

Methodical system of kettlebell lifting training of cadets during their physical education

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Abstract

Based on a developed methodical system of kettlebell lifting training the influence of kettlebell lifting classes on the physical fitness of cadets was analyzed. The timeliness of the research is defined conditioned by the need to increase the level of physical preparedness of future officers of the Armed Forces of Ukraine to professional activity. The participants of the research: the study included cadets from S. P. Koroliov Zhytomyr Military Institute aged 18–24 years, who entered a higher military educational institution in 2013 (n=119). The duration of the experiment was 5 years. Three groups were formed: EG1 included cadets who were involved in kettlebell lifting section at the institute during their studies (n=29), EG2 included cadets who were involved in the kettlebell lifting section at faculty (n=33), and CG included cadets who were engaged in the current system of physical training (n=57). The study groups were formed from cadets with statistically equivalent levels of preparedness. The number of hours of physical training in all groups was the same and equaled to 12 hours per week. The research was conducted according to the following tests: 100 m - running, pulling up on a cross-beam, 3 km - running, lifting with a coup on a cross-beam, bending the arms on the bars, complex power exercise (dip ups during a minute and sit-ups during a minute), inclination of trunk in sitting position, holding the body in a horizontal position, 5 km - running. The methods of the research are a theoretical analysis and generalization of scientific and methodical literature, pedagogical observation, pedagogical experiment, methods of mathematical statistics. Upon completion of the experiment, the cadets in EG1 and EG2 had a significantly better level of physical fitness ($p < 0.05 - 0.001$) than the CG, according to endurance, strength, static endurance of the muscles of the body and flexibility indicators, which showed the effectiveness of kettlebell lifting classes according to the developed methodical



system. Conclusions. The model of the methodical system focuses on the personality of future officers who should have a high level of physical and methodical preparedness and health, has fitness competencies for the implementation of physical education and sports in the field of professional activity, and who can effectively perform the tasks of professional activity. The high level of physical qualities in graduate cadets will ensure the effective execution of assignments in the conditions of their future military-professional (combat) activity.

Keywords: methodical system, kettlebell lifting, physical fitness, cadets

1. Introduction

The modern system of physical education in Ukraine does not meet the biological need of young people in physical activity, does not provide it with the necessary level of health, physical preparedness and working capacity, which negatively affects the quality of protection of the state from external invasion [1, 2, 3]. The main reasons for this are the insignificant amount of physical activity and the lack of effective organization of the process of physical education in educational institutions. Therefore, it is necessary to find effective methods for optimizing the regime of physical training of future officers of the Armed Forces of Ukraine by such means as to ensure the health promotion and the necessary level of physical and professional training of the cadets.

One of the directions of improving the effectiveness of the training of cadets from higher military educational institutions (HMEI) is the implementation of fundamentally new learning technologies that would have a comprehensive impact on physical activity, which should form the knowledge, skills and habits of maintaining health and improving the effectiveness of professional (combat) activity of military servicemen [4, 5, 6, 7].

2. Literature Review

Analysis of literature sources [8, 9, 10, 11, 12, 13] showed that an effective mean of psychophysical training of cadets for future military-professional (combat) activity may be kettlebell lifting, which has such advantages as: lack of significant material costs; inventory compactness; possibility of training in limited space as well as in the open area; possibility of conducting both self-training and simultaneous classes with a large group of people; a wide range of simple and accessible exercises eliminates the possibility of adaptation to the same type of load; opportunity to conduct classes simultaneously with servicemen who have different levels of physical fitness, high efficiency in the development of physical and psychological qualities; prevention of injury.

Theoretical analysis of literature about the problems of physical education of cadets [1, 2, 4, 5, 6, 7] shows that, despite the rather close attention of researchers to this problem, it remains insufficiently studied, especially those aspects which related to the improvement of theoretical and methodical principles of kettlebell lifting training of cadets from HMEI.

The aim of study is to investigate the influence of kettlebell lifting classes, based on the developed methodical system of kettlebell lifting training of cadets, on the level of their physical fitness during their study.

3. Method

3.1. Participants

The study was attended by cadets from S. P. Koroliov Zhytomyr Military Institute aged 18–24 years (n=119). The duration of the experiment is 5 years. To test the effectiveness of the methodical system two experimental (EG1, n=29, EG2, n=33) and control (CG, n=57) groups were formed. EG1 included cadets who during studying process were involved in the kettlebell lifting section of institute (n=29), EG2 included cadets who were involved in the kettlebell lifting section of faculty (n=33), CG included cadets who were engaged in the current system of physical training (n=57). The study groups were formed from cadets (year of admission – 2013) with statistically equivalent levels of preparedness.

The research related to human use has been complied with all the relevant national regulations and institutional policies and has followed the tenets of the World Medical Association (WMA) Declaration of Helsinki – ethical principles for medical research involving human subjects.



3.2. Materials

The research was conducted according to the following tests: 100 m - running, pulling up on a cross-beam, 3 km - running, lifting with a coup on a cross-beam, bending the arms on the bars, complex power exercise (dip ups during a minute and sit-ups during a minute), inclination of trunk in sitting position (flexibility of the back), holding the body in a horizontal position (static endurance of body muscles), 5 km - running.

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

During the researches, the authenticity of the difference between the indices of cadets by means of Student's criterion was determined. The significance for all statistical tests was set at $p < 0.05$. All statistical analyses were performed with the SPSS software, version 21, adapted to medical and biological researches.

3.3. Procedure

In this study it was supposed to investigate the influence of kettlebell lifting exercises by the various types of organization of training with cadets on the level of their physical fitness. For this purpose, three groups were formed. The number of hours of physical training in all groups was the same and equaled to 12 hours per week. Distribution of time for physical training: in CG (according to the schedule of the day at the military institute): 4 hours - training sessions, 3 hours - morning physical exercise, 5 hours - sports-mass work (SMW). In EG2 - the same as in CG, but during the hours of SMW cadets were engaged not in the current program, but in kettlebell training in the section of the faculty. In EG1: 3 hours - morning exercise, 9 hours - kettlebell training (4 hours of training sessions and 5 hours of SMW). The main difference between EG1 and EG2 was the goals and tasks that were solved during kettlebell training, and, accordingly, the applied means, methods and loads. The ultimate goal of the classes in EG1 was the preparation of high-level sportsmen (kettlebell lifting was considered as the main means of physical education), in EG2 - the preparation of sportsmen of mass grades (kettlebell lifting was an additional means of physical training of cadets).

4. Results

Taking into account the work of many scientists [1, 2, 3, 4, 6, 12, 15, 16] and the results of our own researches [10, 13, 14], the methodical system of kettlebell lifting training of cadets from HMEI in the process of physical education, which includes target, content, organizational-technological, control-diagnostic components and which is focused on the personality of a future specialist - an officer of the Armed Forces of Ukraine - who has a high level of physical and methodical preparedness, health, and fitness competencies for the implementation of physical education and sports in the field of professional activity, and who can effectively perform official duties, was theoretically substantiated.

The model of the methodical system, which was built on the basis of the concept of the methodical system and on the idea of the integrating all components of the integral system of training the cadet to future activities, was grounded on the methodological, theoretical and practical levels. On the methodological level, the relationships and interaction of scientific approaches to the study of the problem (humanistic, systemic-activity, personality-activity, cultural-system, systemic, person-oriented, competence, innovation, technological) were reflected. On the theoretical level, the system of initial parameters, definitions, and evaluations, which was based on the understanding of the essence, content and structure of the methodical system of kettlebell lifting training of cadets in the process of physical education, was determined. On the practical level, the development of four author's techniques was foreseen: training in the technique of exercises in kettlebell lifting; development of physical qualities; formation of moral-volitional qualities and prevention of traumatism, which together with other components form a methodical system; checking the efficiency of the functioning of the methodical system, which will contribute to the formation of physical culture and recreational competencies.

The main tasks of the methodical system are: to increase the level of physical preparedness of the cadets with emphasis on the development of strength qualities and endurance that are most effective in their future military-professional (combat) activity; to improve the health level and level of morphofunctional development in future officers; to increase the level of components of physical, functional and technical training of cadets meaningfully important for the training of kettlebell lifting; to increase the level of



methodological preparedness of future officers in the field of physical education and special physical training (the theoretical knowledge, skills and abilities of the organization and conducting sports and sport mass work and recreational activities in future activities); to increase the mental working capacity, emotional state and professional psychological qualities of cadets and, consequently, to improve the educational success; to improve the knowledge, skills and abilities regarding the use of physical education and sports for the prevention of injuries in the process of future professional activities, as well as in physical training and sport lessons; to form the need for future officers and the positive attitude towards systematic physical exercise and sports.

The main functions of the methodical system are: educational, organizational, recreational, training, preventive, and restorative. The implementation of the methodical system was carried out in 2013–2018 during three stages: I stage – studying of cadets on the 1st course; II stage – the period of studying of cadets in the 2nd course; III stage – studying of cadets in the 3–5th courses. The content of each stage of the methodical system varied depending on the main pedagogical tasks and was determined by the ratio of means, methods, magnitude and direction of physical load, types of training.

According to the methodical system three main groups of methods were used: methods aimed at mastering of knowledge; methods aimed at mastering of motor skills and abilities; methods aimed primarily at the development of physical qualities. In the process of constructing the methodical system, the task was to minimize the separation of cadets from the educational process in HMEI, therefore, kettlebell classes were conducted within the limits of the existing forms of physical education: training sessions and SMW. Among the methods of organizing the cadets in classes according to the methodical system: group, frontal, current, circular methods. Kettlebell lifting classes, based on the developed methodical system of kettlebell lifting training of cadets, include general preparation, auxiliary, special-preparatory and classical exercises with kettlebells. Dosage and load regulation at the stages of the methodical system were by change in the volumes and intensity of facilities, individual classes, cycles, magnitude and directional of loads, taking into account the individual capabilities of each cadet, level of its preparedness, weight category and determined by the peculiarities of the application and order of the combination of such components as: the type, the duration and nature of individual exercises, the number of approaches and occupations, the intensity of work during their execution (rate of movements, speed of their execution, time) etc.

The level of physical fitness is determined by the main criteria of readiness of graduate cadets from physical education for future military-professional activity.

The analysis of results in 100 m - running showed that the level of development of speed qualities of the cadets in all three groups in the 1–3rd years of study did not credibly differ from each other ($p > 0.05$). In the 4th year of study the results of CG cadets were significantly better than in EG1 cadets for 0.29 sec, and in the 5th year of study the level of development of speed qualities in CG cadets (13.73 sec) was found to be significantly better than in EG1 (14.08 sec) and in EG2 (13.97 sec) for 0.35 sec and 0.24 sec ($p < 0.01$; $p < 0.05$). Instead, the results in 100 m - running in the 4th and 5th years of study in EG1 and EG2 do not significantly differ ($p > 0.05$) (Table 1). Analysis of the dynamics of the results in 100 m - running during the pedagogical experiment showed that in all three groups of cadets the level of speed qualities improved: in EG1 – for 0.48 sec ($p < 0.01$), in EG2 – for 0.67 sec ($p < 0.01$), in CG – for 0.86 sec ($p < 0.001$). But, in EG1 and EG2 the level of speed qualities in the all years of study is rated as a «good» grade, then in CG in the senior academic years – as an «excellent» grade (Table 1).

Table 1. Dynamics of physical fitness indices (100 m - running, pulling up on a cross-beam, 3 km - running) among cadets of EG1, EG2 and CG during the pedagogical experiment ($X \pm m$).

Stages of experiment	EG1 (n=29)	EG2 (n=33)	CG (n=14)	Statistical significance		
				p1-p2	p2-p3	p1-p3
<i>100 m - running, sec</i>						
1 st year	14.56±0.13	14.64±0.12	14.59±0.09	>0.05	>0,05	>0,05
2 nd year	14.39±0.12	14.42±0.11	14.25±0.09	>0.05	>0,05	>0,05
3 rd year	14.21±0.11	14.17±0.11	14.02±0.08	>0.05	>0,05	>0,05
4 th year	14.13±0.10	14.05±0.10	13.84±0.07	>0.05	>0,05	<0,05
5 th year	14.08±0.09	13.97±0.09	13.73±0.07	>0.05	<0,05	<0,01



p (1-5)	<0.01	<0.001	<0.001			
<i>Pulling up on a cross-beam, times</i>						
1 st year	12.1±0.71	12.5±0.67	12.3±0.52	>0.05	>0,05	>0,05
2 nd year	16.9±0.68	15.2±0.64	14.6±0.51	>0.05	>0,05	<0,05
3 rd year	18.8±0.64	17.6±0.62	16.3±0.49	>0.05	>0,05	<0,01
4 th year	21.5±0.61	19.9±0.59	17.2±0.45	>0.05	<0,01	<0,001
5 th year	22.7±0.59	21.3±0.57	18.1±0.47	>0.05	<0,001	<0,001
p (1-5)	<0.001	<0.001	<0.001			
<i>3 km - running, sec</i>						
1 st year	792.4±8.96	800.9±8.47	797.8±6.78	>0.05	>0,05	>0,05
2 nd year	733.8±8.15	749.2±8.02	754.9±6.43	>0.05	>0,05	<0,05
3 rd year	703.3±7.56	729.8±7.32	734.1±6.31	<0.05	>0,05	<0,01
4 th year	686.6±6.37	707.9±6.51	719.8±6.18	<0.05	>0,05	<0,01
5 th year	673.9±6.03	691.7±6.24	714.2±5.94	<0.05	<0,05	<0,001
p (1-5)	<0.001	<0.001	<0.001			

The examination of results in pulling up on a cross-beam shows that only in the 1st year of study the difference between the indices of the studied groups was not detected ($p > 0.05$). In the 2nd and 3rd years of study the results of cadets of the EG1 were significantly better than in the CG for 2.3 times ($p < 0.05$) and 2.5 times ($p < 0.01$). And at the 4th and 5th years of study the indexes of cadets both of experimental groups (EG1 and EG2) were significantly better than in the CG ($p < 0.01, 0.001$), which indicates the effectiveness of the training by the methodical system for development of strength qualities in cadets. Instead, the results of EG1 and EG2 during the whole experiment do not significantly differ ($p > 0.05$) (Table 1). The analysis of the dynamics of results in pulling up during the experiment indicates that all groups have significantly improved the results ($p < 0.001$), but in the CG the difference between cadets at the end and at the beginning of the study is 5.8 times, in EG1 – 8.8 times, and in EG2 – 10.6 times, which testifies to the superiority of occupations according to the experimental system than in the current one.

The greatest efficiency of the methodical system of kettlebell lifting training of cadets was revealed during the research of results of 3 km - running. In the 1st year of study the results of cadets of the EG1, EG2 and CG were substantially the same ($p > 0.05$). In the 2nd year of study in the EG1 a significantly better level of endurance development than in the CG was found (21.1 sec, $p < 0.05$). In the 3rd and 4th years of study the difference between the results of EG1 and CG increased to 30.8 sec and 33.2 sec ($p < 0.01$), besides in these years of study a significant difference was found between the indicators of EG1 and EG2 ($p < 0.05; 0.01$). In the 5th year of study the best result was recorded in EG1 (11 min 14 sec) which for 17.8 sec is significantly better than in EG2 (11 min 32 sec) ($p < 0.05$) and for 40.3 sec than in CG (11 min 54 sec) ($p < 0.001$). The difference between EG2 and CG at the end of the experiment is also significant and is 22.5 sec ($p < 0.05$) (Table 1). The positive influence of occupations by the methodological system on the level of development of endurance is also confirmed by the increasing the results of 3 km - running during the period of the pedagogical experiment – the largest difference between the initial and final data of the study was found in the EG1, it is 1 min 58 sec ($p < 0.001$). In the EG2 the level of endurance improved for 1 min 49 sec ($p < 0.001$), and in the CG – for 1 min 24 sec ($p < 0.001$). It indicates a more pronounced positive effect of methodical system of kettlebell lifting training of cadets compared with the current program of physical education.

The analysis of the results of cadets in the lifting with a coup on a cross-beam showed that from the 2nd year of study the results of cadets of the EG1 and EG2 are significantly better than the results of cadets of the CG ($p < 0.01; 0.001$) (Table 2). At the 5th year of study the difference between the results of the EG1, EG2 and CG was the greatest (6.7 times and 5.5 times ($p < 0.001$)). During the experiment the results in this exercise significantly increased in all groups of cadets ($p < 0.001$), but if in the CG the difference between the initial and final data of the experiment is 3.5 times, then in EG2 – 8.8 times and in EG1 – 10.3 times.

Table 2. Dynamics of physical fitness indices (lifting with a coup on a cross-beam, bending the arms on the bars, complex power exercise) among cadets of EG1, EG2 and CG during the pedagogical experiment ($X \pm m$).

Stages of	EG1	EG2	CG	Statistical significance
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experiment	(n=29)	(n=33)	(n=14)	p1-p2	p2-p3	p1-p3
<i>Lifting with a coup on a cross-beam, times</i>						
1 st year	4.8±0.70	5.1±0.65	4.9±0.49	>0.05	>0,05	>0,05
2 nd year	9.1±0.69	8.5±0.62	6.2±0.47	>0.05	<0,01	<0,01
3 rd year	11.7±0.68	10.9±0.66	7.1±0.54	>0.05	<0,001	<0,001
4 th year	13.2±0.68	12.2±0.64	7.6±0.52	>0.05	<0,001	<0,001
5 th year	15.1±0.66	13.9±0.63	8.4±0.55	>0.05	<0,001	<0,001
p (1-5)	<0.001	<0.001	<0.001			
<i>Bending the arms on the bars, times</i>						
1 st year	14.5±1.06	14.8±0.98	15.1±0.81	>0.05	>0,05	>0,05
2 nd year	23.2±1.12	19.7±1.04	16.9±0.85	>0.05	<0,05	<0,01
3 rd year	29.4±1.33	26.6±1.15	19.3±0.90	>0.05	<0,001	<0,001
4 th year	34.6±1.23	31.7±1.19	22.1±0.96	>0.05	<0,001	<0,001
5 th year	38.1±1.31	35.4±1.23	25.2±1.02	>0.05	<0,001	<0,001
p (1-5)	<0.001	<0.001	<0.001			
<i>Complex power exercise, times</i>						
1 st year	47.8±1.34	46.4±1.27	47.2±1.04	>0.05	>0,05	>0,05
2 nd year	60.2±1.43	58.5±1.34	55.3±1.32	>0.05	>0,05	<0,51
3 rd year	68.9±1.52	67.1±1.42	60.1±1.49	>0.05	<0,01	<0,001
4 th year	77.5±1.61	74.8±1.48	61.9±1.53	>0.05	<0,001	<0,001
5 th year	81.4±1.69	79.9±1.53	63.8±1.61	>0.05	<0,001	<0,001
p (1-5)	<0.001	<0.001	<0.001			

The analysis of the dynamics of the results of cadets in the bending the arms on the bars and complex power exercise showed a similar trend to the lifting with a coup on a cross-beam in the period of the experiment - the absence of a significant difference between the results of cadets of the studied groups in the 1st year ($p>0.05$) and a significant prevalence of strength indicators for cadets EG1 and EG2 in 2nd - 5th years of study ($p<0.001$) (Table 2). The highest results in these exercises were recorded in the EG1 in the 5th year of study (38.1 times in bending the arms on bars and 81.4 times in complex power exercise), but they are not significantly different from the results of cadets EG2 (34.4 times and 79.9 times) ($p>0.05$). During the study the level of strength qualities in the cadets of all groups has improved: in the bending the arms on the bars in the CG - for 10.1 times, in EG2 - for 20.6 times, in EG1 - for 23.6 times ($p<0.001$); in complex power exercise in CG - for 16.6 times, in EG2 - for 33.5 times, in EG1 - for 33.6 times ($p<0.001$).

The study of the level of development of flexibility in cadets shows a low level of development of this quality in the majority of cadets of the three groups at the beginning of the experiment - the average results in the inclination of trunk in sitting position in the 1st year of study do not differ significantly ($p>0.05$). The positive effect of the methodical system of kettlebell lifting training is already observed on the 2nd year of study: the indicators of the EG1 and EG2 are significantly better than in the CG for 4.8 sm ($p<0.001$) and 2.7 sm ($p<0.01$) (Table. 3). At the senior courses the difference between the results of the experimental and control groups only increases and at the end of the experiment is 8.4 sm ($p<0.001$) and 6.6 sm ($p<0.001$). Starting from the 2nd year of study, there is a significant difference between the flexibility indicators of the EG1 and EG2 - the results of EG1 are similar to those in EG2 for 1.8-2.8 sm ($p <0.05-0.001$). During the pedagogical experiment the level of flexibility in all groups has significantly improved ($p<0,001$) - the difference between the indicators at the beginning and at the end of the study in CG is 5.3 sm, in EG2 - 11.5 sm, in EG1 - 13.5 sm. This study has shown a significant advantage of kettlebell lifting training by the methodical system in comparison with the current program of physical education.

Table 3. Dynamics of physical fitness indices (inclination of trunk in sitting position, holding the body in a horizontal position, 5 km - running) among cadets of EG1, EG2 and CG during the pedagogical experiment ($X\pm m$).

Stages of experiment	EG1 (n=29)	EG2 (n=33)	CG (n=14)	Statistical significance		
				p1-p2	p2-p3	p1-p3



<i>Inclination of trunk in sitting position, sm</i>						
1 st year	6.1±0.65	6.3±0.59	5.9±0.41	>0.05	>0.05	>0.05
2 nd year	11.9±0.63	9.8±0.57	7.1±0.45	<0.05	<0.01	<0.001
3 rd year	16.5±0.61	14.3±0.55	9.0±0.49	<0.05	<0.001	<0.001
4 th year	18.1±0.58	15.3±0.56	10.6±0.56	<0.01	<0.001	<0.001
5 th year	19.6±0.56	17.8±0.54	11.2±0.59	<0.05	<0.001	<0.001
p (1-5)	<0.001	<0.001	<0.001			
<i>Holding the body in a horizontal position, sec</i>						
1 st year	97.4±3.75	100.7±3.61	103.1±2.66	>0.05	>0.05	>0.05
2 nd year	118.9±3.92	121.8±3.85	112.4±2.91	>0.05	>0.05	>0.05
3 rd year	167.2±4.17	151.3±4.06	127.9±3.25	<0.05	<0.001	<0.001
4 th year	212.6±4.46	189.2±4.21	139.1±3.58	<0.01	<0.001	<0.001
5 th year	234.1±4.68	216.2±4.37	151.3±3.89	<0.01	<0.001	<0.001
p (1-5)	<0.001	<0.001	<0.001			
<i>5 km - running, sec</i>						
1 st year	1408.1±8.22	1411.3±8.03	1398.5±6.43	>0.05	>0.05	>0.05
2 nd year	1290.8±8.13	1311.1±7.99	1353.4±7.12	>0.05	>0.05	<0.51
3 rd year	1255.7±8.08	1278.9±8.05	1316.2±7.95	<0.05	<0.01	<0.001
4 th year	1212.3±8.06	1242.4±7.96	1288.3±8.62	<0.05	<0.001	<0.001
5 th year	1182.3±7.98	1218.4±7.94	1256.8±9.35	<0.01	<0.001	<0.001
p (1-5)	<0.001	<0.001	<0.001			

The analysis of the results in holding the body in a horizontal position showed that at 1st and 2nd years of study the results of studied groups did not differ significantly ($p>0.05$). From 3rd to 5th years of study a significant advantage of the results of cadets of the EG1 and EG2 above the results of the CG was set ($p<0.05-0.001$). The greatest effect of the kettlebell lifting training by the methodical system for the development of static endurance of the back muscles was found at the end of the experiment, where in EG1 the average result in this exercise is the best (3 min 54 sec) and significantly better than in the EG2 (3 min 36 sec) and CG (2 min 31 sec) for 17.9 sec and 1 min 23 sec respectively ($p<0.01$; $p<0.001$). The difference between EG2 and CG is also reliable and is 1 min 05 sec ($p<0.001$). During the study the results of the cadets of all three groups have significantly improved ($p<0.001$), but in the cadets of CG the difference between output and ending data is 48.2 sec, then in EG2 and EG1 the difference is significantly greater (1 min 56 sec and 2 min 17 sec respectively), which confirms the superiority of the methodical system.

The analysis of the results in 5 km - running showed a similar trend to the 3 km - running - in the 2nd year of study the significantly better level of endurance in cadets EG1 and EG2 than in CG was set ($p<0.05-0.001$). And the value the difference increased to the 5th year of study to 1 min 15 sec and 38.4 sec respectively. Since the 3rd year of study the results in EG1 have been significantly improved not only in comparison with CG, but also with EG2. At the end of the pedagogical experiment the difference between EG1 and EG2 was the highest and was 36.1 sec ($p<0.01$). Analysis of the dynamics of the results in 5 km - running during the experiment indicates the improvement of the level of endurance in all groups ($p<0.001$), but the largest increase was recorded in EG1 - 3 min 46 sec, which indicates the positive influence of exercises with kettlebells by the methodical system on the level of development of endurance of the cadets.

5. Discussion and Conclusion

Kettlebell lifting, as one of the simplest and most available military means of physical training, can have a positive effect on the physical development and fitness of future officers, both in the process of their training in HMEI and in the process of future service [8, 9, 11, 12]. The scientists [17, 18] mention that kettlebell lifting place high demands to the cardiorespiratory system of cadets and that the improvement of the results in kettlebell lifting correlates with the indicators of step-test, timed inspiratory capacity, 3 km race that proves high level of endurance development of the kettlebell lifters. The authors mention that systematic kettlebell lifting training makes the volume of cardiac muscle and blood vessels larger; changes blood composition (increase the quantity of erythrocytes and hemoglobin) [19, 20]. Studies of many scientists



[15, 17, 18, 20] have shown that in the process of kettlebell lifting, there is a significant decrease in the heart rate in rest, stabilization of blood pressure and body mass index. As a result of kettlebell exercises, the musculoskeletal system strengthens, the circumference of the chest increases, the vital capacity increases; the activity of the basic systems of an organism is improved.

Our researches of physical fitness of cadets of the experimental and control groups have shown the significant influence of exercises with kettlebells by the developed methodical system on the level of development of the basic physical qualities of future officers, compared with the current system of physical education. The most pronounced positive effect of kettlebell lifting classes was found on the development of endurance, strength qualities, static endurance of the muscles of the body and flexibility.

At the end of the pedagogical experiment the level of physical qualities (endurance, strength qualities, static endurance of the muscles of the body, flexibility) of the cadets of EG1 and EG2 in comparison with the CG was determined to be the best ($p < 0.05-0.001$) according to the results in such tests: pulling up on a cross-beam – for 4.6 times (20.3%) and 3.2 times (15.1%), 3 km - running – for 40.3 sec (5.6%) and 22.5 sec (3.2%), lifting with a coup on a cross-beam – for 6.7 times (44.4%) and 5.5 times (39.6%), bending the arms on the bars – for 12.9 times (33.9%) and 10.2 times (71.2%), complex power exercise – for 17.6 times (21.6%) and 16.1 times (20.2%), the inclination of trunk in sitting position – for 8.4 cm (42.9%) and 6.6 cm (37.1%), holding the body in a horizontal position – for 1 min 23 sec (35.4%) and 1 min 05 sec (30.1%), 5 km - running – for 1 min 15 sec (5.2%) and 38.4 s (3.1%). At the same time, for the majority of tests, no significant difference was found between the indicators of EG1 and EG2 ($p > 0.05$) that indicates the positive effect of exercises with kettlebells in both variants of organization of classes according to the methodical system. The high level of these physical qualities in graduate cadets will ensure the effective execution of assignments in the conditions of their future military-professional (combat) activity.

Conclusions

The model of the methodical system combines the components of pedagogical process and focuses on the personality of future officers who should have a high level of physical and methodical preparedness and health, has fitness competencies for the implementation of physical education and sports in the field of professional activity, and who can effectively perform the tasks of military-professional (combat) activity. Experimental verification of the effectiveness of the methodical system of kettlebell lifting training of cadets in the process of physical education showed its more positive effect, compared with the current system of physical education, to improve the indicators of physical preparedness of cadets – at the end of the experiment in cadets of the EG1 and EG2 recorded significantly better ($p < 0.05-0.001$) level of development of endurance, strength qualities, static endurance of the muscles of the body, flexibility.

Prospects for further research in this direction. The dynamics of physical fitness of officers, which going into kettlebell lifting at HMEI, during their professional activity is expected to be examined.

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