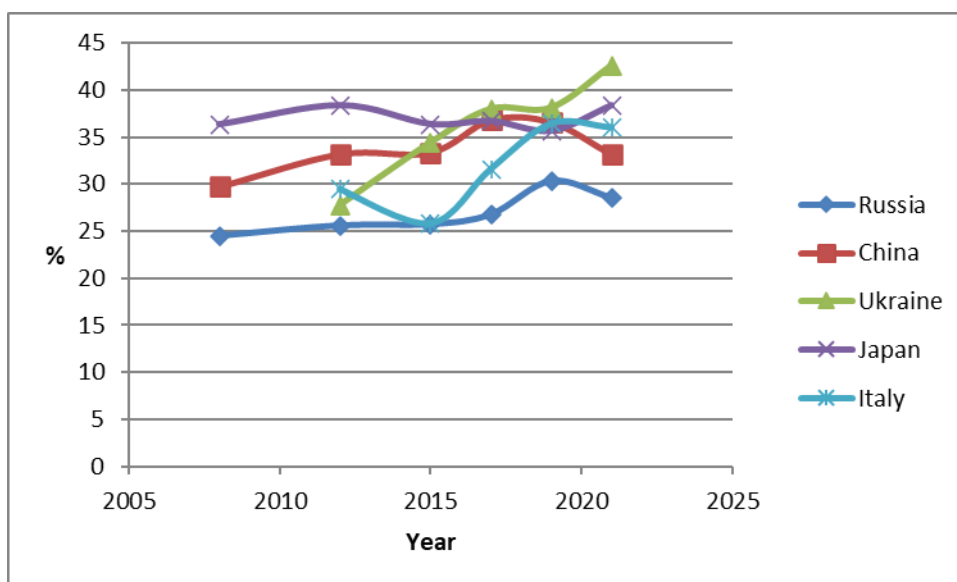


Fig. 1. Comparison of the time spent on the implementation of hybrids (%) of the top countries of the world from 2008 to 2021

No less important data we obtained when comparing the time spent on acrobatic movements, the best countries in the world in artistic swimming. The data obtained is shown in Figure 2.

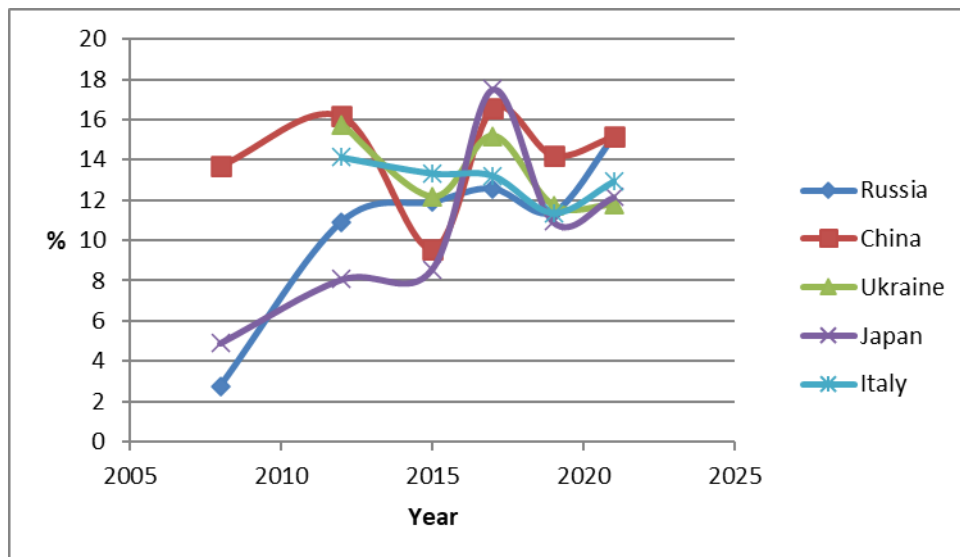


Fig. 2. Comparison of the time spent on performing acrobatic movements of the top countries of the world from 2008 to 2021 (%)

The data obtained allow us to confidently assert that acrobatic movements play a very important role in artistic swimming. So, we can see that from 2008 to 2015, the top teams performed a different number of acrobatic movements (the Russian national team in 2008 - 4, the Japanese national team - 3, the Chinese national team - 6; in 2012, the Russian national team - 7, the national team of Japan - 3, the national team of China - 7; in 2015, the national team of Russia 5, the national team of Japan - 7, the national team of China - 5) and various types of acrobatic movements, which are different in structure, we see very diverse numbers, but starting in 2017, the top countries started doing almost the same number of acrobatic movements from 5 to 6. This enables us to compare the demonstrated times with each other. The results obtained allow us to state the fact that with the same number of acrobatic movements, the teams performed less time to demonstrate acrobatic movements perform them faster than others (the Ukrainian national team – 11,8%, the Japanese national team – 12,1% and the Italian national team – 12,9%), and therefore have the advantage to demonstrate more elements in the program and a better score (a certain bonus from the judges), since the speed of "collecting and disbanding" of an acrobatic movement is also evaluated in artistic swimming and is considered both in the judging panel

"Execution" and the "Difficulties" panel, because it requires special technical skills from the athletes.

The data of our research allowed us to conclude that at this stage of the development of artistic swimming the best teams in the world are directly:

1) demonstrate the maximum number of acrobatic movements, limited only by the rules of the competition - there are 6;

2) "collection and disbandment" of the acrobatic movements is performed very quickly, despite the appearance;

3) time of holding the breath and the demonstration of the number of hybrids has now reached its "peak", compared with other years - 10 hybrids and 105 s from the total time of demonstration of hybrids;

4) all the leading teams of the world artistic swimming from year to year significantly complicate the competitive programs due to the greater number and complexity of acrobatic movements performed and an increase in the number of hybrids with prolonged breath holding.

Prospects for further research. In the future, it is planned to analyze hybrids and classify them according to difficulty level, taking into account the "components" of complexity.

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