

Transforming women's beach volleyball physical fitness through innovative fitness technologies

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Abstract:

This study focuses on assessing the effectiveness of integrating innovative fitness training methods into the physical training regimen of elite beach volleyball athletes. The aim is to enhance their physical fitness metrics and impact on the result of their competitive activities during performance throughout the sports season. It provides an overview and characteristics of the *Procedos* fitness technique, one of the most modern fitness techniques, which uses modern methods, and the possibility of using it in combination explores its potential in conjunction with other fitness training methods. Also approaches to improve physical fitness levels in women's beach volleyball are presented. The aim of the study was to optimize the physical fitness of highly qualified volleyball players specializing in beach volleyball in the preparatory period of the annual training cycle, based on the use of innovative fitness technologies. During the experimental study, the following methods were used: analysis of Special Scientific and methodological literature; pedagogical observations; pedagogical experiment; control tests; expert assessment; methods of Mathematical Statistics. The results of the study showed that at the end of the 2021 sports season volleyball players had mostly average values of indicators of the level of physical fitness.

Key words: beach volleyball; physical training; fitness technologies; TRX; HIIT; 6D-Sliding; *Procedos*.

Introduction.

The current level of development of high-performance sports puts forward high requirements to the level of athletes' fitness in various sports. Nowadays, it is already considered impossible to achieve high results in any sport without a high level of absolutely all types of athletes' fitness. At the same time, these circumstances force athletes and coaches in team sports to find unusual solutions to training tasks and opportunities to combine them with competitive activities. (Hunchenko, 2018; Boichuk, et al., 2020; Oliinyk, 2021; Brynzak, S., Putrov, S., et al., 2023).

The analysis of literature data on this problem allowed us to establish that a fairly large number of studies have been devoted to the issue of optimizing the physical fitness of athletes in various sports (Hunchenko, 2021; Platonov, 2022; Kokareva, Kokarev, & Doroshenko, 2022; Lisenchuk G., Leleka V., et al., 2023).

According to most experts (and taking into account the most strict control measures by WADA), the main limiting factor for achieving high results in sports and, above all, in the international arena is precisely the level of physical and functional fitness of athletes (Balasas D.G., et al., 2018; Bozzini, Brittany N., et al., 2019; Hrynchenko, Isaiev & Tykhonova, 2019; Platonov, 2022).

Unfortunately, over the past 8-10 years, our athletes in beach volleyball have not achieved impressive results in the Olympic Games, despite the rather high achievements at the World and European Championships. In this regard, the most promising direction in improving the training process, optimizing the functional fitness of athletes in different periods of the annual cycle of sports training is, according to many experts, the development and practical implementation in the training process of highly-qualified athletes of new methods and technologies for building a summer macrocycle that meet the modern requirements of Olympic and professional sports (Engel, et al., 2018; Herzog, Francis & Clarke, 2019; Holtgeerts R.N., et al., 2022; Lisenchuk G., Leleka V., et al., 2023).

Usually, according to V. N. Platonov (2022), this can happen due to the "borrowing" of the so-called "fitness technologies", which radically change the ideas of practical specialists-coaches about the construction of the training process of highly-qualified athletes.

The analysis of research devoted to modern aspects of building physical fitness of athletes in various sports shows that a significant reserve in this issue can be the use of modern fitness technologies borrowed from health training (Kokareva, Doroshenko, Kokarev & Danylchenko, 2021; Chayun, Kletsov, & Manzheley, 2020; Platonov, 2022; Seemann-Sinn, Kwiatkowski, Rüdrieh, & Naundorf, 2022).

However, the results of these studies showed that the use of fitness technologies, methods and means of health-improving training proposed by the authors do not fully contribute to the optimization of the training process and do not always bring the expected effect due to their selective orientation. Most of them were aimed at improving individual components of the overall physical condition and their complex impact on various aspects of athletes' fitness was almost not considered (Novikov, 2018; Shankulov et al., 2020; Kaufmann, et al., 2022; Brynzak, S., Putrov, S., et al., 2023). It is also important to note that the objectivity of assessing the effectiveness of certain means of physical and functional training was insufficient due to the rather small sample of athletes who participated in the studies. This circumstance is difficult to overcome, if we take into account the features of beach volleyball as one of the varieties of Team game sports, the high qualification of athletes and the ability to conduct high-quality training sessions during various restrictions associated with the COVID-19 pandemic (Piatti, et al., 2021; Iermakov, et al., 2022; Orselcik, et al., 2022; Hardiman, Dorsch, & Vierimaa, 2022).

Thus, the development, experimental testing and practical implementation in the training process of athletes of innovative fitness technologies that take into account the nature of competitive activities, age characteristics of volleyball players, specific features of this type of sports games, periods of the annual cycle of sports training aimed at optimizing their physical and functional fitness determine the relevance and practical significance of this problem. This thesis served as the basis for conducting our research.

Hypothesis.

1. The use of innovative fitness technologies in the training process of women's beach volleyball contributes to the effective transformation of athletes' physical fitness, improving their athletic endurance, coordination and increasing the effectiveness of the game.
2. As a result of applying the proposed physical training program based on the use of innovative fitness technologies, individual indicators of physical fitness of players will increase, as a result, this leads to more significant sporting achievements of teams in women's beach volleyball.

Purpose. Optimization of the physical fitness of highly-qualified volleyball players specializing in beach volleyball in the preparatory period of the annual training cycle, based on the use of innovative fitness technologies.

Material and Methods.

Analysis of Special Scientific and methodological literature. The analysis of scientific and methodological literature has shown that modern strength training is a complex pedagogical process that is provided by the functions of various body systems and sections of athletes' training. Of particular importance is the choice of the direction of pedagogical influences and the selection of training tools. However, the orientation of the pedagogical influences of training in the development of physical and functional qualities in Game Sports has not been sufficiently studied. In beach volleyball, this statement is true both at the level of children's and youth sports schools (specialized children's and youth sports schools of the Olympic reserve, schools of higher sports skills) and at the level of elite teams and players. There is practically no scientific and methodological support for Game sports coaches, which reflects the possibility of using the latest fitness technologies to build the process of physical training of athletes.

Pedagogical observations. In our pedagogical observation of the indicators of special physical fitness of qualified athletes in beach volleyball, control exercises were used, the methodological essence and purpose of which are shown in Table 1 (Hunchenko, V. V., 2021).

Table 1. Criteria for assessing the physical fitness of athletes aged 18-19 who specialize in beach volleyball (Hunchenko, V.V., 2021)

Control exercise	Result	Control exercise	Result	Level
Running 30 m from a high start, sec	4.1 or less	Long jump from a standstill, sm	248 or more	High
	4,2 – 4,6		238 – 247	Above average
	4,7 – 5,1		228 – 236	Average
	5,2 – 5,6		218 – 227	Below average
	5.7 or more		217 or less	Low
Running 400 m, min	1.1 or less	Jump up with a run-up push of both legs, sm	64 or more	High
	1,11 – 1,13		58 – 63	Above average
	1,14 – 1,16		52 – 57	Average
	1,17 – 1,19		46 – 51	Below average
	1.20 or more		45 or less	Low
Shuttle run 3 x 10 m, sec	7.0 or less	Pull-ups from the vise on the crossbar, number of repetitions	9 or more	High
	7,1 – 8,1		8	Above average
	8,1 – 7,5		7	Average
	8,6 – 9,0		6	Below average
	9.1 or more		5 or less	Low
Running 92 m ("herringbone"), sec	26.7 or less	Throw a stuffed ball (2 kg) with both hands from behind the head while sitting, sec	610 or more	High
	26,8 – 27,2		570 – 609	Above average
	27,3 – 27,7		530 – 569	Average
	27,8 – 28,2		490 – 529	Below average
	28.3 or more		489 or less	Low

To assess the physical fitness of athletes, we used the following tests:

- the level of speed abilities was assessed using the test "running 30 m from a high Start, sec";
- the level of endurance was assessed using the test "running 400 m, sec";
- to determine the level of dexterity of athletes, the tests "running 92 m ("herringbone"), sec" and "shuttle running 3x10 m, sec" were used;
- the level of speed and power abilities was assessed using the tests "long jump from a standstill, cm", "jump up with a run-up push of both legs, cm";
- the assessment of strength capabilities was carried out using tests that are provided by the training program in beach volleyball, "pull-ups from the vise on the crossbar, the number of times" and "throwing a stuffed ball weighing 2 kg with your hands from behind your head lying down, m". Of the three suggested attempts, the best one was taken into account.

Pedagogical experiment. The experimental part of the study was organized on the basis of Zaporizhzhya National University. The study involved 10 highly qualified athletes (5 women's pairs who make up teams according to the rules of beach volleyball) aged 16-18 years. All athletes had a sports qualification not lower than "candidate for Master of sports".

At the first stage of the experimental study (corresponds to half of the 2021 sports season), the participants of the experiment were engaged in physical training using specially developed complexes of acrobatic exercises using volleyball and stuffed balls weighing 1 kg as weights. TRX training devices (derived from the phrase training Resistance Extender) using the HIIT (High-Intensity Interval Training) method were also widely used. Features of the method of using a training device help to increase the level of speed and strength qualities. At the same time, the increase in muscle mass is insignificant, which is especially valuable for athletes (Girard, Feng, & Chapman, 2018; Hnatchuk, Lynets, Kh. Khimenes, & Pityn, 2018; Platonov, 2022; Kokareva, Kokarev, & Doroshenko, 2022).

At the second stage of the experimental study (corresponding to the preparatory period of the 2022 sports season), the main experiment was conducted, the essence of which was to replace familiar fitness training methods and corresponding exercises and technologies for organizing the training process with new, unfamiliar ones. So, according to its conditions, we used a set of specially designed exercises based on innovative methods inherent in fitness training, namely: 6D-Sliding (fig. 1) and procedures (fig. 2).

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, i.e. "6 directions" or "6 directions". The 6D-Sliding system is actively used in many other sports. The 6D-Sliding concept was specially designed for trainers. In general, the structure of the 6D-Sliding training program may vary depending on the tasks set and the target group. This type of training is widely used in various professional sports clubs from handball, soccer, hockey, tennis, etc. the 6D-Sliding system is aimed at developing stability, balance, strength, endurance, technique and body coordination. It may require serious physical training, but it can be adjusted to suit specific tasks and the level of training: from beginner to professional athlete (Federer & Aagaard, 2016).

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1. Stability. Muscle interaction is trained, both static and dynamic. Basic body stability develops. At the same time, the core muscles are trained, which allows you to get rid of excessive load on the skeleton in everyday life.

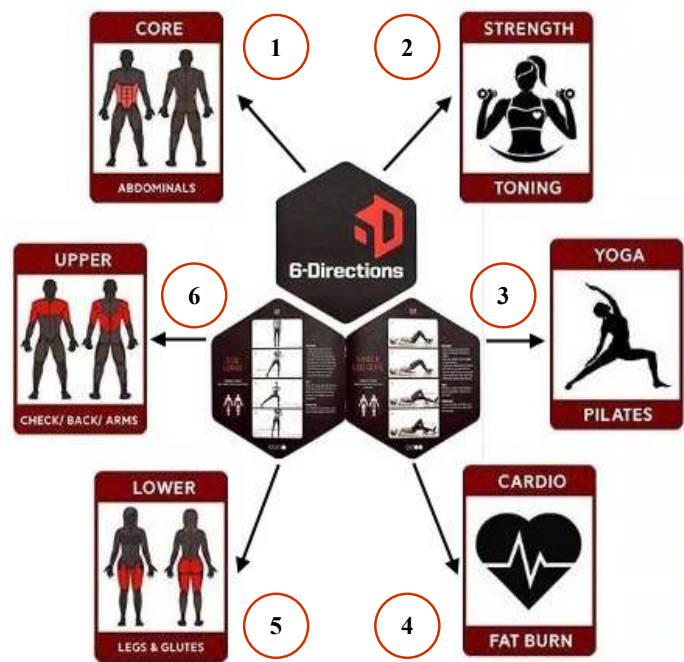


Fig. 1. Concept of using 6D Sliding exercises for physical and functional training of athletes

2. Balance. Static and dynamic balance is improved. When performing sliding exercises, you have to constantly monitor your balance. Balance is extremely important both in sports and in everyday life.
3. Manifestations of power abilities. As the basis for all motor skills, a certain strength in the muscles is necessary both for everyday life and for sports. Due to exercises, strength qualities are increased, in particular, strength endurance.
4. Endurance. Increases endurance in both aerobic and anaerobic ways. In this way, the muscles can work longer without the onset of exhaustion.
5. Technique. Improves the ability to perform exercises correctly and accurately. The better the technique, the more effective the training and competitive activities. Moreover, it increases the safety and effectiveness of training.
6. Coordination abilities. The basic interaction between the nervous system and muscles is improved in many aspects.

In summary, 6D slide training not only enhances stability, balance, power abilities, endurance, technique, and coordination but also promotes muscle interaction and improves the overall safety and effectiveness of training. Building on the success of the 6D-Sliding system, the second part of the experimental study introduced another innovative method known as *Procedos*.

Procedos is a new word in functional fitness. They are a *Procedos* mat measuring 100 by 130 cm, with numbers from 1 to 9, degrees and a ruler around the edges (fig. 2). Based on the different indications of the coach, the student can change the direction of



Fig. 2. Fragment of a workout using the *Procedos* platform

movement within the specified zone (which, not least, is typical for volleyball) of the body position, add turns and movements, 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 "Twister", but with a scientific approach. The special feature of training with the *Procedos* mat is that behind simple, accessible movements lies a scientific approach and knowledge of how muscles and joints should work. Thus, you can try dozens of different exercises and their variations. In Ukraine, this type of training is still only gaining popularity. To methodological features of this article the methods include the following. The warm-up is slower so that participants can explore the platform and remember the approximate location of the coordinates. The main part of training is dozens of options for already familiar exercises. Just the fact that they are performed in unusual conditions immediately gives 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 to form new neural connections. The training session lasts 45-60 minutes

Control tests. The method of control tests (pedagogical testing) was implemented using tests from the curriculum for sports schools of the Olympic reserve, schools of higher sports skills in beach volleyball. It is based on the testing methodology proposed by Hunchenko, V. V. in the dissertation research (2021), taking into account the specifics of beach volleyball. Pedagogical testing was performed at the beginning and end of a sequential pedagogical experiment. Expert assessment. The method of expert assessment is often used in martial arts, complex coordination sports, where it is not possible to obtain objective data on some indicators (for example, technical skills). In this work, the opinion of specialist coaches was sought, focusing on their views regarding the applied means, methods, techniques, and technology of physical training for qualified athletes specializing in beach volleyball. Specialists were given the opportunity to express their opinions orally or in any other informative form. Methods of Mathematical Statistics. Statistical data processing was carried out using the research results processing programs Microsoft Excel "Data Analysis" and SPSS, with the calculation of the following indicators: arithmetic mean (\bar{X}), standard deviation (S), confidence interval (Δx). As well as evaluating the reliability of the results, according to the calculated values of the student's t-criterion, by the average significance level (p). The differences were considered significant at a value equal to $p < 0.05$. the Kolmogorov-Smirnov test was used to estimate the parameters of the score distribution.

Results.

The development of the author's methodology of physical training was carried out on the basis of the program generally accepted for these athletes. It was based on the principles of compliance of the sports training tools included in the program with the age characteristics of volleyball players, continuity and cyclicity of the training process, the gradual increase in load (contributes to improving the performance and mobilization of the functional capabilities of the athletes' body), as well as the principle of similarity of the technique of performing the proposed physical training exercises to the technique of playing elements of beach volleyball. Everything together should comply with the principles of building the training process in the preparatory period, taking into account the specifics of building a holistic training process and future competitive activities (Vanyuk, et al., 2020; Hunchenko, 2021; Platonov, 2022; Kokareva, Doroshenko & Kokarev, 2022).

The main structural elements of this program were specially developed, taking into account the specifics of beach volleyball, acrobatic exercise complexes, 6D-Sliding and procedures, as well as general physical training facilities, presented in the form of complexes (functional classes) of wellness aerobics.

The program of training sessions for volleyball players in the 2021 and 2022 sports seasons had similar and distinctive features. Similar features included the following: training sessions were conducted in the same conditions (game room of the University); the level of competitive activity of volleyball players was the same; training sessions among all volleyball players were conducted by the same coaches; testing of functional and special physical fitness was conducted by one group of researchers in the same conditions.

Distinctive features were:

- use in the 2021 sports season mainly familiar, classic exercises and techniques of fitness training, as well as the corresponding technology for building the training process;
- priority use of 6D-Sliding and Procedos tools in the training process of volleyball players in the 2022 sports season, combined in specially developed sets of exercises, and their corresponding technological approaches to the training process.

Both in the first and second cases, the author's program for planning physical activity training sessions for the preparatory period of the annual training cycle was implemented. As part of the operational and ongoing monitoring of the physical condition of athletes, the capabilities and software of the cardio monitoring system for measuring heart rate (heart rate, bpm) were widely used. In order to experimentally evaluate the effectiveness of the methods proposed by us and the corresponding means of physical training, a study of the level of physical fitness of highly qualified athletes whose specialization is beach volleyball was conducted. Table 2 shows experimental data on the peculiarities of changes in the physical fitness of volleyball players aged 18-19 during the preparatory periods of the annual training cycle, sports seasons 2021 and 2022. The results of the study showed that at the end of the first of the considered (sports season 2021), female athletes were characterized mainly by average values of indicators that characterize the level of their special physical fitness. In addition, the athletes had above-average levels of development of Speed, Special dexterity and leg strength. The level of development "below average" corresponded only to the results of the test for assessing the strength of the hands.

In general, the results of the 1st experimental sports season indicated a rather high, but still insufficient effectiveness of the training process of volleyball players in terms of physical fitness in the preparatory period.

Table 2. Average indicators and level of special physical fitness of beach volleyball athletes before and after the experimental study (n = 10)

Test	Statistical indicators		Δ%	t	p
	At the beginning of the experiment *	At the end of the experiment **			
Running 30m from a high start, sec	4.90±0.19 average	4.40±0.08 above average	10.2	10.57	<0.01
Running 400 m, min	1.14±0.11 average	1.11±0.02 above average	2.6	3.26	>0.05
Shuttle run 3x10 m, sec	7.90±0.22 above average	7.20±0.07 above average	8.8	4.29	<0.01
Running 92 m ("herringbone"), sec	27.70±0.65 average	27.40±0.80 average	1.1	3.56	>0.05
Long jump from a standstill, cm	245.00±7.16 above average	251.00±0.95 high	2.5	8.14	>0.05
Jump up with a run-up push of both legs, cm	55.00±5.32 average	61.00±2.72 above average	10.9	13.75	<0.01
Pull-ups from the vise on the crossbar, number of repetitions	6.00±0.83 below average	7.00±0.34 average	16.6	2.27	<0.001
Throw a stuffed ball (2 kg) with both hands from behind the head while sitting, cm	567.00±7.40 average	592.00±2.94 above average	4.4	3.42	<0.05

Notes: * – corresponds to the end of the preparatory period of the 2021 sports season;

** – corresponds to the end of the preparatory period of the 2022 sports season.

The results of control tests on physical fitness in athletes who took part in the experimental study were observed, in the vast majority, at the "average" level. The results of only 2 Tests corresponded to the "above average" level: "shuttle run 3x10 m, sec" and "long jump from a standstill, cm". This can be explained by the fact that the development of these physical qualities, the manifestation of which is demonstrated by the above-mentioned test tasks, in beach volleyball is given increased attention at all stages of long-term training of athletes, starting from the initial one. That is, highly qualified athletes who claim high places in the world ranking simply have to demonstrate a fairly high level of results in such exercises. By the way, in the test "Pull-Ups from the height on the crossbar, the number of repetitions" we must state the level "below average", which, in contrast to previous tests, is, on the contrary, a non-specific manifestation of strength abilities for volleyball players.

Thus, despite the high sports results of the best pair (A. Khmel / T. Lazarenko) in the biggest starts – 3rd place of the U-19 World Championship and 1st place of the U-21 World Championship in Thailand (Table 3) the General Group results of the studied volleyball players remained mainly at the overall average level. This course of circumstances did not satisfy the management and coaching staff of the Ukrainian national team, who were counting on future high results of performances in the leading tournaments of 2022 (details are available here: <https://www.volleyball.ua/beach-volleyball/>).

Table 3. The best results of the participants of the experiment are shown in international competitions during the 2021-2022 sports seasons

Result	Competitions	Age category	Venue
2021 year			
3rd place	World Championship	U-19	Thailand
1st place	World Championship	U-21	Thailand
3st place	European Championship	U-22	Baden, Austria
Result	Competitions	Age category	Venue
2022 year			
1st place	Beach Pro Tour Futures	Adults (absolute)	Warsaw, Poland
2nd place	Beach Pro Tour	Adults (absolute)	Bialystok, Poland
1st place	European Championship	U-20	Izmir, Turkey
3rd place	European Championship	U-22	Fleissingen, Netherlands

This, in turn, became the basis for the development of the author's program for planning training loads in the next preparatory period of the 2022 sports season. The program incorporated more innovative fitness technologies for building training sessions, addressing specific areas identified during the analysis of the 1st experimental sports season. It should be noted here that at the time of the beginning of the 1st part of the experimental study, the volleyball players who took part in the experiment were 16-18 years old. The data obtained by US largely coincide with the authors of other studies that were conducted on a similar age contingent. But regarding the methods and technology of their application, significant differences were found with almost all the authors (Kokareva, Doroshenko & Kokarev 2017; Vanyuk, et al., 2020; Boichuk, et al., 2020).

After the end of the 2nd part of the experiment, athlete s (on average) showed not only a significant ($p < 0.05$ – $p < 0.001$) increase in more than half of the indicators of control tests for special physical training, but also a qualitative change for the better in the level of physical fitness (Table 2).

As can be seen from the presented data, at the end of the preparatory period of the 2nd experimental season, the studied volleyball players showed significantly higher values of special physical fitness than in the previous season. So, according to the tests "running 30 m from a high Start, sec", "shuttle running 3x10 m, sec", "jump up with a run-up push of both legs, cm", we see a positive increase in the result from 8.8 to 10.9% ($p < 0.01$, the level is "above average"). Slightly more modest is the increase in the test result "throwing a stuffed ball (2 kg) with both hands from behind the head while sitting, cm" (+4.4%, $p < 0.05$). Although in this case, the level of "above average" is shown. And finally, the most significant increase in the result (+16.6%) was observed in the Test "pull-up from the vise on the crossbar, number of times" ($p < 0.001$), which reached the "average" level.

Along with this, there were also results that did not change significantly ($p > 0.05$). Among them, the results of testing speed and speed-power endurance on the tests "running 400 m, min." (+2.6 %, $p > 0.05$) and "running 92 m ("herringbone"), sec" (+1.1 %, $p > 0.05$). And also, a universal test that characterizes the coordination abilities and strength of the muscles of the lower extremities, "long jump from a standstill, cm" (+2.5 %, $p > 0.05$). However, it should be noted that despite this, there were still qualitative changes in most of these indicators, with the exception of the level of speed and power endurance, which remained at the same, "average" level (table 2). So, the values of the first (level "above average") and third ("high level") of the above tests moved to a higher category.

A convincing confirmation of the high degree of effectiveness of the training load planning program developed by us, in our opinion, was the results of the performances of the best pair A. Khmel / T. Lazarenko in the 2022 sports season at the largest international competitions. In addition, Angelina and Tatiana have won the 2020 U18 European Championship titles.

Discussion.

The analysis of scientific and methodological literature on the topic of the research confirms that the effectiveness and growth rate of professional skills of athletes in sports games, in particular, in beach volleyball, depend not only on material, technical and socio-economic factors, but also on the development of methodological approaches to the organization of the training process at various stages of long-term training. This statement is especially relevant for athletes who are at the stage of maximum realization of individual capabilities (Hnatchuk, Lynets, Khimenes & Pityn, 2018; Pérez-Turpin J.A., et al., 2019; Shankulov, et al., 2020; Hunchenko, 2021; Kokareva, Kokarev & Doroshenko, 2022; Kokarev, Kokareva, Putrov, et al., 2023)

There is no doubt that due to the rational form of building the training process at different stages and in different periods of the annual macrocycle, it is possible to guarantee a high level of overall fitness of athletes and their achievement of impressive results in competitions of various ranks. From a large number of possible options for organizing the training process for highly qualified athletes, it is important to choose the most optimal ones, which take into account the rational combination of the volume and intensity of training loads, the relationship between specific and non-specific training tools, and so on.

Our previous experience in training athletes and developing new training process programs that take into account modern achievements of sports science in sports such as sports aerobics, gymnastics, football and handball is a qualitative basis for conducting both current and innovative comprehensive experimental research. In the light of the above, we did not unreasonably consider the analysis and generalization of practical experience in applying innovative fitness technologies in the training process of highly qualified athletes to be a promising direction in solving this problem in women's beach volleyball. But for the implementation of this statement, it is critically important to study the features of changes in key indicators of physical and functional fitness of volleyball players during the annual training cycle under the influence of existing training programs. It is obvious that understanding such general patterns and at each individual stage of the training cycle is a necessary basis for scientifically based correction of the educational and training process in order to maximize sports achievements.

This conclusion harmoniously coincides with the views of certain reputable experts in the field of sports training and the use of modern fitness technologies for training highly qualified athletes (Hrynchenko, Isaiev, & Tykhonova, 2019; Boichuk, Iermakov, et al., 2020; Hunchenko, 2021; Kokareva, Kokarev & Doroshenko, 2022; Pimenov, 2022; Kokarev, Kokareva, Atamaniuk, et al., 2023). They argue that the development of objective modern criteria for monitoring the physical fitness of athletes for participation in high-ranking competitions, based on the study of the dynamics of their general and special physical fitness, contributes to improving the skills of athletes and improving their athletic performance.

However, the analysis of the studied scientific and methodological literature on the studied issues does not allow us to confidently assert that the issues related to the introduction of innovations in the field of Health Fitness in the training process of volleyball players are sufficiently developed. Thus, the presented work has a certain innovative focus. In this regard, we have developed an experimental program of physical and functional training of beach volleyball players, which would take into account the general features and features of each of the proposed innovative methods.

In addition, it was very important to take into account both the average group and individual characteristics of general and special physical fitness of highly qualified athletes.

The program is designed for 2 meso-cycles (7-8 weeks) using the block creation method. A characteristic feature of blocks can be considered the combination in each block of exercises that are inherent in different techniques, but similar to each other structurally. The pilot program was developed on the basis of the classic beach volleyball program, which is recommended by the Ministry of youth and sports of Ukraine. It was based on the goals and objectives of the stage of maximum realization of individual capabilities and the principles of sports training. The program was created taking into account the age characteristics of female athletes, the competition calendar, the initial level of physical fitness and the data of control tests of female athletes at the beginning of the experiment (Hunchenko, V.V., 2021).

The results obtained convincingly indicate that the use of innovative means and methods of fitness training during the physical training of highly qualified athletes in beach volleyball contributed to an increase in the level of their physical fitness in the second part of the experiment. However, the traditional methods of physical training that were used in the first part (corresponding to the first half of the 2021-2022 sports season) also proved to be effective. We believe that this, not least, made it possible to maintain the optimal level of physical fitness indicators of athletes during the second part of the experiment.

It is also important to note that female athletes who participated in the study showed significant positive changes in their athletic performance (Table 3). This success was the best sporting achievement in their sports

career and the best result of the Ukrainian national beach volleyball team in 30 years of independent existence of the Federation (details are available here: <https://www.volleyball.ua/beach-volleyball/>).

The results obtained indicate the high efficiency of the developed physical training program for highly qualified athletes representing women's beach volleyball. The practical application of this program significantly improved their physical fitness at the end of the preparatory period and maintained a high level of the indicators considered during the long competitive period in the first half of 2022. The results give grounds to recommend the developed experimental program for practical use in the training of highly qualified athletes not only in beach volleyball, but also in other game sports. The results obtained allow us to formulate 3 groups of data that arose as a result of an experimental study of the features of physical fitness of highly qualified volleyball players-beachgoers under the influence of the proposed means of modern fitness training.

First of all. The statement of a large number of authors, such as Novikov, (2018), Engel, Ackermann, Chtourou, & Sperlich, (2018), Hrynchenko, Isaiev, & Tykhonova, (2019), Vanyuk, et al., (2020), Hunchenko, (2021), Kokareva, Kokarev & Doroshenko, (2022), Hardiman, Dorsch, & Vierimaa, (2022), Kokarev, Kokareva & Putrov, (2023), Lisenchuk G., Leleka V., et al., (2023) on the need to develop a new content of the educational and training process in sports games, in particular, in beach volleyball at various stages of long-term training.

Second. It is necessary to plan the process with a bias towards the use of the latest technologies for training athletes, based on the latest achievements of sports science and other industrial sectors that provide new opportunities for the growth of achievements. Third. The presented materials prove the need to improve the theoretical, methodological and organizational aspects of training highly qualified athletes (Girard, Feng, & Chapman, 2018; Engel, Ackermann, Chtourou, & Sperlich, 2018; Chayun, Kletsov & Manzheley, 2020; Kokareva, Doroshenko, Kokarev & Danylchenko, 2021; Kokarev, et al., 2023).

Thus, the research offered to the attention of the scientific community opens up a new direction of research in the field of the effectiveness of using innovative fitness techniques, special training devices, and appropriate tools in the training process of highly qualified athletes representing beach volleyball. The results obtained complement previous studies by well-known scientists and indicate the possibility of improving various components of the overall physical fitness of athletes. The proposed study is a system with its own structure, algorithms, mathematical apparatus and extended data on the improvement and features of changes in the level of physical fitness of highly qualified volleyball players at the preparatory stages of the annual macrocycle. These data are based on the results of studying the works of the scientific community related to professional sports, such as Pérez-Turpin J.A., et al., (2019); Vanyuk, et al., (2020), Oliinyk, (2021), Piatti, Turati, Bigoni & Gaddi, (2021), Kaufmann, et al., (2022), Hardiman, Dorsch, & Vierimaa, (2022). This approach gives optimistic hopes for further development of this area of research.

Prospects for further research. Based on the study and analysis of sources of scientific and methodological literature, the state of practical solution of issues of special physical training of highly qualified world-class athletes in various sports, it is considered appropriate to continue scientific research in the direction of developing methods and justifying means for improving the level of physical fitness of athletes. Especially those who represent the national teams of Ukraine in the international arena. In this direction, in our opinion, is the prospect of further scientific research on this topic.

Conclusions.

The proposed system of physical training is based on the use of innovative methods and means of health-improving fitness training, which meets the basic requirements of competitive activities in beach volleyball. The program has successfully passed the stage of testing among qualified athletes representing the national beach volleyball team of Ukraine at all international competitions of the highest rank, including the European Championships and the World Championships of the 2021-2022 sports season.

The use of specially developed and created sets of exercises made it possible to obtain reliable information about the special physical fitness of highly qualified volleyball players during various structural blocks of the educational and training process: micro -, meso- and macrocycle.

In general, the results obtained during the experiment confirmed that the use of innovative methods characteristic of health-improving fitness training in the training process of beach volleyball representatives contributed to a significant improvement in their physical fitness, which in turn had a positive effect on the effectiveness of training. This had a direct impact on the results of competitions, which gives grounds to recommend this program for practical use in the system of sports training of volleyball players at the stage of maintaining the highest sports skills.

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