The ways of improvement special physical training of high-qualified women volleyball players in competitive period of annual macrocycle

Malikova A.N.^{1ABCDE}, Doroshenko E.Yu.^{2ABCDE}, Symonik A.V.^{1ABCDE}, Tsarenko E.V.^{1ABCDE}, Veritov A.I.^{1ABCDE}

¹ Zaporizhzhya National University, Ukraine

² Zaporizhzhya State Medical University, Ukraine

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: to evaluate the influence of creating the program of training process in the competition period of the annual macro cycles on the level of special physical training of women volleyball players.

Material: women volleyball players of high qualification participated in the experiment (n=14, age 20-22 years). An assessment of the level of special physical fitness of volleyball players was conducted. It is used author's program.

Results: features of the functional dependence of the level of general physical preparedness with the separate components of the special physical preparedness of volleyball players are established. The peculiarities of dynamics of indicators of athletes' special physical training in the competition period are determined. The strongest correlation relationship was the level of general physical fitness with: the level of general and hopping endurance; the level of development of jumping; special dexterity; special endurance; speed and strength of hands. As part of corrective modules, the training load of aerobic-anaerobic direction was increased. The main means of compound character training are: complex-coordinated and technical actions in combination with the accuracy of transmission; response to moving object; locking; attacking strikes.

Conclusions: application of the experimental program of training process construction helps to maintain high level of basic indicators of athletes' special physical fitness during the competitive season. The experimental program involved the redistribution of training loads of aerobic and anaerobic-aerobic orientation within the framework of correcting modules.

Keywords: special, physical, preparedness, volleyball, women, competitive period.

Introduction

Volleyball in modern sport firmly occupies one of the leading places in polarity. The achievement of high sports results in volleyball is extremely complex [1, 2]. The team's skill development is aimed at finding new forms of organization of volleyball training [3, 4]. The training of volleyball players is enhanced by the competence of the coaching staff [5, 6]. Particular attention is paid to raising the levels of general physical and special physical, functional, technical and tactical and psychological preparedness [7, 8]. It is proved that insufficient level of special physical fitness of athletes of different specialization does not allow them to be realized at the highest level [9, 10]. In a number of scientific papers, the problem of increasing the skill of teams is determined, which has a direct dependence on the interaction of individual players in the team and on the level of preparedness of each individual athlete [11, 12]. It is also offered a complex of special physical training facilities that corresponds to the technical and tactical actions of athletes [13, 14].

The severely indicated problem is manifested today in women's volleyball. There is an insufficient level of efficiency of training sessions, which should be aimed at increasing the special physical fitness of volleyball players. This significantly reduces the ability of the domestic volleyball players to achieve high sporting results in the international arena [15, 16].

The problem of improving the process of special physical training of volleyball players at the stage of

maximum realization of individual capabilities is devoted to many studies of specialists in the field of sports [5, 17]. The authors established: indicators of body volleyball players' response to standard physical activity [18]; the main causes of injury in volleyball [19].

Today, some authors propose to raise the level of special physical fitness of volleyball players by introducing: combined exercises of anaerobic aerobic orientation [20]; special exercises to enhance exclusively anaerobic abilities of the body [2; 21]; special exercises for the development of speed-strength abilities [22, 23]; special exercises on the development of the main components of special physical fitness [24, 25]. Particular attention deserves attention to the study of the application of specific training targets of specific direction in separate micro- and mesocycles of the training process [6].

At the same time, the question of finding the most effective means of optimizing the special physical fitness of volleyball players is still very relevant today [26-28].

In the opinion of low specialists, the promising direction of the solution of this issue is the development of new programs of training sessions at different periods of the annual training cycle. It takes into account the functional dependence of individual components of special physical fitness of athletes with a general level of physical fitness [6, 29, 30].

Therefore, the development of training programs can be considered as modern approaches to increase the special physical fitness of athletes. Such approaches are a powerful factor in optimizing the training process of volleyball players.

Hypothesis. It is planned to build a program of training sessions in a competitive period that takes into account

functional dependencies: between the level of general physical fitness of athletes and the individual components of their special physical preparedness. It is assumed that the introduction into the training process of volleyball players experimental program of training sessions will significantly optimize the training process.

The purpose of the work is to determine the influence of the experimental program of constructing a training process in the competition period of the annual macrocycle on the level of special physical fitness of volleyball players of high qualification.

Materials and methods

Participants. In research participated high-class volleyball players (n=14, masters of sports, aged 20-22 years old) of volleyball club "Orbita-ZTMK-ZNU" ("Orbita-ZTMK-ZNU", Zaporizhzhya, the super league of the Ukrainian Championship) with.

Organization of research. Testing the level of special fitness training of athletes was conducted at the beginning and end of the competition period of the annual macro cycles of the 2014/15 season (first stage of the experiment) and 2015/2016 (second phase of the experiment).

The results of the first stage of the experiment were used to develop the author's program for constructing the

training process of volleyball players VC "Orbita-ZTMK-ZNU" in the competition period of the next competitive season (Table 1).

The basis of the experimental program consists of the following principles: the compliance of included in the program sports training facilities for age characteristics of volleyball players; continuity and cyclicity of the training process; gradual increase of loads; modular construction of the training process in the competitive period. The program of volleyball training sessions was presented in the form of three competitive (Z-1, Z-2, Z-3) and two corrective (K-1, K-2) modules.

The content of the training sessions within the framework of the competition modules was determined by the calendar of competitions of the Ukrainian volleyball championship (super league). The content of corrective modules was conditioned by: 1) test results after each competitor module; 2) the results of competitive activities of volleyball players in the previous adversary module. Changes in the amount of physical activity (corrective modules) are presented as percentages of the absolute values of physical activity data (previous competition module).

The main structural elements of the proposed program were special-preparatory, special exercises, means of

Table 1. Experimental program of planning training sessions in the competitive period of the annual cycle of training for women's volleyball team of higher qualification

Load volume, means of preparation and mode of operation	Program modules				
	Z-1	K-1	Z-2	K-2	Z-3
General developing exercises, hours	5,5	-1,3	5,85	-0,6	6,0
Exercises on stretching of muscles, acrobatics, hours	5,7	-1,6	6,75	-3,4	7,0
Aerobics (special coordination, mixed mode of heart rate 140-170 beats per minute ⁻¹), hours	2,0	0	0	+4,5	0
Volume of background running (uniform running, crosses, aerobic mode, heart rate 130-150 beats per minute ⁻¹), hours	0	+6,7	0	+3,4	0
The volume of special running combined with the elements of the game technique (mixed mode, heart rate 145-185 beats per minute ⁻¹), hours	2,8	+2,1	2,9	-0,3	2,0
Athleticism: special power and speed training (mixed mode, heart rate 145-185 beats per minute ⁻¹), hours	1,5	+0,8	1,5	0	2,0
Swimming, relay-race and water games (aerobic mode, heart rate 130-160 beats per minute ⁻¹), hours	1,0	+1,7	0	+4,5	2,0
Volume of technical training: feeding, transmission, attacking strokes, blocking (mixed mode, heart rate 135-170 beats per minute ⁻¹), hours	4,12	+6,5	9,0	0	6,0
Tactical training: individual, group, team (heart rate 135-165 beats per minute ⁻¹), hours	10,38	-3,6	10,0	+3	10,0
Volume of integral preparation (mixed mode, heart rate 150-190 beats per minute ⁻¹), hours	17,0	+2,8	18,5	-2,8	24,0
The amount of gaming training (mixed mode, heart rate 150-190 beats per minute ⁻¹), hours	10,0	-13,1	10,5	-6,8	10,0
Testing training	1,0	0	1,0	0	1,0

Note: Z – Competitive module; K – corrective module. Corrective module graphs show data on changes in the volume of relevant loads (in percentages) from their absolute values in the previous adversary module.

general physical training.

To assess the development of special physical qualities of volleyball players, it was used a set of informative tests [7, 15]. All volleyball players registered the following indicators of special physical fitness: jumping (jump up from place, cm); speed (test 9-3-6-3-9 m. – numbers indicate the distance to run on the volleyball court, c); jump stamina (number of ball losses); high-speed endurance (running 92 m “herringbone”, c); general endurance (exercises in attacking impact from zones 2/4, c); special acrobatic endurance (c); mobility in the shoulder joints (conditional units, c.u.); leg force (number of squats for 20 s); the strength of the muscles of the hands (a drop of a scored ball weighing 1 kg, m); muscle strength of the abdominal press and back (the number of torso lifts from the position lying on the back for 10 s).

It was also determined the level of general physical fitness [31]. The algorithm of the survey assumed: the implementation of the standard submaximal veloergometric test PWC170, measuring the length (cm) and weight (kg) of the body of athletes. It was carried out an automatic calculation of the absolute and relative importance of total physical capacity, absolute and relative value of aerobic capacity. Calculated quantitative values of the following indicators were determined: alactated and lactate power and capacity; anaerobic exchange threshold; heart rate at the threshold of anaerobic metabolism; total metabolic capacity; backup capabilities; the efficiency of the energy supply system for muscle activity.

Statistical analysis. Statistical processing of the research results was carried out using packages of

standard programs “STATISTICA 7.0” and Excel with the calculation of the following indicators: arithmetic mean ($\bar{x}$), mean square deviation (σ), error arithmetic mean (S). It was also used correlation analysis.

Results.

The results obtained at the first stage of the experiment indicated that during the competitive season there was a characteristic gradual deterioration of the special physical fitness of volleyball players (Table 2).

It was established the following: at the end of the competition period there was a significant deterioration in overall and jump resistance ($28,55 \pm 1,60\%$ and $50,70 \pm 1,69\%$ respectively), jump ($10,0 \pm 1,32\%$), strength feet ($11,9 \pm 1,41\%$), hands ($11,2 \pm 1,77\%$), muscles of the abdominal press and back ($17,5 \pm 1,18\%$).

By the end of the season there was a significant deterioration of the high-speed endurance volleyball players ($4,75 \pm 1,30\%$), speed ($5,92 \pm 1,17\%$), special agility ($2,40 \pm 1,46\%$) and mobility of shoulder joints ($7,16 \pm 1,38\%$).

It should also be noted that negative qualitative changes in these indicators, which were already considered as mostly average.

In order to determine the reasons for these changes, we conducted an analysis of the correlation of the indicators of special physical fitness of volleyball players with their level of general physical fitness (Table 3).

During the competitive season, the strongest correlation between the level of general physical fitness (LGPF) with: the level of general and hopping endurance;

Table 2. Indicators of special physical preparedness of high qualification volleyball players at the beginning and end of the first stage of the experiment ($\bar{x} \pm S$)

Indicators	Beginning	Ending	$\Delta\%$
General endurance (sec)	103,92 $\pm$ 2,21 above average	133,58 $\pm$ 2,74*** average	28,55 $\pm$ 1,60
Hopping endurance (amount of losses)	5,92 $\pm$ 0,40 above average	8,92 $\pm$ 0,54*** average	50,70 $\pm$ 1,69
Speed endurance (sec)	24,76 $\pm$ 0,21 above average	25,93 $\pm$ 0,17*** average	4,75 $\pm$ 1,30
Jumping ability (cm)	60,83 $\pm$ 0,84 above average	54,75 $\pm$ 0,73*** average	-10,0 $\pm$ 1,32
Speed (sec)	8,45 $\pm$ 0,14 above average	8,95 $\pm$ 0,08** average	5,92 $\pm$ 1,17
Special dexterity (sec)	3,38 $\pm$ 0,02 above average	3,46 $\pm$ 0,02* below average	2,40 $\pm$ 1,46
Mobility of the shoulder joints (conventional units)	1,61 $\pm$ 0,04 average	1,72 $\pm$ 0,04 average	7,16 $\pm$ 1,38
Strength of legs (number of times for 20 sec)	17,50 $\pm$ 0,45 above average	15,42 $\pm$ 0,45** average	-11,9 $\pm$ 1,41
Strength of hands (m)	17,08 $\pm$ 0,45 average	15,17 $\pm$ 0,66* average	-11,2 $\pm$ 1,77
Strength of press and back (number of times for 10 sec)	6,67 $\pm$ 0,50 above average	5,50 $\pm$ 0,31 average	-17,5 $\pm$ 1,18

Note: * - $p < 0,05$; ** - $p < 0,01$; *** - $p < 0,001$ compared to the values of the indicators at the beginning of the experiment.

Table 3. Coefficients of correlation between the level of general physical fitness and indicators of special physical fitness in volleyball players at the beginning of the first stage of the experiment ($\bar{x} \pm S$)

Correlation pairs	Beginning	Ending
Level of general physical training – General endurance	0,69±0,17* (2,86)	0,63±0,20* (2,43)
Level of general physical training – Hopping endurance	0,67±0,18* (2,71)	0,62±0,21* (2,37)
Level of general physical training – Force endurance	0,61±0,21* (2,31)	0,61±0,21* (2,31)
Level of general physical training – Jumping ability	0,64±0,2* (2,50)	0,61±0,21* (2,31)
Level of general physical training – Speed	0,61±0,21* (2,31)	0,57±0,23 (2,08)
Level of general physical training – Special dexterity	0,63±0,2* (2,43)	0,59±0,22 (2,19)
Level of general physical training – Mobility of the shoulder joints	0,55±0,23 (1,98)	0,41±0,28 (1,35)
Level of general physical training – Strength of legs	0,59±0,22 (2,19)	0,55±0,23 (1,98)
Level of general physical training – Strength of hands	0,61±0,21* (2,31)	0,62±0,21* (2,37)
Level of general physical training – Strength of press and back	0,42±0,27 (1,39)	0,34±0,29 (1,08)

Note: * - the true values of the correlation coefficients.

the level of development of jumping; special dexterity; special endurance; speed and strength of hands.

At the second stage of the experiment, an analysis of the peculiarities of the dynamics of the level of special physical fitness of volleyball players in the competitive period of 2015/2016 was conducted. This made it possible to evaluate the effectiveness of the developed training programs.

At the end of the experiment there was observed among the athletes a significant decrease in only their overall endurance (by 11,09±1,15%), high-speed endurance (by 2,11±1,38%) and special agility (by 1,56±1,52%) (Table 4).

Changes in the remaining indicators of special physical training of volleyball players in the experimental group were insignificant and unreliable.

After the completion of the second stage of the experiment, there were no qualitative changes in the indicators of the special physical training of volleyball players (with the exception of the level of hopping endurance).

Discussion.

The analysis of special physical training of volleyball players showed a gradual deterioration of the indicators of their special physical training to the end of the competitive season. This fact coincides with the research data of other authors [3, 17, 24].

It is known that special physical training increases the functionality of the body. As a result, there is an improvement in the mobile qualities of volleyball players

needed to improve sports results. The studies of a number of authors [8, 22] determined that the study of the features of this relationship can be the basis for the compilation of an optimal program of training sessions. This is important for the various stages of the annual cycle of training (especially during the competition period).

This conceptual position was confirmed by our research. This gave an opportunity to substantiate the need for further improvement of the level of special physical fitness of athletes. At the basis of the experimental program of creating a training process were taken into account functional dependencies of the level of general physical preparedness of volleyball players with separate components of their special physical fitness. The developed program of constructing a training process in a competitive period is based on the modular principle. The program provides for the redistribution of the training load volumes of aerobic and aerobic-anaerobic orientation within the framework of corrective modules.

We conducted a correlation analysis of the relationship of indicators of the level of general physical fitness with indicators of special physical fitness. This allowed to identify the main emphasis on changes in volumes of special physical training.

As part of corrective modules, the training load of aerobic-anaerobic direction was increased, which was performed at heart rate (HR) 145-180 beats per minute⁻¹. The main means of training mixed nature are the following: complex-coordinated and technical actions in combination with the accuracy of transmission; response to moving object; technical blocking; attacking strikes.

Table 4. Indicators of special physical fitness of volleyball players at the beginning and end of the second stage of the experiment ($\bar{x} \pm S$)

Indicators	Beginning	Ending	$\Delta\%$
General endurance (sec)	108,17 $\pm$ 3,17 above average	120,17 $\pm$ 1,8*** above average	11,09 $\pm$ 1,15
Hopping endurance (amount of losses)	6,17 $\pm$ 0,53 above average	7,08 $\pm$ 0,36 average	14,81 $\pm$ 1,21
Force endurance (sec)	24,93 $\pm$ 0,15 average	25,46 $\pm$ 0,14** average	2,11 $\pm$ 1,38
Jumping ability (cm)	59,92 $\pm$ 1,07 above average	57,92 $\pm$ 0,71 above average	-3,33 $\pm$ 1,2
Speed (sec)	8,64 $\pm$ 0,12 average	8,58 $\pm$ 0,05 average	-0,71 $\pm$ 1,08
Special dexterity (sec)	3,41 $\pm$ 0,02 average	3,47 $\pm$ 0,02* average	1,56 $\pm$ 1,52
Mobility of the shoulder joints conditional units	1,67 $\pm$ 0,03 average	1,70 $\pm$ 0,02 average	1,74 $\pm$ 1,28
Strength of legs (number of times for 20 sec)	16,75 $\pm$ 0,46 average	16,67 $\pm$ 0,28 average	-0,48 $\pm$ 1,17
Strength of hands (number of times for 10 sec)	16,25 $\pm$ 0,35 average	16,67 $\pm$ 0,31 average	2,56 $\pm$ 1,33
Strength of press and back (number of times for 10 sec)	6,75 $\pm$ 0,41 above average	6,75 $\pm$ 0,25 above average	0 $\pm$ 1,17

Note: * - $p < 0,05$; ** - $p < 0,01$; *** - $p < 0,001$ compared with the beginning of the second stage of the experiment.

Volleyball is characterized by a complex manifestation of speed in gaming situations that are continuously changing. It requires: the manifestation of the reaction with the choice and reaction to a moving ball; performance of repeated start accelerations during blocking or strikes during an attack; performance of technical and gaming interactions with partners at the fastest pace [3, 26]. Therefore, the volume of special running training combined with the elements of the game technology was increased. The hours of integral training were also increased, which enabled the athletes to increase their speed. To improve the special speed, it was recommended to use repeated, interval and competitive training methods.

Execution of technical techniques in volleyball is characterized by the manifestation of power qualities. This refers to the explosive force that manifests itself in the special jump. The training program envisaged an increase in the amount of exercise that was aimed at improving the special force and speed-power abilities. The main means have become various jumps, few jumps one by one, jump to a height (50-70 cm), jumps through barriers, exercises with encumbrance. The obtained experimental data confirm the research of specialists on improving the special physical fitness of volleyball players: the use of special exercises (anaerobic regimen at heart rate of 190-200 beats per minute⁻¹, maximal tempo) with the manifestation of significant muscle tensions in the minimum time [2, 22, 24].

In the framework of the pilot program, an increase in the amount of running training (uniform running, cross), swimming (aerobic regimen – heart rate 130-150 beats

per minute⁻¹) was envisaged, use of exercises for special coordination (aerobic-anaerobic regimen – heart rate 140-170 beats per minute⁻¹. Our data supplements the information of other researchers [20] that an integrated approach is needed to improve the special physical fitness of volleyball players, which combines aerobic and mixed-action exercises.

Confirmation of the correctness of our positions regarding the content and directions of special physical training of volleyball players is shown in the work of V.M. Kostiukevich [6] and studies by other authors [9, 16, 32]. The results of our study supplement the information of authors [7, 10, 32] on modern approaches to optimize the level of special physical fitness of volleyball players.

The results of the conducted research indicate a significant increase in the effectiveness of the training process of volleyball players. Confirmation of this was a successful statement by VC “Orbita-ZTMK-ZNU” in the competitive season of 2015/2016 (silver medals of the Ukrainian Championship).

The results of our study as a whole coincide with the data of the above studies. It should be noted, however, that the importance of optimizing the level of special physical training of volleyball players is to determine the general orientation of the training process and the specific volume of physical activity of different orientations.

Conclusions.

It is confirmed that maintaining a high level of special physical fitness of volleyball players in a competitive season for a long time is necessary to achieve high sports

results.

It was established that the introduction into the training process of volleyball players of high qualification of the experimental program in the competition period requires the emphasis on the exercises of anaerobic and aerobic-anaerobic orientation. This contributes to the significant optimization of the level of special physical fitness of volleyball players.

Financing

The research was performed according to the topic: "Studying the adaptive possibilities of the athlete's body at different stages of the training process" (2011-2015) (state registration number 0110U000683).

Conflict of interest.

The authors state that there is no conflict of interest.

References

1. Furmanov AG. *Training of volleyball players*. Minsk: MET; 2007. (in Russian)
2. Marian CA. Functional training in maintaining the physical preparation volleyball player. *Science, Movement and Health*, 2016; 16: 370-376.
3. Dombachojnbol Kh. Increase the effectiveness of educational and training work of high qualification volleyball players by means of special physical training (on the example of the national team of Mongolia). Cand. Diss. Ulan-Ude; 2004. (in Russian)
4. Boichuk R, Iermakov S, Nosko M, Kovtsun V. Special aspects of female volleyball players' coordination training at the stage of specialized preparation/ *Phys Educ Sport*, 2017;17(2):884 - 891. doi:10.7752/jpes.2017.02135
5. Kozina ZhL. *System of individualization of training athletes in game sports*. Lambret Academic Publishing Russia; 2011. (in Russian)
6. Kostiukevich V, Shchepotina N. Model training tasks as a tool for building the training process for team sports athletes. *Nauka v olimpijskom sporte*. 2016;2:24-31. (in Russian)
7. Legon'kov SV. *Physical training in the system of volleyball sports training*. Smolensk; 2003. (in Russian)
8. Maslov VA. *Special power training of qualified volleyball players in the system of improving their technical skills*. Cand. Diss. Moscow; 2003. (in Russian)
9. Platonov VN. *The system of training athletes in the Olympic sport*. Kiev: Olympic Literature; 2004. (in Russian)
10. Bompa TO, Haff GG. *Periodization: Theory and methodology of training*. Champaign, IL, USA: Human Kinetics; 2009.
11. Kkoblikova TV, Bulatova EN. The technology of individualization of the process of training volleyball players and its implementation. *VII International Scientific and Practical Conference "A New Word in Science: Prospects of Development"*. Чебоксары: ЦНС «Интерактив плюс»; 2016;1 (7):305-307. (in Russian)
12. Shipulin GIa. *The analysis of competitions of highly skilled volleyball players as a basis of construction of the competitive-training activity in classical volleyball*. Cand. Diss. Moscow; 2002. (in Russian)
13. Bogush V, Getmantse V, Sokol O, Reznichenko O, Kuvaldina O, Yatsunskiy Y. Perfection of the special preparation of volleyball players. *Slobozhanskyi herald of science and sport*. 2015;1:19-22.
14. Boichuk R, Iermakov S, Nosko M, Kovtsun V, Nosko Y. Influence of motor coordination indicators on efficiency of game activity of volleyball players at the stage of specialized basic training. *Journal of Physical Education and Sport*, 2017;17(4):2632 - 2637. doi:10.7752/jpes.2017.04301
15. Beliaev AB, Bulykina LV. *Volleyball: theory and technique of training*. Moscow: Physical Culture and Sport; 2007. (in Russian)
16. Augustsson RS, Augustsson J, Thomee R, Svantesson U. Injuries and preventive actions in elite Swedish volleyball. *Scand J Med Sci Sports*. 2006; 16:433-440.
17. Stankiewicz B. Status, problems and future directions of research in volleyball. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2013; 17(12): 77-81. doi:10.6084/m9.figshare.880631
18. Popel' S L, Tsap IG, Yatsiv Ya N, Lapkovsky E Yi, Synitsya AV, Pyatnichuk DV. Special aspects of hemo-dynamic and reaction of erythrocytes in blood to standard physical load of different qualification female volleyball players. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2017; 21(5): 251-259. doi:10.15561/18189172.2017.0508
19. Kovalchuk VYa. Traumatism in training process of students - volleyball players. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2017; 21(1): 31-35. doi:10.15561/18189172.2017.0105
20. Okano K, Tanigawa S, Naitoh H, Okumoto T. Effects of complex training on jump height, muscle strength and power in university male volleyball players. *Journal of Volleyball Sciences*, 2015;17:12-18.
21. Boichuk R, Iermakov S, Nosko M. Pedagogical conditions of motor training of junior volleyball players during the initial stage. *J Phys Educ Sport*, 2017;17(1):327-334. doi:10.7752/jpes.2017.01048
22. Pereira A, Aldo M, Costab C, Santos P, Figueiredo A T, João PV. Training strategy of explosive strength in young female volleyball players. *Medicina*. 2015;51(2):126-131.
23. Verhagen E, Van der Beek A, Bouter LM, Barh RM, Van Mechlen W. A one season prospective cohort study of volleyball injuries. *Br J Sports Med*. 2004;38:477-481.
24. Marques MC, Van den Tillaar R, Gabbett T, Reis VM, González-Badillo JJ. Physical fitness qualities of professional volleyball players: determination of positional differences. *J. Strength Cond. Res.*, 2009; 23: 1106-1111.
25. Reeser JC, Verhagen E, Briner WW, Askeland TI, Bahr R. Strategies for the prevention of volleyball related injuries. *Br. J. Sports Med*. 2006;40:594-600.
26. Avramova NV. *Increase of sports skill of the qualified volleyball players of 15-17 years on the basis of programming and correction of leading techniques*. Cand. Diss. Naberezhnye Chelny; 2013. (in Russian)
27. Vertel' AV, Frolova OA. Pedagogical testing as one of the types of control and perfection of training athletes of volleyball players. *Visnik Visnik Chernigivs'kogo nacional'nogo pedagogichnogo universitetu*, 2016;112 (4):53 - 56. (in Russian)
28. Dopsaj M, Nešić G, Čopić N. The multicentroid position of the anthropomorphological profile of female volleyball players at different competitive levels. *Facta Universitatis. Series: Physical Education and Sport*, 2010;8(1):47-57.
29. Klevcov VA, Popova RF. *Techniques for playing volleyball*. Belgorod: IPT "POLITTERA"; 2005. (in Russian)
30. Kozina ZhL. Analysis and generalization of the results of the practical implementation of the concept of an individual approach in the training process in sports games. *Fizicheskoe vospitanie studentov tvorcheskikh special'nostej*, 2009;2:34-47. (in Russian)
31. Malikov MV, Svat'iev AV. *Functional diagnostics in physical education and sports*. Zaporozhye: ZNU; 2006. (in Ukrainian)
32. Platonov VA. *Modeling of volleyball training*. Kiev: Health; 1998. (in Russian)

Information about the authors:

Malikova A.N. (Corresponding author); <http://orcid.org/0000-0002-7754-1089>; anmaliq@gmail.com; Zaporizhzhya National University; Zhukovsky str. 66, Zaporizhzhya, 69000, Ukraine.

Doroshenko E. Yu.; <http://orcid.org/0000-0002-3299-2548>; doroshenko.e.yu@gmail.com; Zaporizhzhya State Medical University; Mayakovsky avenue, 26, Zaporizhzhya, 69000, Ukraine.

Symonik A. V.; <http://orcid.org/0000-0001-8574-8744>; 020190@ukr.net; Zaporizhzhya National University; Zhukovsky str. 66, Zaporizhzhya, 69000, Ukraine.

Tsarenko E. V.; <http://orcid.org/0000-0002-9228-8093>; tsarenko.fkis@gmail.com; Zaporizhzhya National University; Zhukovsky str. 66, Zaporizhzhya, 69000, Ukraine.

Veritov A. I.; <http://orcid.org/0000-0002-6069-3684>; averitov@gmail.com; Zaporizhzhya National University; Zhukovsky str. 66, Zaporizhzhya, 69000, Ukraine.

Cite this article as: Malikova AN, Doroshenko EYu, Symonik AV, Tsarenko EV, Veritov AI. The ways of improvement special physical training of high-qualified women volleyball players in competitive period of annual macrocycle *Physical education of students*, 2018;22(1):38–44. doi:10.15561/20755279.2018.0106

The electronic version of this article is the complete one and can be found online at: <http://www.sportedu.org.ua/index.php/PES/issue/archive>

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (<http://creativecommons.org/licenses/by/4.0/deed.en>).

Received: 25.11.2017

Accepted: 12.12.2017; Published: 27.02.2018