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Original Article

Efficiency of special training devices for forming technical skills in female student volleyball players

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Abstract:
The article is devoted to the problem of the formation of the volleyball technical elements using special devices. The author's technology was based on a differentiated approach according to the levels of physical and technical preparedness of female volleyball players during academic year. There was proved, developed and tested the efficiency of the author's technology of forming the techniques of volleyball trainer using special devices. It enabled to increase the level of technical and physical fitness of female volleyball players. The structure of the distribution volume and intensity of training loads for volleyball players, with different levels of physical fitness to improve their technical training during the game in attack and defense. Differentiated approach and training devices could be used at physical education colleges, boosting interest in the exercise and for effective learning and improving the techniques in the training process. There were determined significant increases of technical preparedness: the accuracy of the top direct serve significantly increased ($p < 0,001$), which allowed the players to complicate the organization of receiving the ball for further attack. The highest amount of winning points achieved by a spiking attack at the 2nd and 4th zones – 44%; from the 6th zone – 22 %; from the 3rd zone – 18 %. The volleyball players in the experimental group performed more receptions without errors – 68%, while the students of the control group – 36% ($p < 0.01$. The efficiency of the blocking in the experimental group is 82 % (the amount of won balls from the block was taken into account), while the students of the control group – 43% ($p < 0.001$).
Key words: physical education, student, volleyball, fitness devices, physical fitness, technical readiness, a differentiated approach.

Introduction

One of the priority directions for the formation and strengthening of the nation's health is the physical education of students. The level of students' physical fitness at higher educational institutions principally depends on the direction of the educational process. Besides, this level determines the structure, content, methods and means of implementation and control of educational process (Drachuk, 2018; Onyshchuk, 2017)

According to the scientific researches (Galan, 2017; Onyshchuk, 2017) the main problem of the physical state of youth is a significant increase in the intensity of the educational process and the academic loading. As a result, by the moment of graduance from the university the deterioration of the state of students' health degrades so that efficiency of their future professional activities also worsens. The educational process at higher educational institution has certain features connected with the chronic, emotional and intellectual stress which is accompanied by the motor activity deficit. Due to this fact, the process of students' adaptation becomes slow. Moreover, sometimes it may cause neuropsychiatric breakdowns and various disorders of the cardiovascular system.

It should be mentioned that positive effect in strengthening health is provided by systematic use of the motor activity (Bohuslavska, 2017; Gorshova, 2017; Kropta, 2017). It is known that systematic motor activity of students at higher education institutions is obligatory and provided with compulsory physical education classes. According to the relevant legislation and regulations, such classes must take place twice a week. However, such amount of classes, even with optimal parameters, does not allow to achieve the necessary effect. Thus, there is a need for additional motor activity during extracurricular time (Briskin 2016; Gorshova).

It should be mentioned that the majority of modern publications (Gavrylova, 2017; Hruzevych,2017;

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Sulyma, 2017) is devoted to the particular aspects of organizing and conducting extracurricular forms of studies for students at higher educational institutions, which are aimed at increasing their psychophysical skills. Moreover, in those researches there were recommended various ways of increasing of physical education classes. In particular, there was considered the implementation of pedagogical innovations in extracurricular classes based on the use of elements in various sports.

From this point of view, some scientists confirm that volleyball takes a special place because of enthusiasm and students' active participation in volleyball matches (Hnatchuk, 2018, Kostiukevych, 2017; 2018). It is considered as an important mean not only for physical education and improvement of physical skills, but also for mental development. Thus, it enables people to realize their potential in an active lifestyle and achievement of high sports results.

One of peculiarities of extracurricular university classes is the fact that female students with different levels of physical and technical preparedness attend volleyball classes. As a result, such differences have negative influence on the efficiency of the training process and the team's ability to participate in competitions.

In the recent scientific works (Kostykevich, 2018; Kovalchuk, 2017; Kuts, 2014) there was proven the positive effect of the use of special training devices during studying technical elements in various sports such as basketball, volleyball, football. It suggests an opportunity to use an individual approach to female students in physical education process. However, the amount of such devices in volleyball is limited. Besides, the methodology of their use is absent, which determines the relevance of our research.

The aim of the research was to work out a technology for forming the elements of volleyball game (special training devices) in the physical education of female students to improve their technical preparedness.

Research methods

To accomplish the tasks, we have used the analysis and synthesis of scientific and methodological literature; sociological research; pedagogical observation, pedagogical experiment, pedagogical testing; medical and biological methods; method of physical health assessment by G. L. Apanasenko; determination of workability on a cycling machine according to the method of V. L. Karpman (veloergometric test); psychodiagnostics by G. Eysenko's method; methods of mathematical statistics.

Organization of research

There was made a range of anthropometric measurements aimed at determining the physical development of female volleyball students such as length and weight of the body, chest circumference, length of arms and legs. For the evaluation of the cardiovascular system there were used indices of heart rate during rest, blood pressure (systolic and diastolic), within respiratory system – indices of vital capacity of the lungs. There were also used express-estimation of the level of somatic health (it was carried out in accordance with the method of G. L. Apanasenko), physical fitness on a cycling-machine (according to the method of V. L. Karpman).

The pedagogical testing was conducted with the purpose of assessing the physical and technical preparedness of female volleyball students in accordance with the "Volleyball Training Program of the Glukhiv National Pedagogical University of O. Dovzhenko". An expert evaluation was used to determine the peculiarities of technical training and to identify the ways of forming the technical elements of the game. The mathematical and statistical processing of the actual material was conducted for interpretation the results of pedagogical experiments using the PC (the Microsoft Word, SPSS, STATISTICA 6.0 applications in the Windows 7 operating system).The research was conducted in few stages. Before the beginning of the pedagogical experiment there was hold a questionnaire survey of the first-year female students of different faculties (61 students at the age from 17 to 19 years old), who would like to participate in volleyball. The aim of the second questionnaire was to define the opinions of volleyball specialists regarding the application of effective devices and methods of volleyball technical training during the university classes.

Within the pedagogical experiment, using standard tests by the random sample method there were formed two groups: control (CG) and experimental (EG) which included 31 and 30 persons respectively.

According to the level of technical preparedness the students in the EG were divided into three groups: the level below the average (9 persons), average (14 persons) and above average (7 persons). Special means and methods were selected for the forming of technical elements within each group.

The basis of the experimental methodology for the formation of technical elements in volleyball with the use of special devices included three interrelated sections:

- differentiated methods for increasing the special physical fitness in the training process using the developed special complexes of physical exercises with the definition of volume and intensity of physical activity (number of repetitions, series of performances, intervals of rest);
- differentiated method of forming technical elements taking into account the individual characteristics of female students;

• the use of training devices for the formation and improvement of technical preparedness: to improve the reception of the ball with two hands from above; workout for accuracy of ball reception; attack spike; single or group blocking. Statistical processing of special physical and technical preparedness of female students allowed to develop a special scale for determining the levels of preparedness: below average, average and above average.

Results

The analysis of the female students' indices of heart rate and vital capacity of the lungs correspond to the norm (heart rate – 77,5 ± 0,38 beats per minute, vital capacity – 2710 ± 0,51 cm^3). Besides, the analysis of the initial indices by G. L. Apanasenko's method did not reveal the female students with a high level of somatic health. At the same time, there were 18 % female students with a low level and 30 % female students – with the level below the average. Moreover, there were 37 % female students with the average level and 15% – with the level higher than the average. Thus, there was a need to find effective ways, forms, means and methods for improving the health of student youth.

The study was conducted in two stages. Within autumn period of study and at the end of the academic year there was determined the level of physical fitness during the season (Table 1). Particularly, at the beginning of the autumn period of study the female students performed three stages of the veloergometric test (loading had been increased to refusal) by the method PWC_{170} by V. L. Karpman (1988). However, this test has been modified by A. V. Magliovanyy (1997). Thus, the indices of physical fitness received by the test WC_{170} demonstrated (Table 1) that within autumn period of training female students had a slightly lower level of physical capacity, which was 11.9 ± 1.41 kgm · min · kg^{-1} and tended to little changes during spring period of training – up to 13,5 ± 0,27 kgm · min · kg-1 (p> 0,05).

Table 1.Indices of physical fitness of female students during various periods of the academic year, n=61 ($\bar{x} \pm \delta$)

Indices of physical fitness	Autumn period of study	Spring period of study
Capacity within the heart rate 170 kgm · min^{-1}	657,4 ± 22,3	669,9 ± 17,1
Capacity within the heart rate 170 kgm · min · kg^{-1}	11,9 ±1,41	13,5 ± 0,27*
Amount of work by the heart rate 170 beats · min^{-1}, kgm	4228,5 ± 49,3	4656,8 ± 66,7
Amount of work "by refusal", kgm	5071,1 ± 120,5	4842,3 ± 74,8*
The ratio between the amounts of work, conventional units	820,9 ± 37,3*	488,9 ± 32,2*

Note: * – the probability of difference is significant at the level p < 0,05.

The level of physical fitness of female students-volleyball players mainly increased from the beginning to the end of the academic year, but the received differences were inconceivable (p> 0.05). The next stage of our research was aimed at determination of the ways for improvement the technical training of student volleyball teams. For this purpose, we have conducted an expert assessment involving 18 coaches of national volleyball teams. On their opinion, there are 15 factors that influence on the technical preparedness of the volleyball student players. Their significance was also determined by the expert assessment. The experts had to fill out a questionnaire which included technical elements with appropriate scale with average arithmetic estimates. The respondents highlighted the most significant technical elements of the game which affect the team's efficiency. Among them: ball serve, ball reception and transfer, attack spike, blocking. The established low level of technical and physical preparedness of female students encouraged us to develop a differentiated approach to the formation of the technical elements of the game to improve their skills. The results of the average data on sigma deviations gave us the opportunity to compose three groups of students with different levels of technical preparedness (average, below average and above the average level). Thus, the results of the evaluation of their technical preparedness showed that for the average level, the initial students' results were estimated from 4 to 5 points out of 10 attempts; for the lower than average level – from 3 and less points; for the higher average level – from 6 and more points. There were also used the same tests, but there were given 5 attempts (the estimation scale was the same). An important element of the experimental technology was the use of simulators: 1) a simulator for reception of the ball with two hands from above; 2) a simulator for training the accuracy of ball reception; 3) a simulator for the spike training; 4) a simulator for single or group blocking, 5) jumping expander.

To improve the upper and lower receptions by two hands there was used a special device. It consisted of four nylon (metal) gymnastic hoops of 80 cm in diameter. The distance between the hoops was 120 cm. They were also fastened to two nylon ropes (8 mm in diameter), located in parallel. The device was aimed at the improvement of the lower and upper ball reception, the initial position of the arms and the leg extension.

A simulator for the accuracy training of the ball reception looked like a hoop on a pole. The pole was stretched through the cells of the grid, and the ring was used as a target for accurate ball receptions. At the same

time the simulator with a hanging ball over the grid was used to improve the spike attack. To improve blocking, there was used a simulator for single or group blocking in different zones. It was made of dense rubber or plywood for attachment to hands. To improve the jump, a jump expander was used. The students were fastened with the belt made of 2-4 rubber shock absorbers. The degree of effort was regulated by quantities of rubber shock absorbers. To stimulate the development of maximum efforts, the task was to get a hand in the ball that was located on a sloping frame or over a head.

The pedagogical experiment was conducted with female students-volleyball players at Glukhiv National Pedagogical University of O. Dovzhenko. Within the pedagogical experiment, using standard tests by the random sample method there were formed two groups: control (CG) and experimental (EG) which included 31 and 30 persons respectively. According to the level of technical preparedness students of the EG were divided into three groups: the level below the average (9 persons), average (14 persons) and above average (7 persons). Special means and methods were selected for the forming of technical elements within each group. The experiment had lasted for 5 months. Training sessions were conducted 3 times a week for 2 hours. A total amount of classes was 60. The content of the differentiated method of training sessions for students with the level of technical preparedness below the average at the beginning of the experiment envisaged the inclusion of such technical elements as serve, reception. Training sessions were aimed at studying the game elements with the use of special devices. The time devoted to such sessions was 30 % of the total time for technical training. The number of repetitions of each technical element was 2 series (5-6 exercises), the recovery time between series – 1-2 min.

At the same time within a group with an average level of technical preparedness at the beginning of the study there were included the following technical elements: serve, reception, attack spike. The simulators were used during 40 % of the total time for technical training. The number of repetitions of each technical element was 3 series (6-8 exercises), the recovery time between them – 1-1,5 min.

The methodology of classes for the group with the level of technical preparedness above average included such technical elements as serve, reception, attack spike, blocking. The simulators were used during 50 % of the total time for technical training. The number of repetitions was 4 series (8-10 exercises), the recovery time between them – 1 min. According to the results of technical preparedness, the number of technical elements in each group increased, and accordingly increased time of usage the simulators.

Table 2. Indices of technical preparedness of female students-volleyball players before and after pedagogical experiment (points)

Tests	Periods	EG (n = 30) Lower than average level (n = 14) $\bar{x} \pm Sx$	p	EG (n = 30) Average level (n = 9) $\bar{x} \pm Sx$	p	EG (n = 30) Above average level (n = 7) $\bar{x} \pm Sx$	p	CG (n = 31) $\bar{x} \pm Sx$	p
Upper straight serve (10 attempts)	Before	3,4 ± 0,31	<	4,2 ± 0,26	<	5,6 ± 0,40	>	3,4 ± 0,34	> 0,05
	After	6,2 ± 0,24	0,001	5,1 ± 0,29	0,001	6,3 ± 0,43	0,05	3,7 ± 0,42	
Serve accuracy (10 attempts)	Before	3,4 ± 0,21	<	4,6 ± 0,23	<	5,8 ± 0,42	>	4,4 ± 0,25	< 0,001
	After	5,5 ± 0,19	0,001	5,7 ± 0,33	0,01	6,6 ± 0,46	0,05	5,8 ± 0,44	
Two-handed ball transfer at the top of the ring (10 attempts)	Before	3,1 ± 0,41	<	4,6 ± 0,39	<	5,5 ± 0,36	>	3,8 ± 0,10	< 0,001
	After	5,5 ± 0,21	0,001	5,2 ± 0,28	0,05	6,1 ± 0,41	0,05	5,3 ± 0,32	
Two-handed ball transfer opposite the wall, sitting and standing position (10 attempts)	Before	3,3 ± 0,11	<	4,4 ± 0,36	<	6,3 ± 0,42	>	3,1 ± 0,29	> 0,05
	After	5,2 ± 0,15	0,001	6,2 ± 0,22	0,001	7,1 ± 0,47	0,05	3,4 ± 0,25	
Upper ball transfers with a turning angle of 180 degrees (alternately)	Before	3,4 ± 0,09	<	4,2 ± 0,34	<	5,6 ± 0,42	>	3,4 ± 0,14	< 0,001
	After	4,4 ± 0,11	0,001	6,3 ± 0,26	0,001	6,5 ± 0,52	0,05	4,5 ± 0,28	
Accuracy of the first transfer (ball reception), (8 attempts)	Before	3,3 ± 0,31	<	4,6 ± 0,39	<	6,8 ± 0,42	>	3,8 ± 0,22	< 0,001
	After	4,6 ± 0,13	0,001	6,6 ± 0,42	0,001	7,5 ± 0,53	0,05	5,1 ± 0,31	
Reception of the serves at the horizontal ring (10 attempts)	Before	3,2 ± 0,32	<	4,0 ± 0,27	<	5,6 ± 0,31	>	3,2 ± 0,30	< 0,05
	After	4,7 ± 0,17	0,001	5,3 ± 0,35	0,001	6,2 ± 0,48	0,05	3,6 ± 0,27	
Forward attack spikes at zones (10 attempts)	Before	3,1 ± 0,10	<	3,9 ± 0,44	<	5,7 ± 0,43	>	3,4 ± 0,41	> 0,05
	After	3,7 ± 0,12	0,001	5,2 ± 0,54	0,05	6,1 ± 0,52	0,05	3,7 ± 0,29	
Accuracy of forward attack spikes (5 attempts)	Before	2,8 ± 0,19	<	2,9 ± 0,10	<	3,6 ± 0,37	>	2,3 ± 0,21	> 0,05
	After	3,7 ± 0,22	0,001	3,7 ± 0,22	0,001	4,1 ± 0,45	0,05	2,6 ± 0,32	
Reception of the ball after forward attack spikes at the 6th zone (10 attempts)	Before	3,3 ± 0,43	<	4,7 ± 0,43	<	5,8 ± 0,48	>	4,4 ± 0,42	< 0,001
	After	5,6 ± 0,24	0,001	5,8 ± 0,48	0,05	6,4 ± 0,53	0,05	5,5 ± 0,39	
Blocking (5 attempts)	Before	2,3 ± 0,31	<	2,6 ± 0,38	<	3,8 ± 0,42	>	2,7 ± 0,34	> 0,05
	After	3,8 ± 0,28	0,001	3,3 ± 0,40	0,05	4,4 ± 0,37	0,05	3,2 ± 0,26	

Note: * – Before – before the experiment, After – after the experiment, EG – experimental group, CG – control group.

Table 3. Indices of special physical preparedness of female students-volleyball players before and after pedagogical experiment

Tests for special physical preparedness	Periods	EG (n = 30) Lower than average level (n = 14) $\bar{x}$ ± Sx	p	Average level (n = 9) $\bar{x}$ ± Sx	p	Above average level (n = 7) $\bar{x}$ ± Sx	p	CG (n = 31) $\bar{x}$ ± Sx	p
Pull-ups on the low crossbar, number of repetitions	Before	12,5 ± 0,21	>	13,1 ± 0,16	<	13,5 ± 0,17	>	12,4 ± 0,28	<
	After	13,1 ± 0,31	0,001	14,2 ± 0,27	0,001	13,7 ± 0,27	0,05	12,9 ± 0,21	0,001
Repeated running, distance 18 m, sec	Before	4,6 ± 0,30	>	4,4 ± 0,28	> 0,05	4,1 ± 0,25	>	4,3 ± 0,18	>
	After	4,2 ± 0,33	0,05	4,1 ± 0,29		3,8 ± 0,31	0,05	4,4 ± 0,15	0,05
Strength of leg muscles in squats for 20 sec, number of repetitions	Before	16,6 ± 0,46	>	17,6 ± 0,24	<	19,0 ± 0,44	>	18,2 ± 0,45	>
	After	17,5 ± 0,49	0,05	19,1 ± 0,18	0,001	19,7 ± 0,39	0,05	18,9 ± 0,40	0,05
Running 10 m with acceleration, sec	Before	2,7 ± 0,24	>	2,6 ± 0,20	> 0,05	2,5 ± 0,15	>	2,7 ± 0,20	<
	After	2,5 ± 0,21	0,05	2,4 ± 0,25		2,4 ± 0,18	0,05	2,5 ± 0,22	0,05
Shuttle running 4 x 9 m, sec	Before	11,6 ± 0,25	>	11,3 ± 0,33	> 0,05	10,7 ± 0,22	>	11,3 ± 0,16	<
	After	11,3 ± 0,29	0,05	10,8 ± 0,37		10,5 ± 0,25	0,05	10,4 ± 0,12	0,05
The shot of a stuffed ball 4 kg at standing position, m	Before	3,2 ± 0,15	<	3,5 ± 0,20	<	4,3 ± 0,38	>	3,6 ±0,31	<
	After	4,4 ± 0,21	0,001	4,4 ± 0,17	0,001	4,8 ± 0,32	0,05	4,3 ± 0,35	0,05
Body tilt forward from standing position, cm	Before	14,4 ± 0,18	<	16,3 ± 0,37	<	19,3 ± 0,16	<	16,8 ± 0,35	<
	After	16,2 ± 0,21	0,001	19,2 ± 0,36	0,001	21,2 ± 0,23	0,001	19,1 ± 0,52	0,001
Upper jump after run-up with touching a target, cm	Before	39,7 ± 0,23	<	43,7 ± 0,34	<	47,4 ± 0,26	<	44,7 ± 0,66	<
	After	42,1 ± 0,18	0,001	46,8 ± 0,32	0,001	49,4 ± 0,31	0,001	47,3 ± 0,30	0,001
High jump, cm	Before	40,1 ± 0,17	<	41,1 ± 0,17	<	42,8 ± 0,14	<	39,7 ± 0,82	>
	After	41,2 ± 0,22	0,001	42,9 ± 0,23	0,001	43,9 ± 0,19	0,001	41,6 ± 0,54	0,05
Long jump, cm	Before	170,6 ± 0,26	<	175,1 ± 0,36	<	182,2 ± 0,28	<	173,3 ± 0,88	<
	After	174,1 ± 0,19	0,001	182,1 ± 0,42	0,001	186,1 ± 0,27	0,001	175,4 ± 0,44	0,05
Frequency of hand mobility, number of repetitions	Before	44,3 ± 0,29	<	48,6 ± 0,23	<	49,5 ± 0,30	>	48,9 ± 0,29	<
	After	49,2 ± 0,24	0,001	49,4 ± 0,31	0,001	49,8 ± 0,26	0,05	49,4 ± 0,34	0,05

Note: * – Before – before the experiment, After – after the experiment, EG – experimental group, CG – control group.

Table 4. Correlation between the indices of physical capacity and special physical fitness of female students within experimental group, n = 31 (r)

Physical tests	Physical capacity	
	Before	After
Pull-ups on the low crossbar, number of repetitions	0,231	0,774
Repeated running, distance 18 m, sec	0,248	0,698
Strength of leg muscles in squats for 20 sec, number of repetitions	0,278	0,864
Running 10 m with acceleration, sec	0,226	0,723
Shuttle running 4 x 9 m, sec	0,301	0,654
The shot of a stuffed ball 4 kg at standing position, m	0,321	0,743
Body tilt forward from standing position, cm	0,189	0,556
Upper jump after run-up with touching a target, cm	0,157	0,623
High jump, cm	0,116	0,498
Long jump, cm	0,247	0,487
Frequency of hand mobility, number of repetitions	0,123	0,478

At the beginning and at the end of the pedagogical experiment students of the EG and CG passed special physical fitness and technical tests. It should be mentioned that within the control group there were not used differentiated approach to the studying of the game elements and special devices.

On the one hand, the implementation of the experimental technology based on the use of simulators contributed to increasing the level of technical preparedness, as well as health state. So, within all indices of technical preparedness in the EG there were fixed several changes ($p < 0,05 \div 0,001$). Besides, more than 50 % of volleyball players with the level of technical preparedness below the average have switched to the average level. At the same time over 18.2 % students increased their level from the average to above average. Despite this fact, there was a tendency for improvement, but the difference in the results within a group of students with the above average level was not reliable ($p > 0.05$).

On the other hand, the volleyball players of the control group ($p < 0,05 \div 0,001$) improved their results, but the level of absolute values was significantly lower (accuracy of serves, transfer by two hands above the basketball ring, transfer opposite the wall, accuracy of the first transfer, reception of serves at the horizontal ring, reception of the ball after the attack spike in the 6^{th} zone). Moreover, they corresponded to the average level of technical preparedness. At the same time within the tests with no significant changes, there was a tendency to improve those indices ($p > 0,05$, Table 2).

The results of the pedagogical experiment demonstrated the absence of female volleyball players with the level of physical fitness below the average ($p < 0,05 \div 0,001$), as their level increased. Moreover, the implementation of the author's technology allowed to increase more than 80 % of the indices, which were assessed as higher than the average level of special physical fitness (Table 3). At the same time the smallest growth of results was determined in the experimental group within a group of students with a higher than average level of special physical fitness ($p > 0.05$). This could be explained by the fact that volleyball players with higher qualification need more time to increase the functionality and intensify of the training process.

It should be mentioned that there were also positive changes in the control group ($p < 0,05 \div < 0,001$). However, 27.3 % of the indicators were increased less insignificantly ($p < 0.05$).

To sup up, all those changes enabled to make conclusions about the efficiency of the author's technology for forming the volleyball game elements with the use of special training devices. Besides, there was determined a tight correlation between physical capacity and special physical fitness among female students during academic year (Table 4).

The data in Table 4 indicate that the most significant levels of correlation at the end of the experiment were found between the physical fitness indicators: with the strength of the leg muscles ($r = 0.864$), strength endurance ($r = 0.774$), running 10 m with acceleration ($r = 0,723$) and the capacity at a heart r ate of 170 kgm $\cdot$ min^{-1}. There were also found sufficiently significant levels of correlation with indices of special physical preparedness: speed endurance, agility, Upper jump after run-up with touching a target (from $r = 0.623$ to $r = 0.698$). A moderate level of correlation was noted between other indicators.

Due to the author's technology within the experimental group there were considerably improved the results of physical fitness. In particular, the difference between the initial and the final data was 132,5 kgm $\cdot$ min^{-1}. In comparison, the difference in the control group was used 65.2 kgm $\cdot$ min^{-1}.

It should be mentioned that today in the theory of student volleyball there are absent special programs for systematic and effective preparation of volleyball teams. Moreover, the attention given to technical training during academic year is not enough. That is why the teams don't have proper opportunities to achieve high results during official competitions of different levels (Hnatchuk,2018; Kostiukevych, 2017).

Nowadays, the methodology of volleyball students training at higher educational institutions is fragmentally developed. One of the most progressive directions in this way is development and use of special complexes of technical devices (Kostiukevych, 2018; Kovalchuk, 2017; Kuts, 2014).

According to the scientific literary, it has been proved that volleyball is one of the most popular and accessible kind of sport in physical education at universities. That is why, the subject "Volleyball" has been included in the curriculum.

However, there has been found a range of problems in studying volleyball technical elements. First of all, the traditional system of training student volleyball players during the academic year does not solve all the tasks. In particular, we mean the tasks connected with the achievement sports results in student sports events. This problem illustrates the need of development a new effective technology for improving the technical training of volleyball players.

To determine the indices of the physical fitness of female students and their division for groups, there was conducted pedagogical observation. According to the study, there was no student with a high level of physical health. At the same time 18 % of students had a low level, 30 % – below the average, 37 % – the average, 15 % – above the average. Moreover, students' physical capacity during the academic year increased. For example, in autumn period the capacity at the heart rate 170 beats per minute was $\bar{x} = 4228,5$ beats per minute, kgm, in spring period – $\bar{x} = 4656,8$ beats per minute, kgm). There was determined the low level of

special physical fitness among the majority of female students and high variation in the indicators of tests for physical fitness and technical preparedness. Thus, it testifies to the heterogeneity of the group of students-volleyball players. So the accuracy of serves out of 10 attempts was $\bar{x} = 4.5 \pm S = 0.84$; attack spike at zones out of 10 attempts $\bar{x} = 3.3 \pm S = 0.40$; blocking out of 5 attempts $\bar{x} = 2,6 \pm S = 0,56$.

To determine the ways of technical training improvement in student volleyball teams there was conducted an expert evaluation among 18 volleyball coaches who worked at universities. It was found that coaches pay special attention to improving such technical elements as ball reception, ball spike, blocking. Those results were used for the development of author's technology which included special simulators. The devices were aimed at increase of technical preparedness of volleyball players.

The results of the study enabled us to get three data groups: those that confirm, those that complement existing researches and completely new within from the research problem. In particular, there has been confirmed general information about the female students' physical fitness [0, 0], as well as the attitude of volleyball players to systematic physical exercises and the influence of various factors on physical fitness (Drachuk, 2018; Hnatchuk, 2018).

Our research has confirmed that insignificant attention is paid to the improving of technical training for female student volleyball players, which, in turn, does not allow to achieve high results during official competitions of different levels (Kuts, 2014).

Besides, there has been supplemented and expanded data got by V.M. Kostykevich, 2017, 2018; S.P. Drachuk 2018; Y. Hnatchuk, 2018. The data was connected with the improvement of approaches and methods of physical fitness in volleyball teams; with the correlation between the game elements and high level of special physical fitness. Moreover, there was added information about the efficiency of special simulators during the technical training in volleyball.

For the first time there have been experimentally substantiated and implemented the technology of forming the game elements in student volleyball with the use of special training devices. There have also been determined the structure and intensity of training load for female volleyball players of different levels of technical preparedness. All the data allowed to increase the indices of special physical fitness and the ability to implement them during competitions.

Conclusions

1. The use of special training devices among female volleyball students with below average and average levels of technical preparedness has led to improvement of all indicators ($p < 0,05 \div 0,001$). The results of the control group (the accuracy of serves, the transfer with two hands above the basketball ring, the accuracy of the first transfer, reception in the horizontal ring, reception of the ball after a strike attack at the 6th zone) were significantly lower than in the experimental group. Besides, the indices in the control group corresponded to the average level of technical preparedness.

2. The indices of special physical fitness of female volleyball players in the experimental group increased from 3.6 % to 35.1 %. Besides, there were no volleyball players with the level of physical fitness below the average. The smallest increment of results in the experimental group was determined among the students with a higher than average level of special physical fitness. Thus, this confirms that the athletes with the higher fitness level need more time and intensification of the training process to increase their functional capabilities. Moreover, the level of physical fitness was improved, so the capacity of the heart rate 170 kgm · min^{-1} increased by 132.5 kgm · min^{-1}.

3. There were determined significant increases of technical preparedness: the accuracy of the top direct serve significantly increased ($p < 0,001$), which allowed the players to complicate the organization of receiving the ball for further attack. The highest amount of winning points achieved by a spiking attack at the 2nd and 4th zones – 44%; from the 6th zone – 22 %; from the 3rd zone – 18 %. The volleyball players in the experimental group performed more receptions without errors – 68%, while the students of the control group – 36% ($p < 0.01$. The efficiency of the blocking in the experimental group is 82 % (the amount of won balls from the block was taken into account), while the students of the control group – 43% ($p < 0.001$).

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