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## Development of power qualities of cadets of Ukrainian higher military educational institutions during kettlebell lifting training

Kostiantyn Prontenko

*Department of Physical Education, Special Physical Training and Sport, S.P. Koroliov Zhytomyr Military Institute, Zhytomyr, Ukraine, prontenkokostya@ukr.net*

Grygoriy Griban

*Department of Physical Education and Sport Improvement, Zhytomyr Ivan Franko State University, Zhytomyr, Ukraine*

Ihor Bloschchynskiy

*English Translation Department, Bohdan Khmelnytskyi National Academy of the State Border Guard Service of Ukraine, Khmelnytskyi, Ukraine*

Dmytro Boyko

*Department of Physical Education, Kfar Hasidim Middle School Maayan, Haifa, Israel*

Orest Loiko

*Department of Physical Education, Special Physical Training and Sport, Hetman Petro Sahaidachnyi National Army Academy, Lviv, Ukraine*

*See next page for additional authors*

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### Abstract

**Background:** The influence of kettlebell lifting training on the development of cadets' power qualities during studies at Ukrainian higher military educational institutions is examined in the article. Also, a comparative analysis of the development of cadets' power qualities depending on their sports qualification in kettlebell lifting is conducted. **Material and methods:** The investigation of the development of cadets' power qualities was conducted according to the following tests: bar pull-ups, bar pullover, bar muscle up, parallel bars dips, complex power exercise, L-sit on parallel bars, holding the body in a horizontal position, back squat, bench press and barbell deadlift. **Results:** A reliably better level of the development of power qualities of cadets who were involved in kettlebell lifting training during studies was found in comparison with cadets who were involved in the current system of physical training, which proves the efficiency of kettlebell lifting exercises concerning the formation of graduates' physical preparation for professional activity. **Conclusions:** The research shows a necessity to implement kettlebell lifting to the physical training of cadets who are the future Ukrainian Armed Forces' officers in order to ensure high efficiency of their future professional activity.

### Keywords

power qualities, cadets, kettlebell lifting, physical training

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### Authors

Kostiantyn Prontenko, Grygoriy Griban, Ihor Bloschynskiy, Dmytro Boyko, Orest Loiko, Volodymyr Andreychuk, Inesa Novitska, and Pavlo Tkachenko

# Development of power qualities of cadets of Ukrainian higher military educational institutions during kettlebell lifting training

Kostiantyn Prontenko<sup>1 ABCDE</sup>, Grygoriy Griban<sup>2 ACD F</sup>, Ihor Bloschynskiy<sup>3 BDE</sup>, Dmytro Boyko<sup>4 CEF</sup>, Orest Loiko<sup>5 AG</sup>, Volodymyr Andreychuk<sup>5 BG</sup>, Inesa Novitska<sup>6 CF</sup>, Pavlo Tkachenko<sup>7 BG</sup>

**Authors' Contribution:** **A** Study Design, **B** Data Collection, **C** Statistical Analysis, **D** Data Interpretation, **E** Manuscript Preparation, **F** Literature Search, **G** Funds Collection

<sup>1</sup> Department of Physical Education, Special Physical Training and Sport, S.P. Koroliov Zhytomyr Military Institute, Zhytomyr, Ukraine

<sup>2</sup> Department of Physical Education and Sport Improvement, Zhytomyr Ivan Franko State University, Zhytomyr, Ukraine

<sup>3</sup> English Translation Department, Bohdan Khmelnytskyi National Academy of the State Border Guard Service of Ukraine, Khmelnytskyi, Ukraine

<sup>4</sup> Department of Physical Education, Kfar Hasidim Middle School Maayan, Haifa, Israel

<sup>5</sup> Department of Physical Education, Special Physical Training and Sport, Hetman Petro Sahaidachnyi National Army Academy, Lviv, Ukraine

<sup>6</sup> Department of Postgraduate and Doctorate Studies, Zhytomyr Ivan Franko State University, Zhytomyr, Ukraine

<sup>7</sup> Department of Physical Education, Zhytomyr National Agroecological University, Zhytomyr, Ukraine

## abstract

**Background:** The influence of kettlebell lifting training on the development of cadets' power qualities during studies at Ukrainian higher military educational institutions is examined in the article. Also, a comparative analysis of the development of cadets' power qualities depending on their sports qualification in kettlebell lifting is conducted.

**Material and methods:** The investigation of the development of cadets' power qualities was conducted according to the following tests: bar pull-ups, bar pullover, bar muscle up, parallel bars dips, complex power exercise, L-sit on parallel bars, holding the body in a horizontal position, back squat, bench press and barbell deadlift.

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**Corresponding author:** Corresponding author: Dr. Kostiantyn Prontenko, Department of Physical Education, Special Physical Training and Sport, S. P. Koroliov Zhytomyr Military Institute, Mira str., 22, 10001, Zhytomyr, Ukraine, tel.: +3-8-067-506-91-42, e-mail: prontenko-kostya@ukr.net

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## INTRODUCTION

Taking into account the military and political situation in Ukraine, today as never before, Ukraine needs reliable defenders of the state, consistently able to overcome the difficulties of military activity and effectively perform official duties. Physical training as one of the main subjects of combat training of military personnel has significant potential in shaping the readiness of graduates of higher military educational institutions (HMEI) for future military professional activities [1, 2]. After all, among the main negative factors of modern military activity are: carrying significant weight (weapons, equipment and ammunition); irregularity of the motor regime (long-term hikes in full equipment or low motor activity in a limited space (at checkpoints, in dugouts), permanent staying in a state of fatigue that requires significant strength training of military personnel [3, 4]. Due to the low level of physical fitness and health of young people entering the HMEI and for other reasons, the traditional system of physical training does not fully ensure the formation of future officers' readiness for military activity [1, 3, 5].

Among the significant arsenal of physical training means, kettlebell lifting, due to compact size of equipment, applicability, accessibility and other benefits, is a very effective means of forming the graduates' physical readiness for future military professional activities [6, 7, 8, 9]. In the process of exercising with weight, all of the cadets' physical qualities are developed, and first of all power, then moral and volitional qualities, increased physical fitness, prevention of injury to the spine and joints [10, 11, 12]. Therefore, the study of the influence of kettlebell lifting training on the level of the development of cadets' power qualities as well as the determination of cadets' - kettlebell lifters' - results in power tests, depending on their sports qualification in kettlebell lifting, is timely and relevant.

The aim of the study is to investigate the influence of the kettlebell lifting training on the development of cadets' power qualities during studies at HMEI.

Tasks:

1. to conduct a comparative analysis of the development of power qualities of cadets who were attending kettlebell lifting classes during studies and cadets who were studying according to the current system of physical training;
2. to investigate the level of power qualities development of cadets of different sports qualifications in kettlebell lifting.

## MATERIAL AND METHODS

### PARTICIPANTS

Cadets of the 1st - 5th years of study (N = 474) of the S. P. Koroliov Zhytomyr Military Institute who were studying according to the current system of physical training (group A, N = 416) and cadets who were attending kettlebell lifting classes during the studies (group B, N = 58) took part in the investigation. To investigate the development of power qualities of the cadets attending kettlebell lifting classes depending on their qualification, group B (N = 58) was divided into three subgroups: subgroup No. 1 - the cadets who had the 3rd and the 2nd grades in kettlebell lifting (N = 26), subgroup No. 2 - the cadets who had the 1st grade and Candidates in Masters of Sport (CMS, N=21), subgroup No. 3 - the cadets who were Masters of Sport (MS) and Masters of Sport of International Class (MSIC) (N = 11). In addition, in order

to prove the influence of kettlebell lifting training on the level of cadets' power qualities development, the results in bar pull-ups of cadets who were trained in kettlebell lifting section (group B, N = 58) and cadets who attended other sports sections (hand-to-hand combat, military all-round events, armsport, powerlifting, athleticism, basketball, volleyball, mini-football, shooting) during studies at the HMEI (N = 171) were examined.

## **METHODS**

The investigation of the level of development of cadets' power qualities was carried out in 2014–2018 according to the following tests: bar pull-ups (4 min), bar pullover (4 min), bar muscle up (4 min), parallel bars dips (4 min), complex power exercise (push-ups per minute and sit-ups per minute), L-sit on parallel bars, holding the body in a horizontal position (plank), barbell back squat, bench press and barbell deadlift. Testing was carried out by teachers of the Department of Physical Education, Special Physical Training and Sports during the final tests and exams, as well as by kettlebell lifting coaches during control exercises. Research methods included theoretical analysis and generalization of scientific and methodical literature, pedagogical observation, testing, and methods of mathematical statistics.

## **STATISTICAL ANALYSIS**

During the research, the authenticity of difference between the indices of cadets by means of Student's t-test was determined. The dynamics of indices in each of groups was also estimated. 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 research.

## **ETHICAL APPROVAL**

Research related to the involvement of cadets was carried out in compliance with all relevant national regulations and institutional policies (Order of the Minister of Defense of Ukraine «On Approval of the Regulation on the Organization of Scientific, Scientific and Technical Activities in the Armed Forces of Ukraine» dated 27.07.16, No. 385), and also the principles of the Helsinki Declaration of the World Medical Association – ethical principles for medical research involving human subjects. Informed consent was obtained from all individuals involved in this study.

## **RESULTS**

The analysis of the cadets' results in bar pull-ups shows that the level of cadets' power qualities of both groups does not significantly differ only in the 1st year of study ( $p > 0.05$ ) (Table 1). In the 2nd year, the results of cadets of group B proved to be better than in group A by 1.5 times, but the difference is unreliable ( $p > 0.05$ ). In the 3rd year, the difference between the results of the cadets of groups A and B is 3.1 times, in the 4th year – 4.6 times, in the 5th year – 5.8 times ( $p < 0.05$ – $0.001$ ). The analysis of the results of bar pullover and bar muscle up shows a greater effect of kettlebell lifting training on the improvement in cadets' power qualities. During all years of study, the results of cadets in group B are better than in group A, but in the 1st and 2nd years the difference is unreliable ( $p > 0.05$ ), while during the 3rd–5th years of study it is reliable ( $p < 0.05$ – $0.001$ ).

Table 1. Dynamics of the power qualities development among cadets of groups A and B (N = 474)

Years of study	Group A (n = 416)		Group B (n = 58)		Significant level
	N	Mean±SD	N	Mean±SD	
Bar pull-ups, times					
1st year	62	12.1 ±0.75	16	13.7 ±0.93	p > 0.05
2nd year	112	14.3 ±0.48	9	15.8 ±1.04	p > 0.05
3rd year	91	16.1 ±0.61	14	19.2 ±0.96	p < 0.05
4th year	76	17.3 ±0.72	12	21.9 ±1.02	p < 0.001
5th year	75	18.2 ±0.78	7	24.0 ±1.06	p < 0.001
Bar pullover, times					
1st year	62	5.2 ±0.67	16	6.7 ±1.42	p > 0.05
2nd year	112	6.0 ±0.48	9	8.3 ±1.55	p > 0.05
3rd year	91	6.8 ±0.52	14	10.5 ±1.16	p < 0.05
4th year	76	7.7 ±0.59	12	13.1 ±1.09	p < 0.001
5th year	75	8.5 ±0.63	7	15.3 ±1.17	p < 0.001
Bar muscle up, times					
1st year	62	4.1 ±0.76	16	4.8 ±1.22	p > 0.05
2nd year	112	5.3 ±0.71	9	7.8 ±1.43	p > 0.05
3rd year	91	6.7 ±0.65	14	9.7 ±1.17	p < 0.05
4th year	76	7.4 ±0.68	12	12.6 ±1.12	p < 0.001
5th year	75	8.2 ±0.64	7	14.5 ±1.19	p < 0.001
Parallel bars dips, times					
1st year	62	14.7 ±1.12	16	15.2 ±2.95	p > 0.05
2nd year	112	16.5 ±0.62	9	21.9 ±3.12	p > 0.05
3rd year	91	19.1 ±0.71	14	28.6 ±2.06	p < 0.001
4th year	76	21.2 ±0.75	12	33.6 ±2.13	p < 0.001
5th year	75	23.4 ±0.68	7	37.3 ±2.85	p < 0.001
Complex power exercise, times					
1st year	62	52.2 ±2.17	16	57.5 ±3.52	p > 0.05
2nd year	112	57.1 ±1.29	9	63.8 ±3.76	p > 0.05
3rd year	91	59.8 ±1.78	14	70.3 ±3.63	p < 0.05
4th year	76	62.4 ±1.93	12	76.2 ±3.27	p < 0.01
5th year	75	64.5 ±1.84	7	82.6 ±3.41	p < 0.001
L-sit on parallel bars, sec					
1st year	62	82.0 ±1.53	16	83.1 ±2.98	p > 0.05
2nd year	112	84.2 ±1.22	9	96.3 ±4.12	p < 0.05
3rd year	91	86.2 ±1.37	14	107.8 ±3.31	p < 0.001
4th year	76	91.7 ±1.39	12	115.2 ±3.36	p < 0.001
5th year	75	93.8 ±1.48	7	127.4 ±4.25	p < 0.001
Holding the body in a horizontal position, sec					
1st year	62	94.3 ±4.25	16	112.1 ±6.71	p < 0.05
2nd year	112	110.6 ±3.10	9	199.8 ±8.27	p < 0.001
3rd year	91	127.1 ±3.57	14	215.3 ±5.65	p < 0.001
4th year	76	136.4 ±3.13	12	221.9 ±5.42	p < 0.001
5th year	75	142.9 ±4.06	7	228.2 ±6.18	p < 0.001

Legend: N – number of subjects; Mean – arithmetical mean; SD – standard deviation

The research of the results of testing the cadets in parallel bars dips indicates that although the results of cadets in the 1st and 2nd years of study of group B are better than in group A, no reliable difference is found between them ( $p > 0.05$ ). In the 3rd year of study, the kettlebell lifters' power qualities are significantly better than in group A by 9.5 times ( $p < 0.001$ ), in the 4th year - by 12.4 times ( $p < 0.001$ ), in the 5th year - by 13.9 times ( $p < 0.001$ ), which testifies to the positive influence of kettlebell lifting training on the level of development of cadets' power qualities. Testing the results in complex power exercise shows a tendency similar to the previous power exercises - the results of cadets who were attending kettlebell lifting classes during studies, especially in senior academic years, are significantly better than of cadets who were studying according to the current system of physical training. Thus, no significant difference was found between the results of cadets of groups A and B in the 1st and the 2nd years of study ( $p > 0.05$ ). In senior academic years, the indicators of cadets of group B in complex power exercise are significantly better than those of cadets of group A by 10.5; 13.8 and 18.1 times, respectively ( $p < 0.05-0.001$ ). The analysis of the results of cadets in the L-sit on parallel bars shows that the power of the abdominal muscles of cadets of both groups in the 1st year of study is reliably equal ( $p > 0.05$ ). Starting from the 2nd year of study, the results in L-sit on parallel bars of cadets who were trained in the kettlebell lifting section are significantly better than those who were engaged in the current system of physical training: in the 2nd year of study - by 12.1 sec ( $p < 0.05$ ); in the 3rd year of study - by 21.6 sec ( $p < 0.001$ ); in the 4th year of study - by 23.5 sec ( $p < 0.001$ ); in the 5th year of study - by 33.6 sec ( $p < 0.001$ ). The analysis of the results of cadets in holding the body in a horizontal position shows a noticeable influence of kettlebell lifting training on strengthening the muscles of the back of kettlebell lifters. Starting from the 1st year of study, the results in the static exercise of cadets of group B are significantly better than of cadets of group A ( $p < 0.05-0.001$ ). The difference between the power indicators of the back muscles of cadets of group B and A is as follows: in the 1st year of study - 17.8 sec; in the 2nd year of study - 89.2 sec; in the 3rd year of study - 88.2 sec; in the 4th year of study - 85.5 sec; in the 5th year of study - 85.3 sec (Table 1).

In order to study the influence of kettlebell lifting training on the level of development of cadets' power qualities, the results in bar pull-ups of cadets who were trained in the kettlebell lifting section (Group B, N=58) and cadets who attended other sports sections (hand-to-hand combat, military all-round events, armsport, powerlifting, athleticism, basketball, volleyball, mini-football, shooting) during studies at the HMEI (N=171) were examined. Testing the athletes of all sections was carried out in identical conditions during the annual review of the best organization of physical training and sports work at the HMEI in 2018 (Fig. 1).

The study shows that in addition to the mean result of athletes in the military all-round events section (24 times), where bar pull-ups is a competitive exercise, the kettlebell lifters have the best result among the remaining sections (22.2 times). At the same time, no significant difference has been found between the power qualities of all-round events athletes and kettlebell lifters ( $p > 0.05$ ). The mean result of cadets-kettlebell lifters is reliably better ( $p < 0.05-0.001$ ) than of cadets who specialize in ball games by 4.9-7.8 times, in hand-to-hand combat - by 3.3 times, in athleticism - by 3.8 times and in shooting - by 5.9 times and does not reliably differ from the results of cadets who specialize in powerlifting and armsport ( $p > 0.05$ ).

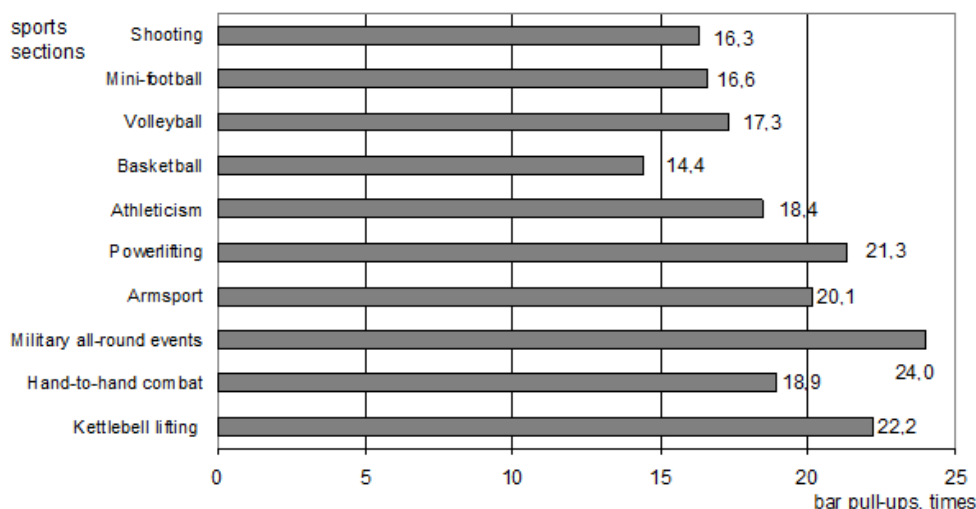


Fig. 1. Results of cadets from various sports sections of HMEI in bar pull-ups (N = 229), times

In order to determine the influence of kettlebell lifting training on the level of power qualities of cadets depending on their level of skills in kettlebell lifting, we investigated the results of kettlebell lifters (Group B, N = 58) of different sports qualifications (three subgroups) in exercises with own body weight and exercises with a barbell (Table 2).

Table 2. Level of the power qualities development of cadets-kettlebell lifters (Group B) of different sports qualifications (Mean±SD, N=58)

Investigated tests	Subgroup No. 1 N = 26	Subgroup No. 2 N = 21	Subgroup No. 3 N = 11	Significant level		
				p1-p2	p2-p3	p1-p3
Bar pull-ups, times	18.5 ±0.87	22.6 ±0.69	23.2 ±0.71	< 0.001	> 0.05	< 0.001
Bar pullover, times	7.2 ±0.56	12.4 ±0.45	12.8 ±0.52	< 0.001	> 0.05	< 0.001
Bar muscle up, times	5.9 ±0.49	11.8 ±0.37	11.9 ±0.46	< 0.001	> 0.05	< 0.001
Parallel bars dips, times	31.7 ±2.23	38.5 ±2.06	39.9 ±1.95	< 0.05	> 0.05	< 0.05
Complex power exercise, times	69.7 ±2.70	78.8 ±2.45	80.4 ±2.18	< 0.05	> 0.05	< 0.05
L-sit on parallel bars, sec	98.1 ±2.75	116.4 ±2.90	123.9 ±3.27	< 0.001	> 0.05	< 0.001
Holding the body in a horizontal position, sec	207.2 ±4.96	221.5 ±5.04	238.0 ±5.54	< 0.05	< 0.05	< 0.001
Barbell back squat, kg	106.2 ±3.27	117.1 ±3.58	121.6 ±3.69	< 0.05	> 0.05	< 0.01
Bench press, kg	82.8 ±2.12	86.4 ±2.30	91.3 ±2.88	> 0.05	> 0.05	> 0.05
Barbell deadlift, kg	104.9 ±2.94	118.6 ±3.07	133.5 ±3.27	< 0.01	< 0.01	< 0.001

Legend: N - number of subjects; Mean - arithmetical mean; SD - standard deviation; p1-p2 - significance of difference between the indicators of group No. 1 and group No. 2; p2-p3 - significance of difference between the indicators of group No. 2 and group No. 3; p1-p3 - significance of difference between the indicators of group No. 1 and group No. 3

The analysis of the results of cadets in exercises on a horizontal bar showed positive dynamics of power indicators of kettlebell lifters with qualification growth. Thus, the results of the cadets in subgroup No. 3 are the best ones compared to the results of cadets in other subgroups. The cadets of subgroup No. 2 have significantly better results in power exercises on the horizontal bar than those in subgroup No. 1 (p < 0.001): in bar pull-ups - by 4.1 times, in bar pullover - by 5.2 times, in bar muscle up - by 5.9 times (Table 2).



In subgroup No. 3 compared with subgroup No. 1, the results also significantly differ ( $p < 0.001$ ). However, the indicators of the kettlebell lifters of subgroups No. 2 and No. 3 in exercises on the horizontal bar between them are not reliably different ( $p > 0.05$ ). This indicates the importance of the development of power qualities in exercises on the horizontal bar at the initial stage of training, and for narrowing the specialization in kettlebell lifting and achieving high sports results, the need for improvement of power qualities is reduced. The analysis of the results in parallel bars dips testifies to the positive dynamics of power indicators of the shoulder girdle of cadets of different qualifications – the best results in this test were recorded in subgroup No. 3 – 39.9 times. However, this value is reliably better only in comparison with the indicators of cadets of the 3rd and the 2nd grades by 6.8 times ( $p < 0.01$ ), and compared with results of cadets of the 1st grade and the CMS, it is reliably the same ( $p > 0.05$ ). The results of this test testify to the fact that the development of the power of the extensors of arms is an important task during the cadets' training in kettlebell lifting. The analysis of the results in the complex power exercise lets us note that the indicators of subgroup No. 3 are the best and make up 80.4 times. At the same time, if the indicators of cadets in subgroup No. 3 are reliably better than in subgroup No. 1 by 10.7 times ( $p < 0.05$ ), the indicators of subgroup No. 2 do not differ reliably ( $p > 0.05$ ) – the difference is 1.6 times (Table 2). That is, the power indicators of the muscles of the shoulder girdle and the press are effectively significant for the performance of the 1st grade and the CMS in kettlebell lifting. The investigation of the results in the test in L-sit on parallel bars proves that although the uptrend is observed in this exercise in the cadets' qualification increase, but reliable difference is discovered only in the results of cadets from subgroups No. 2 and No. 1 – 18.3 sec ( $p < 0.001$ ). The results of cadets from subgroup No. 3 are 2 min 04 sec. They are by 7.5 sec better than the results of cadets from subgroup No. 2 ( $p > 0.05$ ) that shows that the abdominal muscles are not significant indicators of cadets' physical fitness in the process of improving sports qualification. The analysis of the back muscles power level shows the other trend – the indicators are increased reliably with increased qualification of cadets. The cadets of a high qualification are discovered to have the best result in holding the body in a horizontal position, which is 3 min 58 sec. It is by 16.5 sec and 30.8 sec better reliably than the results of cadets who have the 1st grade and CMS ( $p < 0.05$ ) and cadets of low qualification ( $p < 0.001$ ) respectively (Table 2). It defines the connection of the achievements in kettlebell lifting and the indicators of the back muscles power – the higher qualification cadets have in kettlebell lifting, the better results they achieve in holding the body in a horizontal position.

The examination of the cadets' absolute power qualities was held due to three exercises with the barbells of maximal weight: back squat, bench press, deadlift. The analysis showed that the cadets of high qualification have the best results in all exercises. However, the results of the cadets from subgroup No. 3 in deadlift are reliably better than the results of cadets from other subgroups ( $p < 0.001$ ), and the results of cadets from subgroup No. 3 in back squat are reliably better only than the results of cadets from subgroup No. 1 ( $p < 0.01$ ), but the results of cadets from all subgroups in bench press are found out to be similarly reliable ( $p > 0.05$ ). Thus, the results of cadets from subgroup No. 3 in deadlift are 133.5 kg, subgroup No. 2 – 118.6 kg, subgroup No. 1 – 104.9 kg; the difference between subgroups No. 3 and No. 2 is 14.9 kg ( $p < 0.01$ ), subgroups No. 2 and No. 1 – 13.7 kg ( $p < 0.01$ ), subgroups No. 3 and No. 1 – 28.6 kg ( $p < 0.001$ ). Also the reliable difference in the indicators of the groups is discovered in the results in back squat – the indicators of the

cadets of high qualification (121.6 kg) are by 15.4 kg better than the results of the cadets of low qualification (106.2 kg) ( $p < 0.01$ ). The difference of the cadets from subgroups No. 3 and No. 2 in the absolute indicators of the legs muscles power is 4.5 kg, but it is not reliable ( $p > 0.05$ ). The cadets of subgroup No. 3 have better results by 4.9 kg and 8.5 kg (91.3 kg) in bench press than kettlebell lifters from subgroups No. 2 (86.4 kg) and No. 1 (82.8 kg) respectively; however, the reliable difference is not revealed ( $p > 0.05$ ).

## DISCUSSION

The analysis of literature [6, 9, 13, 14, 15] shows a high popularity of power kinds of sport and exercises among youth, and also among the cadets of HMEI. Kettlebell lifting takes the leading place among those kinds of sport and it has a positive influence on the cadets' organism [7, 8, 16]. In scientific publications [17, 18, 19, 20] it is proved that power exercises contribute to aesthetic self-improvement due to the proportionality and symmetry of the muscles and the all-balanced development of all muscle groups, body correction, including elimination of disadvantages in it, recovery after injuries, increase in ability to work, and the formation of a harmonious figure. Scientists [21, 22] point out that power loads have a positive effect on the state of health, ability to work and a range of physical and psychological qualities. Authors [23, 24, 25] state that the optimal level of power development is an effective factor in preventing diseases and providing energy-forming functions of the body. According to the results of scientists' works [9, 26, 27, 28], kettlebell lifting has several advantages over other power sports and exercises: low costs; sports equipment compactness, possibility of training both within limited space and in the open area, an opportunity to conduct both self-training and exercises simultaneously with a large group of people, a wide range of simple and available exercises that eliminates a possibility of adaptation to the same type of load, a possibility to conduct exercises simultaneously with servicemen of different levels of physical fitness, high efficiency in the development of physical qualities and moral-volitional qualities, strengthening the muscles of the back and the whole body, prevention of injury to the spine and joints [16, 26, 29]. Authors [6, 12, 26] think that a large number of exercise with kettlebells is performed with the bending and straightening of the body, which greatly contributes to strengthening the back muscles, the shoulder girdle, legs, abdominal press - as a result the formation of a «muscular corset» and prevention of injuries in everyday life, military service, etc. Research [8, 11, 30, 31, 32, 33] has proved that regular kettlebell lifting training contributes to effective power development, general and power endurance, static endurance of the body muscles, coordination abilities while having a positive effect on the emotional state of those who do this sport.

The investigation of the cadets' results in power exercises proved that the results of cadets who were attending kettlebell lifting classes in the majority of power exercises in the last years of study are better than the results of cadets who were studying according to the current system of physical training ( $p < 0.05-0.001$ ). Analysing the changes of the results in power exercises of the cadets from every group during studies, it should be mentioned that the results are increased in groups A and B reliably - the best results are observed in the 5th year of study. The difference in the results of the cadets of both examined groups in the 1st and 5th years of study is reliable ( $p < 0.001$ ).

The analysis of the results of the cadets from every group in bar pull-ups showed that the level of power indicators is rated as excellent and increased

during studies in both groups A and B in every year of study. But the results of the cadets of the 5th year of study are better by 6.1 times than the results of the cadets of the 1st year of study ( $p < 0.001$ ) in group A, whereas the difference in group B is 10.3 times ( $p < 0.001$ ). It proves the more expressed positive influence of kettlebell lifting on the development of the cadets' power qualities during studies. The results of both groups in bar pullover and bar muscle up are increased reliably ( $p < 0.001$ ) - in the 5th year of study they are the best. The difference in the results of the cadets of the 5th and 1st year of study is 3.3 times in bar pullover and 4.1 times in bar muscle up in group A and 8.6 times in bar pullover and 9.7 times in bar muscle up in group B. Additionally, the level of the power qualities development concerning these exercises is rated as adequate in the 1st year of study and as good in the 5th year of study in group A and as excellent in group B. Analysing the changes in the cadets' results in parallel bars dips, it can be concluded that the results have increased reliably in both groups ( $p < 0.001$ ), but the difference in the power indicators of the cadets in the 1st and 5th years of study is 8.7 times in group A and 22.1 times in group B. Moreover, the results of the cadets of both groups are rated as excellent in all years of study. In complex power exercise the cadets of both groups have the best results in the 5th year of study (64.5 times in group A and 82.6 times in group B), that proves the increase in the cadets' level of physical fitness during studies ( $p < 0.001$ ). However, the results of cadets who were studying according to the current system of physical training in the 5th year of study are by 12.3 times better than in the 1st year of study and the results of the cadets who were attending kettlebell lifting classes are by 25.1 times better. The reliable improvement also is observed in parallel bars dips among the cadets of both groups during studies ( $p < 0.001$ ), but in the group of the kettlebell lifters these changes are more expressed that proves the superiority of kettlebell lifting training over the traditional physical training. Therefore, the difference in the results of the cadets of the 1st and 5th years of study is 44.3 sec in group B and 11.3 sec in group A. The development level of the abdominal muscles static endurance of the cadets from both groups is rated as excellent in all years of study. Investigating the results changes in holding the body in a horizontal position of every group show that the results in both groups are increased reliably during studies ( $p < 0.001$ ), but the results of cadets in the 5th year of study (2 min 23 sec) are by 48.6 sec better than the results of cadets in the 1st year of study (1 min 34 sec) in group A and the difference in the results of cadets in the 1st year of study (1 min 52 sec) and the 5th year of study (3 min 48 sec) is 1 min 56 sec in group B. The development level of the back muscles static endurance of cadets of group A is rated as adequate in the 1st, 2nd and 4th years of study and as good in the 3rd and 5th years of study; the results of cadets of group B are rated as excellent during the whole period of study.

The analysis of the level of power qualities development of cadets-sportsmen of different sports sections showed that the results of the kettlebell lifters in bar pull-ups are the best in comparison to other sections (except sportsmen who attended classes in the military all-round events, where this exercise is competitive). It proves the high level of power qualities development and general physical fitness of the kettlebell lifters [6, 11, 12, 16, 30].

The analysis of the results of kettlebell lifters of different qualification in the power exercises with barbells showed the main tense during the exercises with kettlebell is aimed at the back and legs muscles. The high level of development of exactly these muscles will ensure future professional military

activity improvement [7, 8, 9, 26, 29]. Therefore, the analysis of the kettlebell lifters' power qualities development showed that their level depends on the qualification. The reliable increase of the power qualities development level is revealed in subgroup No. 2 ( $p < 0.001$ ), and the results of the cadets from subgroups No. 2 and No. 3 do not differ reliably ( $p > 0.05$ ). Thus, the level of the power qualities development of kettlebell lifters of the 1st grade and CMS is enough for efficiency of the performed tasks of the educational and future professional activity. To extend the specialization and increase the competitive results in kettlebell lifting, the improvement in special endurance is needed, and in the future the improvement in the power qualities will not be needed. Power exercises should be performed to maintain the achieved level and to prevent injuries. The conclusions of the scientists' works [5, 7, 10, 16] confirm the obtained results.

## CONCLUSIONS

1. The positive influence of kettlebell lifting training on the level of power qualities development of cadets was determined – the results of cadets who were involved in the kettlebell lifting classes are authentically better ( $p < 0.05-0.001$ ) than the results of cadets who were studying according to the current system of physical training in bar pull-ups, bar pullover, bar muscle up, parallel bars dips, complex power exercise, muscles endurance exercises in the last years of study. It proves the efficiency of kettlebell lifting exercises concerning the formation of graduates' physical readiness for professional activity.
2. The investigation of the level of power qualities development of cadets-sportsmen of different sports sections showed that the results of the kettlebell lifters in bar pull-ups are the best in comparison to other sections (except sportsmen who attended classes in the military all-round events, where this exercise is competitive) that proves the high level of power qualities development and general physical fitness of the kettlebell lifters.
3. The examination of the results of cadets of different qualification in power exercises proved that the level of power qualities development is increased to the level of the 1st grade and CMS reliably ( $p < 0.001$ ), and the level of power indicators is not changed reliably with increased qualification of the cadets to MS and MSIC ( $p > 0.05$ ). Therefore, the level of power qualities development of the kettlebell lifters of the 1st grade and CMS is enough for efficiency of the performed tasks of the educational and future professional activity.
4. The high level of power qualities development of the cadets will ensure the improvement in the efficiency of the future professional military (combat) activity's tasks performance. Investigation shows the necessity of the implementation of kettlebell lifting to the physical training of cadets who are the future Ukrainian Armed Forces' officers in order to ensure high efficiency of their future professional activity.

Future research will aim at studying the impact of various components of the training process on the competitive results in kettlebell lifting.

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