

Influence of innovative methods of fitness training on improvement of technical fitness of qualified gymnasts in aerobic gymnastics

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Abstract:

Purpose. Nowadays it is impossible to imagine the training process of highly qualified athletes in various kinds of professional and Olympic sports without the use of innovative fitness technologies with appropriate equipment, tools and techniques. In particular, they are widely used in the educational and training process of gymnasts to improve certain aspects of their physical, functional and technical preparedness. The purpose of this study is to substantiate the feasibility of using innovative tools, methods and related techniques borrowed from health fitness aerobics to improve the technical preparedness of highly skilled athletes in aerobic gymnastics.

Materials and methods. The study involved 24 athletes of the national aerobic gymnastics team of Ukraine aged 18 to 26 years old. Qualification of sportsmen: 5 - master of sports of the international class; 13 - master of sports of Ukraine; 6 - candidates for the master of sports of Ukraine. Indicators of technical preparation of participants of experiment were fixed. The reliability of intra- and intergroup differences in the level of technical preparedness between the arithmetic mean values of the indices of technical preparedness was determined in accordance with the program approved by the Ukrainian Federation of Sports Aerobics and Fitness (FUSAF).

Results. The technical performance of gymnasts under the influence of the latest training techniques borrowed from health and fitness training, namely *Procedos*; *EXOS*; 6-D Sliding: *Procedos*; *EXOS*; 6-D Sliding. It is confirmed that the structure and content of the chosen methods meet the basic requirements for the competitive activity of qualified aerobic gymnasts. The data about the known means of improvement and control of parameters of technical training in aerobic gymnastics are supplemented. The effectiveness of the use of innovative methods borrowed from health fitness training in the construction of educational and training process of qualified athletes in aerobic gymnastics is proved. **Conclusion.** Both the experimental blocks of exercises borrowed from health-improving fitness training and the corresponding innovative methods of practical application of these tools have fully confirmed their effectiveness. The feasibility of using special *Procedos*, 6-D Sliding, *EXOS* methods in the programme of technical training of skilled athletes in aerobic gymnastics in the preparatory periods of the one-year training cycle has been experimentally proved.

Key words: aerobic gymnastics, technique, fitness training, *procedos*, *exos*, technical fitness, control.

Introduction.

In modern top-level sports, the technical training of athletes has reached an extremely high level. This phenomenon is especially relevant for complex coordination sports. However, further improvement of athletes' technical fitness is an extremely difficult task. Undoubtedly, the basis on which all types of training, including technical training, are based is primarily the physical and functional readiness of athletes. At the same time, it is noted that the integral training of highly skilled athletes involves the organic combination of all its components into a single system with a well-established technological process of "conveyor" training. In practice, this problem has been solved mainly on an intuitive and empirical level. This important problem has only recently been addressed at the level of fundamental research (Shepelenko T.V., 2018; Platonov V.N., 2022; Kokarev B., at al., 2023; Lisenchuk G. at al., 2023).

From a large number of studies conducted in the past on the system of training highly qualified athletes, it is known that the achievement of the planned sports result by highly qualified athletes occurs due to the complex combination of all components of their training. Researchers on the system of training athletes in Olympic and professional sports emphasise that the modern technology of training high-class athletes is based on

the results of scientific research and has a scientific and methodological basis. In addition, they are united in determining the priorities for the readiness of athletes to achieve maximum results (Kokarev B.V., 2016; Sosina V. at al., 2019; Le Naour, T., Ré C., Bresciani J., 2019; Kravchuk, T., at al., 2020; Platonov V.N., 2022).

Aerobic gymnastics is not on the list. It develops in accordance with the trends and laws of modern sport, but has its own specific features. Researchers believe that one of the main components of the development of the training system in aerobic gymnastics is the improvement of athletes' technical skills. Along with the modelling of the main parameters of competitive activity, which involves a significant excess of its real demand in technical, physical, functional and psychological aspects, the peculiarity of this sport is the focus on mastering more and more complex movements and technical actions, their effectiveness, which should constantly increase in the process of long-term training (Kyselovičová O., at al., 2020; Lamošová A, Kyselovičová O., 2022; Starzak M., at al., 2022). In addition to its traditional complex coordination status, modern aerobic gymnastics, in a certain sense, is increasingly becoming a sport of speed and power, as a powerful muscle explosion is required to perform modern complex technical tricks and connections, and a large static and dynamic force is needed to perform power elements (Mezei M., at al., 2021; Kaufmann S., at al., 2022; Starzak M., at al., 2022).

And here we are faced with the fact that over the past decade, modern health technologies have made a huge step forward compared to traditional technologies for training athletes in Olympic and professional sports. On the one hand, coaches and managers of professional athletes understood that high-performance sports are the quintessence of the development of technologies for preparing a person for the extreme conditions of modern competition. On the other hand, there was an understanding that the world of sports, like everything else around us, is changing very quickly. Sport is becoming faster and faster. The technologies for manufacturing athletes' equipment and sports facilities are improving. While in the past, athletes' training methods were adapted for recreational training, today the opposite trend prevails: thanks to the rapid introduction of new technological solutions into mass consumption, professional sports has found itself in the role of catching up. Therefore, we see the rapid development and spread of the latest fitness technologies among leading sports teams, including football clubs: «FC Chelsea» (England), «FC Manchester City» (England), «FC Liverpool» (England), «FC Bayern Munich» (Germany), «FC Hamburg» (Germany), «FC Barcelona» (Іспанія), «FC Real Madrid» (Іспанія). NHL Ice Hockey Clubs, such as: «New Jersey Devils», «Toronto Maple Leafs», «New York Rangers» and others (Kokarev B., at al., 2023; Lisenchuk G. at al., 2023).

It seems to be a dissonance that the health-improving direction of aerobics is widely represented in scientific research and publications. In contrast to the health-improving aerobics, the sport aerobics direction, which is aerobic gymnastics, has not yet been properly reflected in the available scientific, methodological and specialised literature. Most of the methods of training athletes in aerobic gymnastics are borrowed from other complex coordination sports (artistic and rhythmic gymnastics, acrobatics, trampoline jumping, etc.) But, unlike the techniques typical of modern fitness training in recent years (Functional Step, Fitball, Medball, Bodybar, Strenflex, Tabata, BOSU, TRX Suspension Training, TRX-RipTrainer™, HIIT, M.A.X®, Tabata, HIIT, various types of circuit training, etc.), these borrowings have long been well known. Most of these techniques have been studied in dissertation research and described in scientific articles by scholars who have been concerned with this issue. Numerous scientific data, confirmed by the majority of performances in the world's highest ranked competitions, indicate that this approach is highly likely to provide the highest achievements in the main competitions of the season (Sosina V., at al., 2019; Mezei M., at al., 2021; Kokarev B., at al., 2023; Lisenchuk G. at al., 2023; Doroshenko E., at al., 2023).

Thus, the conducted researches show that the scientific approach to the improvement of different aspects of preparedness of highly qualified athletes in aerobic gymnastics with the help of modern technologies of health-improving fitness training is able to provide high achievements. However, we see clear disproportions between the empirical approach of practical specialists in gymnastics disciplines and the scientific description of the consequences of such an approach. Unfortunately, there is a lack of scientific and methodological research and development related to the use of modern fitness training methods, such as ProceDOS, EXOS, 6-D Sliding in the training of highly qualified athletes. Our study, along with others, focuses on the use of the above-mentioned techniques, which are not yet properly reflected in the scientific literature. It is devoted to the solution of the problem of improvement of means and methods of technical training of qualified sportsmen in aerobic gymnastics.

Material and Methods.

Analysis of scientific and methodological literature on the research issues; pedagogical experiment; testing; methods of mathematical statistics.

To achieve the research goal, we have identified the following tasks.

1. To define parameters of technical fitness which meet the basic requirements of competitive activity in aerobic gymnastics by structure and content;

2. To define efficiency of the chosen methods of the modern health-improving fitness training and corresponding to them means for the improvement of technical fitness of skilled sportsmen in aerobic gymnastics in the conditions of direct preparation for competitions of the high rank.

3. To supplement knowledge about well-known means and corresponding methods of special motor training as a part of technical training of sportsmen in aerobic gymnastics.

Experiment. The experimental part of the study was organised at the National University of Zaporizhzhia Polytechnic, where the Ukrainian national aerobic gymnastics team was training. The beginning of the first stage of the study corresponded to the end of the 2021 World Aerobic Gymnastics Championships in Baku (Azerbaijan). The study involved 24 student athletes aged 18-26, representing the Ukrainian national aerobic gymnastics team and holding an International Gymnastics Federation athlete licence (https://www.gymnastics.sport/site/athletes/lic_view.php).

At the first stage (2021) a statement experiment was conducted, which studied the features of the dynamics of indicators of physical performance, aerobic capabilities, physical, technical, choreographic-compositional and artistic preparedness of the subjects within the annual cycle of training of gymnasts under the influence of the classical programme of construction of the training process.

On the basis of the analysis of the results of the ascertaining experiment, an experimental programme was developed to build the training process of highly qualified gymnasts in aerobic gymnastics within the annual training cycle using the above innovative techniques borrowed from health and fitness training. The main purpose of attracting additional means of training gymnasts was to improve various types of gymnasts' fitness, including technical.

At the second stage (corresponded to the preparatory period of the sports season 2022) a formative experiment was conducted in order to test the effectiveness of the developed programme of building the training process. The second stage of the research was considered to be the period of direct pre-competitive preparation and participation of the national team of Ukraine in the World Championships in aerobic gymnastics 2022 in Guimaraes (Portugal). The national team athletes who took part in the experiment were divided into two groups: control (12 gymnasts) and experimental (12 gymnasts). Gymnasts of each group were engaged in all kinds of sports training, according to the requirements of the training programme (Pasichnaya T.V., Mohort L.V., Lozenko N.M., 2019).

The sportswomen of the experimental group (EG) during the annual macrocycle were engaged in the developed experimental programme. At this stage of the experimental research the main experiment was conducted, the essence of which consisted in replacement of familiar methods and corresponding exercises and technologies of organisation of the educational and training process with new, unfamiliar ones. Thus, according to its conditions, the experimental group used complexes of specially developed exercises by innovative methods inherent in fitness training, namely: 6-D Sliding (Fig. 1) and *Procedos*. The construction of the training process in the experimental group was carried out according to the EXOS method, which has been popular in the last 3-4 years (especially among teams of game sports).

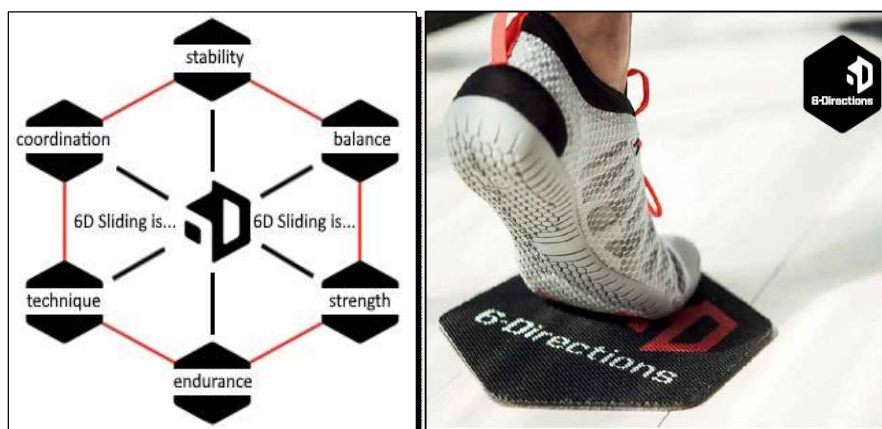


Figure 1. The 6D Sliding training

The control group (CG) consisted of female athletes who trained at Zaporizhzhia National University. They continued to train according to the Aerobic Gymnastics Programme for Sports Schools recommended by the Ukrainian Federation of Sports Aerobics and Fitness, which has already been proven to be sufficiently effective in previous studies (Atamaniuk S.I., 2006; Kokarev B.V., 2016; Pasichnaya T.V., Mohort L.V., Lozenko N.M., 2019; Sosina V. et al., 2019).

At the moment, there is almost no scientific and methodological justification for the use of the methods and technical devices chosen by us for the training of highly qualified athletes whose specialisation is related to gymnastic disciplines. We consider it expedient to provide the main characteristics of the methods used.

6D Sliding is the name of an innovative slide training system that involves training the body in all six directions – up, down, right, left, forward and backward, that is to say "6-Directions". The 6D Sliding system was first introduced in 2014 and since then, slide training has been actively used in many other sports.

The 6D Sliding concept was specially developed for trainers. In general, the structure of the 6D Sliding training programme can vary depending on the tasks and target group (Federer & Aagaard, 2016).

This type of training is widely used in various professional sports clubs in handball, football, hockey, tennis, etc. The 6D Sliding system is aimed at developing stability, balance, strength, endurance, technique and coordination. It may require serious physical training, but it can be adjusted to suit specific tasks and fitness levels: from beginner to professional athlete. The training lasts 45-60 minutes. Of these: 10-15 minutes - warm-up (gradual increase in intensity, performing simple exercises with a gradual increase in complexity); 15-30 minutes - slide training (sliding exercises taking into account the target zone and the desired format); 5-10 minutes - cool-down (gradual decrease in intensity, heart rate to a level close to the start of the session). The benefits of 6D Sliding include:

1. Stability. Muscle interaction, both static and dynamic, is trained. The basic stability of the body is developed. At the same time, the core muscles are trained, which allows you to get rid of excessive stress on the skeleton in everyday life.
2. Balance. Static and dynamic balance improves. When doing sliding exercises, you have to constantly monitor your balance. Balance is extremely important both in sports and in everyday life.
3. Manifestations of strength abilities. As the basis for all motor skills, a certain amount of muscle strength is necessary for both everyday life and sports. Exercise improves strength, in particular, strength endurance.
4. Endurance. Exercise improves endurance in both aerobic and anaerobic ways. This way, muscles can work longer without becoming exhausted.
5. Technique. Improves the ability to perform exercises correctly and accurately. The better the technique, the more effective the training and competition. Moreover, the safety and effectiveness of training increases.
6. Coordination abilities. The basic interaction between the nervous system and muscles improves in many aspects.

The Procedos platforms (Fig. 2) were developed in Sweden in 2014. Procedos is a new word in functional fitness. They consist of a Procedos mat measuring 100 by 130 cm, with numbers from 1 to 9, degrees and a ruler around the edges. Based on various indications from the trainer, the trainee can change the direction of movement within the indicated zone (which is not least typical for volleyball), body position, add turns and movements, and use various kinds of weights. Thanks to this approach, training on the Procedos platform is in many ways similar to the well-known, exciting game of Twister, but with a scientific approach (<https://procedos.store/collections/frontpage>).



Figure 2. General view of the Procedos

The peculiarity of training with the Procedos mat is that behind the simple movements that are accessible to everyone lies a scientific approach and knowledge of how muscles and joints should work. Thus, you can try dozens of different exercises and their variations. This type of training is still gaining popularity in Ukraine.

The methodological features of this technique include the following. The warm-up is slower so that participants can learn the platform and remember the approximate location of the coordinates. The main part of the workout consists of dozens of variations of familiar exercises. The mere fact that they are performed in unusual conditions immediately has a positive training effect. Even the usual squats and lunges with the Procedos mat feel new, because each time the trainer sets new coordinates for them on the platform. Together with the body, the brain is trained, forming new neural connections.

The training lasts 45-60 minutes.

Its methodological features are similar to those of the 6D Sliding technique

In our research we used the EXOS programme (Fig. 3) as a universal programme of training highly skilled sportsmen, which is based on three basic components: 1 - functional training; 2 - physical rehabilitation; 3 - nutrition.



Figure 3. The general view of the Keiser trainer

The main directions of the program.

Fundamentals. The programme forms the basis of correct movement during exercise, develops balance and teaches you to control your body during exercise.

Total Body Strength. Building the right muscle corset, increasing endurance, building strength and power through strength training.

Movement Skills. A technique for improving basic motor skills important in all sports. Helps improve athletic performance.

ESD. High-intensity training at maximum pace with short rest intervals. Use of strength and power movements to maximise energy utilisation during exercise.

Regeneration. Direction for accelerated muscle recovery after stress or increased physical activity, allowing the athlete to return to training faster. The main tools are light stretching and muscular-fascial relaxation.

Keiser By Exos. Pneumatic exercise equipment suitable for professional and amateur athletes of all fitness levels. Their uniqueness lies in their absolute safety for ligaments and joints. Training on this multifunctional trainer strengthens all muscle groups, builds muscle definition and increases the body's endurance.

According to the basic principles of the programme, the athlete's body should be seen as a mechanism that requires energy, fuel, excellent performance of all components, as well as the necessary time for rehabilitation and recovery.

Functional training combines an even distribution of load with maintaining flexibility, stability and body mobility, developing endurance, power and a sense of balance. A well-built structure of training techniques, methods, technologies and tools gradually leads an athlete to his or her intended result. Under this system long and successfully train athletes of the Olympic teams of the United States, China and Japan, the national football team of Germany.

Coaching lasts 45-60 hvin. Its main methodological peculiarities are similar to those of the 6D Sliding and Procedos methodologies.

Testing. To test the level of technical fitness of the gymnasts, we used control exercises from the Programme for Sports Schools and Clubs recommended and approved by the Ministry of Youth and Sports of Ukraine (<https://mms.gov.ua/>) and FUSAF (<https://scu.org.ua/federation/federaciya-ukra%D1%97ni-zisportivno%D1%97-aerobiki-ta-fitnessu/>).

Testing of technical fitness of highly skilled sportsmen in aerobic gymnastics is caused by the main direction of scientific research. In our research for the assessment of the level of technical fitness of gymnasts we used control exercises which are given in the list (table 1).

Table. 1. Scale of qualitative assessment of indicators of special technical fitness in aerobic gymnastics (by B.V. Kokarev, 2016)

Control exercise	Quality level (points)				
	"Excellent" high level	"Doing good" is above average	"Good" average	"Satisfactory" below average	"Unsatisfactory" low
Straddle jump, points	10 points	9 points	8 points	7 points	6 points
Vertical split, points	10 points	9 points	8 points	7 points	6 points
Lateral balance, points	10 points	9 points	8 points	7 points	6 points
Jump with a 360° turn, points	10 points	9 points	8 points	7 points	6 points
Straddle L-support with a 360° turn, points	10 points	9 points	8 points	7 points	6 points

"Jump with a 360° turn with a precise (stationary) landing". The content of the exercise involved the sequential performance of 10 attempts, which were evaluated according to a scoring scheme: "pass" - "fail". An attempt that was performed without gross or medium errors and involved a stable landing with a foot separation not exceeding 1 foot in width was considered to be scored. According to Table 2, the score of "excellent" corresponds to 10 error-free performances; "very good" - 9 performances; "good" - 8; "satisfactory" - 7; "unsatisfactory" - 6 performances and less.

"Vertical splits (on either leg) with hands on the floor" and "Straddle L-support with a 360° turn". The content of the exercise involved the alternate regulated performance of three attempts for evaluation according to the generally accepted competitive method of performance evaluation. The average assessment of the success of the control exercise was recorded in the protocol. The assessment was carried out according to the methodology according to which a certain silhouette of the exercise corresponds to a specific expert assessment: "excellent"; "very good"; "good"; "satisfactory"; "unsatisfactory".

"Lateral balance on the right (left) leg". The content of the exercise involved alternate regulated performance of balance on the right (left) leg sequentially. The average score was recorded in the protocol, which was also determined according to the generally accepted competitive method of performance evaluation.

"Straddle jump". The content of the exercise involved the alternately regulated performance of three attempts to assess the "execution" criterion of the official rules of aerobic gymnastics competitions (IGF Competition Rules 2022), according to which a certain silhouette of the exercise corresponds to a specific expert assessment: "excellent"; "very good"; "good"; "satisfactory"; "unsatisfactory". Attempts that were performed with the minimum requirements for technique were considered to be scored: during the exercise, the hips in the unsupported phase of the jump should be at a level parallel to the floor or higher. The score of the best attempt of the test exercise was recorded in the protocol. The majority of specialists whose works are devoted to aerobic gymnastics note that these control exercises have a direct connection with the further technical improvement of athletes and in a concentrated form represent all basic elements of three main groups of elements of the classification programme according to the FIG rules. In addition, the use of such control exercises allows to determine the level of special technical and motor fitness for the performance of many elements of high cost, which are mostly represented in the competitive compositions of highly qualified gymnasts in aerobic gymnastics (Todorova, V. H., at al., 2019; IGF Competition Rules 2022; Kokarev B., at al., 2023).

It should be noted that the level of artistic, choreographic and compositional training was assessed according to a scale developed according to which the level was considered high if the average expert score was more than 9.0 points. Above average - from 8.5 to 9.0 points. Medium - from 7.5 to 8.5 points, below average - from 6.5 to 7.5 points. Low - below 6.5 points.

Given the large number of control exercises, the number of indicators and their focus, a comprehensive pedagogical observation was conducted six times throughout the study period.

The objectivity of the information was ensured by adherence to standard conditions:

- pedagogical observations of technical readiness indicators were conducted in the morning from 9.00 to 12.00 hours;
- test exercises were performed after a standard warm-up and exercising of the organism of sportsmen;
- determination of indicators of technical fitness took place within the main part of the educational and training session, which did not provide for previous significant physical exertion, after warm-up;
- repetitions of exercises (attempts) were performed after rest and achievement by sportswomen of the minimum individual level of heart rate (the lower limit of the individual training zone of heart rate by means of data of "cardio-leader" on the sound signal of the cardiac heart rate monitor Garmin® Forerunner 55 (<https://www.garmin.com/en-US/p/741137/pn/010-02562-00>)).

Expert assessment. The method of expert evaluation is quite often used in Martial Arts, a complex and coordinated sport, where it is not possible to obtain objective data on some indicators (for example, technical skill). In this study, the opinion of expert coaches was sought, who were able to express their opinion verbally or in any other informative form in terms of the applied means, methods, techniques and technical fitness of qualified gymnasts specialising in aerobic gymnastics. The experts were FUSAF coaches and judges who hold a FIG international licence and brevet.

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Results.

It has been proved that at the beginning of the ascertaining experiment which corresponded to the beginning of the preparatory period of the annual training cycle, the examined gymnasts had average, below average and above average indicators of their technical fitness (Table 2).

Table. 2. **Indicators of technical, artistic and choreographic-compositional preparedness of highly qualified gymnasts (n=24) in aerobic gymnastics at different stages of the ascertaining experiment ($\bar{X} \pm S$)**

Показники	Symbol	Index by FIG CoP	Start	Middle	Completion
Straddle jump, points		B 5104	4,95±0,16 average	5,15±0,13 average	4,71±0,14* average
Vertical split, points		C 801	7,60±0,27 above average	7,95±0,19 above average	7,31±0,17* average
Straddle L-support with a 360° turn, points		B 403	3,90±0,15 below average	4,10±0,13 average	3,64±0,12** below average
Lateral balance, points		C 811	7,05±0,29 above average	7,40±0,17 above average	6,81±0,19* average
Jump with a 360° turn, points		A 214	4,10±0,20* average	4,45±0,14 average	4,02±0,12* below average
Artistic readiness, points		-	7,72±0,11 average	7,78±0,06 average	7,65±0,09 average
Choreographic & compositional readiness, points	-	-	7,36±0,03 average	7,81±0,07 average	7,11±0,05* average

Notice: * – $p < 0,05$; ** – $p < 0,01$ Compared to the values of the indicators in the middle of the confirmatory experiment; CoP – Code of Points.

The repeated testing of gymnasts, which was conducted at the end of the preparatory period (the middle of the confirmatory experiment), did not allow to record significant changes in these indicators, except for the test "Jump with a 360° turn, points". It should also be noted that the level of qualitative assessment in the test "Straddle L-support with a 360° turn, points" improved. In general, we had an improvement in technical fitness from 3.88% to 7.87%, artistic (by 0.77%) and choreographic and compositional fitness (by 5.75%).

The analysis of indicators of technical fitness of the examined gymnasts at the end of the ascertaining experiment testified that by the end of the competitive period the gymnasts were characterised by a significant ($p < 0.05$; $p < 0.01$) decrease of results in more than a half of the presented tests of technical fitness in comparison with the middle of the ascertaining experiment which was considered to be the end of the preparatory period. Similar dynamics was characteristic for artistic and choreographic-compositional preparedness of gymnasts who took part in the research.

After the ascertaining experiment (the end of the competitive period) the examined gymnasts showed a significant ($p < 0.05$; $p < 0.01$) deterioration, in comparison with the results of testing at the end of the preparatory period, of the majority of indicators of special technical fitness (from 7.97 % to 11.22 %), and the level of choreographic and compositional fitness (by 7.87 %). The level of artistic fitness remained almost unchanged (-1.67%, $p > 0.05$).

In order to determine the effectiveness of the experimental programme of building the training process, the analysis of the peculiarities of the dynamics of indicators of technical fitness of highly qualified gymnasts in aerobic gymnastics within the annual training cycle was carried out. At that, the beginning of the annual cycle coincided with the beginning of the formative experiment. The middle of the formative experiment was considered to be the end of the preparatory period, and its completion was considered to be the end of the competitive period.

The analysis of changes of indicators of special technical, artistic and choreographic-compositional preparedness of gymnasts of the experimental group allowed to assert that at the end of the preparatory period they were characterized, unlike gymnasts of the control group, by their reliable ($p < 0.05$; $p < 0.001$) improvement and positive qualitative changes: values on all these indicators which in the vast majority corresponded to the level "above average" and "high" (table 3).

After the end of the preparatory period the gymnasts of the experimental group recorded a significant ($p < 0.05$; $p < 0.01$) improvement of the results of testing of technical (by 11.59 - 43.05 %), artistic (by 9.21 %) and choreographic-compositional (by 10.58 %) preparedness.

After the formative experiment the examined gymnasts of the experimental group recorded significantly better ($p < 0.05$; $p < 0.01$) than the gymnasts of the control group values of indicators of technical fitness (by 9.29 - 40.33 %), artistic (by 10.49 %) and choreographic-compositional (by 9.67 %) fitness.

Table 3. Indicators of technical, artistic and choreographic-compositional readiness of athletes of experimental (n=10) and control (n=10) groups at different stages of the formative experiment, ($\bar{X} \pm S$)

Test	Group	Beginning of the preparatory period	$\Delta\%$	p	Completion of the preparatory period	$\Delta\%$	p	End of the competition period	$\Delta\%$	p
Straddle jump, points	CG	4,81 $\pm$ 0,24 average	5,68	>0,05	5,03 $\pm$ 0,15 average	30,14	<0,01	5,00 $\pm$ 0,21 average	27,54	<0,01
	EG	5,10 $\pm$ 0,19 average			7,20 $\pm$ 0,26 above average			6,90 $\pm$ 0,21 above average		
Vertical split, points	CG	7,79 $\pm$ 0,25 above average	0	>0,05	7,84 $\pm$ 0,22 above average	13,85	<0,01	7,71 $\pm$ 0,29 above average	9,29	>0,05
	EG	7,80 $\pm$ 0,26 above average			9,10 $\pm$ 0,25 high			8,50 $\pm$ 0,23 above average		
Straddle L-support with a 360° turn, points	CG	3,79 $\pm$ 0,25 below average	9,52	<0,01	3,87 $\pm$ 0,18 below average	43,09	<0,01	3,64 $\pm$ 0,22 below average	40,33	<0,01
	EG	4,20 $\pm$ 0,14 below average			6,80 $\pm$ 0,34 above average			6,10 $\pm$ 0,29 above average		
Lateral balance, points	CG	7,19 $\pm$ 0,27 average	4,00	>0,05	7,25 $\pm$ 0,19 average	11,59	<0,01	7,11 $\pm$ 0,22 average	10,00	<0,05
	EG	7,50 $\pm$ 0,28 above average			8,20 $\pm$ 0,21 high			7,90 $\pm$ 0,19 above average		
Jump with a 360° turn, points	CG	4,29 $\pm$ 0,21 average	2,27	>0,05	4,39 $\pm$ 0,17 average	39,03	<0,01	4,08 $\pm$ 0,18 average	40,00	<0,01
	EG	4,40 $\pm$ 0,23 average			7,20 $\pm$ 0,41 high			6,80 $\pm$ 0,35 above average		
Artistic readiness, points	CG	7,57 $\pm$ 0,16 average	4,66	>0,05	7,69 $\pm$ 0,07 average	9,21	<0,05	7,51 $\pm$ 0,06 average	10,49	<0,01
	EG	7,94 $\pm$ 0,07 average			8,47 $\pm$ 0,05 above average			8,39 $\pm$ 0,05 above average		
Choreographic & compositional readiness, points	CG	7,41 $\pm$ 0,05 average	0,27	>0,05	7,52 $\pm$ 0,04 average	10,58	<0,05	7,47 $\pm$ 0,03 average	9,67	<0,05
	EG	7,43 $\pm$ 0,06 average			8,41 $\pm$ 0,07 above average			8,27 $\pm$ 0,09 above average		

The results of testing of gymnasts of the experimental group at the end of the formative experiment (the end of the competitive period) testified to the absence of reliable ($p>0.05$) intergroup changes of the studied indicators in comparison with the end of the preparatory period.

Thus, the comparative analysis of the specified indicators revealed the greater efficiency of the developed programme of construction of the training process in gymnasts of the experimental group in contrast to the control group.

Discussion.

The analysis of scientific and methodical literature on the topic of the conducted work allows to state that the problem of improvement of the training process of gymnasts specialising in aerobic gymnastics at the stage of maximum realisation of individual possibilities requires further research. One of the promising ways to improve various components of the general fitness of highly skilled gymnasts in aerobic gymnastics is the development of new programmes of building the training process in the annual training cycle, which are designed taking into account changes in the indicators of physical and technical fitness of gymnasts within individual micro-, mesocycles and provide for the possibility of correcting the volume of training loads during the competitive period.

In the study presented to your attention we saw that during the ascertaining experiment at the beginning of the preparatory period highly qualified gymnasts had mainly average and above average indicators of their special technical fitness and average levels of artistic and choreographic-compositional fitness. At the end of the preparatory period there were no significant ($p<0.05$) changes in these indicators. Moreover, at the end of the competitive period their decrease was recorded ($p>0.05$). The experiment itself was conducted in accordance with the current programme and competition calendar. The training process in the annual cycle had a classical structure. It included preparatory, competitive and transitional periods, which contained pull-in, basic, control-preparatory, pre-competitive and competitive mesocycles, with all types of microcycles.

The experimental programme was developed on the basis of the classical sports aerobics programme for the stage of maximum realisation of individual capabilities, approved by the coaching council and technical committee of the Federation of Ukraine for Sports Aerobics and Fitness (FUSAF). It was based on the goal and objectives of the stage of maximum realisation of individual capabilities and the principles of sports training. The programme was

developed taking into account the age peculiarities of gymnasts, the calendar of competitions, the initial level of fitness, data of control tests of gymnasts at the beginning of the formative experiment (Table 1). The data obtained by previous researches were also taken into account, which allowed to state the absence of significant ($p > 0.05$) differences in all studied indicators in gymnasts divided into control and experimental groups. The analysis of results, first of all, concerned indicators of general and special physical fitness (Robertson, R., Germain L.S., Ste-Marie D.M., 2018; Kokarev B., at al., 2023).

The general features of the classical and experimental programmes of construction of the training process of highly skilled gymnasts in aerobic gymnastics include the following:

- the total amount of training loads;
- the duration of the preparatory, competitive and transition periods of the annual training cycle (preparatory - 1.5 months, competitive - 9.5 months and transition period - 1 month);
- the complex of training equipment used in the process of gymnasts' training (general developmental and acrobatic exercises, exercises of general and special physical, artistic, choreographic and compositional, technical and integral training); the number of competitions within the competitive period of the annual training cycle (6 official competitions);
- the same conditions of training sessions; the same group of coaches who conducted the training process with athletes of the control and experimental groups.

The main differences between the experimental programme and the classical one are:

- construction of the training process based on the use of innovative fitness training methods (6-D Sliding, Procecos, EXOS) and their corresponding means within the preparatory and competitive periods;
- correction of the content and volume of training loads of different orientation on the basis of express analysis of the level of physical and technical fitness of gymnasts and sports result;
- planning of composition and choreographic training as a separate type;
- use of innovative technical device of patent equipment "Light platform" within the process of technical training (Kokarev B.V., 2014; Tishchenko V.A., 2014).

The presented results allow us to state that the use of the programme recommended by the Federation of Ukraine on sports aerobics and fitness in the process of training highly qualified gymnasts in aerobic gymnastics, unfortunately, did not contribute to a significant increase in the level of their technical, artistic and choreographic-compositional preparedness by the end of the preparatory period. We can also state that the optimal level of these indicators was not maintained during the competition period. By the way, these conclusions do not contradict the previously conducted studies (Todorova V.H., Briskin Yu., & Perederiy A., Pityn M., 2016; Todorova V.G., 2018; Amri-Dardari A., at al., 2021), but only confirm the fact that the time has come in high-performance sports when a large number of specialists around the world have mastered classical methods. In the context of intensifying competition, it is necessary to rethink approaches to the modern system of training athletes in order to have certain advantages over rivals.

It should be noted that there were significant positive changes in the results of the competitive activity of the gymnasts who participated in the study. At all competitions, they took only prize-winning (1-2) places, which was a better sporting achievement compared to the confirmatory experiment (4-9 places).

Conclusions.

The results of the ascertaining experiment allowed to establish that the use of the classical programme of construction of this process in the educational and training process of highly skilled gymnasts specialising in aerobic gymnastics does not contribute to the significant optimisation of the level of their technical, artistic and choreographic-compositional preparedness. The results obtained in the course of the formative experiment showed that the application of the experimental programme of the training process construction within the annual training cycle for optimisation of technical fitness of highly qualified gymnasts specialising in aerobic gymnastics contributed to the improvement of their technical, artistic, compositional and choreographic fitness in the preparatory period and preservation of the optimal level of these indicators in the competitive period of the annual training cycle.

The presented results testify to the high efficiency of the developed programme of construction of the training process of highly qualified gymnasts in aerobic gymnastics, the application of which contributed to a significant improvement of their technical, artistic and choreographic-compositional preparedness at the end of the preparatory period and preservation of a high level of these indicators during a long competitive period. This gives grounds to recommend the developed experimental programme for practical use in the process of training highly skilled gymnasts in aerobic gymnastics at the stage of maximum realisation of individual capabilities.

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Conflicts of interest.

The author(s) declared no have conflict of interest concerning this work, authorship, and/or publications of this paper.

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