

## Health improvement of cadets from higher military educational institutions during kettlebell lifting activities

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### Abstract:

The influence of kettlebell lifting activities on the physical health level of cadets from higher military educational institutions (HMEI) during the study period was examined. Cadets in the 1<sup>st</sup>–5<sup>th</sup> year of study (n=474) who studied according to the current system of physical training at the HMEI (group A, n=416) and cadets who attended a kettlebell lifting class during the study period (group B, n=58) took part in the investigation. Physical health was investigated according to the H. L. Apanasenko method, which allows to determine the body mass index, the life index, the power index, Robinson's index and the heart rate recovery time after dosed physical loading. The health level of cadets who attended a kettlebell lifting class during their 2<sup>nd</sup>–5<sup>th</sup> year was determined to be significantly better ( $P<0.05$ ) than that of the cadets who studied according to the current system of physical training for 2.69–4.46 points (38.7–62.5%). This confirms the positive effect of kettlebell lifting activities on cadets' health improvement during the study period.

**Keywords:** physical health level, cadet, kettlebell lifting

### Introduction

Health is one of the most vital human values. Strong constitution and high resistance to unfavourable factors of the environment are one of the most important requirements for the active longevity, successful studying, productive professional activities, personal and domestic happiness. Only physically, mentally and psychically healthy person can convert his or her opportunities the most effectively and feels a contributing member of society [1, 8].

According to the number of scientists, health is the most essential factor of implementation of individual's life program which considerably defines the social tasks' materialization [4, 6]. According to World Organization of Health Care, health is defined as human condition, which is characterized not only by the absence of diseases or physical defects but also by total physical, mental and social well-being [2, 3]. According to M. M. Amosov's definition, a person can be considered healthy if he or she has harmonious physical and mental development and is well adapted to physical and social environment [1]. The other scientists tell that health is the amount of reserves in the organism, the maximum effectiveness of the organs during maintaining boundaries of functions [2, 8, 9]. Based on the above we can state that just a health person is able to implement his or her physical and mental abilities and achieve their social destiny.

In the current context there is critical situation about the people's health condition because of sharp increase of disease incidence, increased mortality, genetic defections, crime rate degradation, pupils' and students' physical fitness reduction, negative occurrences intensification in the political, international areas and many other factors in Ukraine. Modern development level of society considerably actualizes scientific problems connected with looking for the ways of youth's health preservation and improvement.

In H. L. Apanasenko's studies safe level of physical health is determined to exist (at the boundary between the third and the fourth levels – according to the express-method it is 12 points), above which there is practically no endogenous risk factors of chronic somatic diseases' developing, diseases by themselves and the mortality from them. The scientist notice that the share of population that is at the safe health zone has reduced from 8 to 1% for the last 20 years in Ukraine [2]. Physical activities have a great importance for the health improving and disease prevention. Physical training and sport must provide an excellent health level, high effectiveness of military men's labour and full continuum of recreative and rehabilitation actions. One of the simple and affordable ways of physical training in military area is the kettlebell lifting activities that can have a positive influence on physical health of future army officers during the studying at the HMEI and the future work.

## Materials and methods

Four hundred seventy four cadets of Zhytomyr Military Institute named after S. P. Koroliov in their 1<sup>st</sup>–5<sup>th</sup> year of study who studied according to the current system of physical training at the HMEI (group A, n=416) and cadets who attended a kettlebell lifting class during the study period (group B, n=58) took part in the investigation.

The examination of physical health was held according to the H. L. Apanasnko method which is based on the anthropometry characteristics (body height, body weight, vital capacity, handgrip test) and also state of the cardiovascular system. The health level was evaluated in points and provided estimation of the body mass index, the life index, the power index, Robinson's index and the heart rate recovery time to output level after dosed physical loading (20 squats per 30 seconds). According to the Apanasenko method the low health level corresponded to 3 and lesser points, below the average – 4-6 points, the average – 7-11 point, above the average – 12-15 points, the high health level – 16-18 points.

During the researches the authenticity of difference between the indicators of cadets of groups A and B by means of Student's criterion has been determined. The dynamics of indexes in each of groups has been also estimated.

The aim of the article is to investigate the influence of the kettlebell lifting activities on the level of physical health of cadets of higher military educational institutions during the study period.

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

## Results

The analysis of the height of the cadets at the HMEI showed that in all academic years there was no significant difference between the cadets of the respective groups ( $P>0.05$ ) – the difference between the groups A and B does not exceed 0.4 cm. During the study period, the height of the cadets of both groups increased: in group A – for 1.5 cm, and in group B – for 0.9 cm, but there was not a reliable difference between the indicators of the cadets of the 1<sup>st</sup> and 5<sup>th</sup> years of both groups ( $P>0.05$ ) (Table 1). The conducted analysis shows that the trainings both according to the current system of physical education and in the kettlebell lifting group do not significantly affect the height rates of cadets in the process of studying at the HMEI.

The analyses of body mass index of cadets of HMEI revealed that there is no difference between the characteristics of cadets from the groups A and B in the 1<sup>st</sup> year of study ( $P>0.05$ ). In the 2<sup>nd</sup> and senior years the cadets-kettlebell lifters have better body mass index than the cadets who were studying according to the current system properly for 0.57; 1.20; 1.13 and 1.35 kg/m<sup>2</sup>, however the indicators do not differ from each other credibly ( $P>0.05$ ) (Table 1).

The examination of body mass index changes in each group reveals that the group A had a credible performance degradation – the difference between indices of the 1<sup>st</sup> (23.60 kg/m<sup>2</sup>) and the 5<sup>th</sup> (24.74 kg/m<sup>2</sup>) years is 1.14 kg/m<sup>2</sup> and it is authentic ( $P<0.05$ ). The body mass index of the cadets-kettlebell lifters of the 5<sup>th</sup> grade (23.39 kg/m<sup>2</sup>) does not credibly differ from the cadets' of the 1<sup>st</sup> grade (23.40 kg/m<sup>2</sup>) indices in the group B ( $P>0.05$ ) that confirms the positive effect of the kettlebell lifting activities, in contrast to studying according to the current system of physical training, on the indices of physical development and health of future officers. The evaluation of body mass index reveals that according to the table of body mass index's grading its meaning is within normal range for the cadets of both groups and every year (18.50–24.99 kg/m<sup>2</sup>). However, the analysis of index changes tendency of cadets from the group A due to the extrapolation method enables to state that the average meaning is going to fall outside the limits and equal overweight.

The analysis of the life index revealed that there is no credible difference between cadets from the group A and B in the 1<sup>st</sup> and the 2<sup>nd</sup> grade ( $P>0.05$ ). In the 3<sup>rd</sup> grade the life index of the cadets-kettlebell lifters is credibly better than the cadets who were studying according to the current system of physical training for 6.22 ml/kg ( $P<0.01$ ), in the 4<sup>th</sup> grade – for 7.83 ml/kg ( $P<0.01$ ), in the 5<sup>th</sup> – for 7.85 ml/kg ( $P<0.01$ ) (Table 1). The examination of life index changes during the study allows to notice the negative dynamics of index in the group A – the cadets of the 5<sup>th</sup> grade had worse results than cadets of the 1<sup>st</sup> grade for 0.99 ml/kg ( $P>0.05$ ). In the group B we can see a tendency of the improving the life index during the study. So, the meaning of the life index is the best in the 5<sup>th</sup> grade (63.61 ml/kg) and credibly better in comparison to the 1<sup>st</sup> grade 7.80 ml/kg ( $P>0.05$ ). According to the table of grading the life index is estimated as average in the group A of all years and the level of functional capability of respiratory system is evaluated as average for the cadets of the 1<sup>st</sup> and the 2<sup>nd</sup> grades and as above the average for the cadets of senior grades, that confirms our previous conclusions about positive effect of the kettlebell lifting activities on the characteristics of the cadets' respiratory system.

The investigation of the power index of cadets, which characterizes muscle system's abilities and is determined by ratio of the dynamometry indicator of stronger arm to the body weight, reveals that the meaning of power index of examining groups does not credibly differ in the 1<sup>st</sup> and the 2<sup>nd</sup> grade ( $P>0.05$ ). The average meaning of the power index of the cadets from the group B is credibly better than from the group A in the 3<sup>rd</sup> grade for 8.31% ( $P<0.01$ ), for 11.50% – in the 4<sup>th</sup> grade ( $P<0.001$ ), for 15.75% – in the 5<sup>th</sup> grade ( $P<0.001$ ) (Table 1). The analysis of the dynamics of the power index during the cadets' studying at the HMEI revealed

that the index is credibly improving in the process of studying in both of groups, but if the difference between the indicators of the cadets of the 5<sup>th</sup> and the 1<sup>st</sup> grades is 4.36% in the group A ( $P < 0.001$ ), then in the group B there is 19.26% ( $P < 0.001$ ), that means the positive influence of the kettlebell lifting activities on the future officers' health improving. The evaluation of the power index according to the system of grading demonstrates that the meaning of the power index corresponds to the low level for the cadets of all grades who were studying according to the current system of physical training at the HMEI, and the level of power abilities for the cadets-kettlebell lifters is estimated as below the average in the 2<sup>nd</sup> grade, the average – in the 3<sup>rd</sup> grade and above the average in the 4<sup>th</sup> and the 5<sup>th</sup> grades that emphasizes the advantage of the kettlebell lifting activities.

Table 1. Changes of indicators of physical health of cadets who studied according to the current system of physical training at the HMEI (group A,  $n = 416$ ) and cadets attended a kettlebell lifting class during the study period (group B,  $n = 58$ )

Year of study	Group A ( $n=416$ )		Group B ( $n=58$ )		The authenticity of difference
	n	X±m	n	X±m	
Body mass index, kg/m <sup>2</sup>					
1 <sup>st</sup> year	62	23.60±0.36	16	23.40±0.51	$P > 0.05$
2 <sup>nd</sup> year	112	23.98±0.21	9	23.41±0.71	$P > 0.05$
3 <sup>rd</sup> year	91	24.44±0.25	14	23.24±0.56	$P > 0.05$
4 <sup>th</sup> year	76	24.45±0.30	12	23.32±0.62	$P > 0.05$
5 <sup>th</sup> year	65	24.74±0.31	7	23.39±0.73	$P > 0.05$
Life index, ml/kg					
1 <sup>st</sup> year	62	56.75±0.85	16	55.81±1.90	$P > 0.05$
2 <sup>nd</sup> year	112	56.20±0.69	9	58.94±2.31	$P > 0.05$
3 <sup>rd</sup> year	91	55.72±0.72	14	61.94±1.94	$P < 0.01$
4 <sup>th</sup> year	76	55.77±0.77	12	63.60±1.96	$P < 0.01$
5 <sup>th</sup> year	65	55.76±0.82	7	63.61±2.18	$P < 0.01$
Power index, %					
1 <sup>st</sup> year	62	55.06±1.14	16	55.91±2.49	$P > 0.05$
2 <sup>nd</sup> year	112	57.25±0.86	9	61.08±2.87	$P > 0.05$
3 <sup>rd</sup> year	91	57.84±0.92	14	66.15±2.62	$P < 0.01$
4 <sup>th</sup> year	76	59.23±0.97	12	70.73±2.53	$P < 0.001$
5 <sup>th</sup> year	65	59.42±0.99	7	75.17±2.11	$P < 0.001$
Robinson's index, c. u.					
1 <sup>st</sup> year	62	87.19±0.81	16	86.41±1.82	$P > 0.05$
2 <sup>nd</sup> year	112	86.23±0.65	9	83.36±2.38	$P > 0.05$
3 <sup>rd</sup> year	91	85.65±0.69	14	80.61±1.94	$P < 0.05$
4 <sup>th</sup> year	76	83.66±0.73	12	77.04±2.51	$P < 0.05$
5 <sup>th</sup> year	65	85.69±0.79	7	73.81±2.67	$P < 0.001$
Heart rate recovery time after 20 squats per 30 seconds, s					
1 <sup>st</sup> year	62	132.1±2.58	16	134.6±4.45	$P > 0.05$
2 <sup>nd</sup> year	112	125.6±1.96	9	117.5±4.37	$P > 0.05$
3 <sup>rd</sup> year	91	121.3±2.05	14	103.8±3.12	$P < 0.001$
4 <sup>th</sup> year	76	118.5±2.27	12	95.2±3.28	$P < 0.001$
5 <sup>th</sup> year	65	116.9±2.45	7	88.1±3.21	$P < 0.001$

The analysis of the Robinson's index, which is defined by the product of the heart rate at rest and the systolic blood pressure, demonstrated that the authentic difference between indicators of the groups A and B in the 1<sup>st</sup> and 2<sup>nd</sup> years is not revealed ( $P > 0.05$ ). The cadets who were attending a kettlebell lifting class has the Robinson's index better than cadets who were studying according to the current system of physical training for 5.04 c. u. in the 3<sup>rd</sup> grade ( $P < 0.05$ ), for 6.62 c. u. – in the 4<sup>th</sup> grade ( $P < 0.05$ ), for 11.88 c. u. – in the 5<sup>th</sup> grade ( $P < 0.001$ ) (Table 1), that means the positive effect of the kettlebell lifting activities on the development and improvement of the functional abilities of the cadets' cardiovascular system during the study. Examining the changes of the Robinson's index in each group, we determined that the indicators were improving in the group A till the 4<sup>th</sup> grade ( $P < 0.01$ ), and they deteriorated in the 5<sup>th</sup> grade in comparison to the 4<sup>th</sup> one, and the meaning of the Robinson's index of the cadets of the 5<sup>th</sup> grade does not credibly differ from the cadets of the 1<sup>st</sup> grade ( $P > 0.05$ ), the difference is 1.5 c. u. In the group B we can see pronounced tendency to the improving of the functional abilities of the cadets-kettlebell lifters' cardiovascular system during the study – the indicators in the 5<sup>th</sup> grade is credibly better than in the 1<sup>st</sup> grade for 12.6 c. u. ( $P < 0.001$ ). The evaluation of the Robinson's index allows to state that the reserves of the functional abilities of the cadets' of both groups cardiovascular system

correspond to the average level in the 1<sup>st</sup> grade. In the other grades, except the 4<sup>th</sup> one, the Robinson's index is estimated as the average in the group A, and as above the average in the group B in the 2<sup>nd</sup>–5<sup>th</sup> grades, that confirms the effectiveness of the kettlebell lifting activities during the study at the HMEI.

The analysis of the heart rate recovery time after 20 squats per 30 seconds demonstrated that the indicators of the groups A and B were credibly equal in the 1<sup>st</sup> and the 2<sup>nd</sup> grades ( $P>0.05$ ). The heart rate recovery time of the cadets-kettlebell lifters is revealed better than of the cadets who were studying according to the current system of physical training for 17.5 s in the 3<sup>rd</sup> grade ( $P<0.001$ ), for 23.3 s – in the 4<sup>th</sup> grade ( $P<0.001$ ), for 26.8 s – in the 5<sup>th</sup> grade ( $P<0.001$ ) (Table 1). The analysis of the changes of the activity of the cardiovascular system regeneration indicators revealed that the heart rate recovery time has improved in both examining groups, but if the difference between the indicators of the 5<sup>th</sup> and the 1<sup>st</sup> grade is 15.2 s in the group A ( $P<0.001$ ), then there is 46.5 s in the group B ( $P<0.001$ ), that emphasizes the advantage of the kettlebell lifting activities in the improving of the cadets' activity of the cardiovascular system on the whole and the improving of the reconstructive processes in particular. The estimating of this characteristic according to the H. L. Apanasenko's table allows to state that the duration of the reconstructive processes correspond to below the average level in the group A in the 1<sup>st</sup> – 3<sup>rd</sup> grades, and to the average level in the 4<sup>th</sup> and 5<sup>th</sup> grades. In the group B – below the average level is stated only in the 1<sup>st</sup> grade, the average level – in the 2<sup>nd</sup>–4<sup>th</sup> grades, and above the average level – in the 5<sup>th</sup> grade.

The investigation of the cadets' of the HMEI physical health level (PHL) reveals that the PHL is credibly equal in the groups A and B only in the 1<sup>st</sup> grade ( $P>0.05$ ). Starting from the 2<sup>nd</sup> grade the group of cadets-kettlebell lifters has credibly higher physical health level than the cadets who were studying according to the current system of physical training at HMEI. So, the PHL in group B is credibly better than in the group A for 2.69 points in the 2<sup>nd</sup> grade ( $P<0.001$ ), for 3.58 points in the 3<sup>rd</sup> grade ( $P<0.001$ ), for 3.04 points in the 4<sup>th</sup> grade ( $P<0.001$ ), for 4.46 points in the 5<sup>th</sup> year of study ( $P<0.001$ ) (Table 2).

Table 2. Changes of physical health level of cadets who studied according to the current system of physical training at the HMEI (group A, n = 416) and cadets who attended a kettlebell lifting class during the study period (group B, n = 58), points

Year of study	Group A (n=416)		Group B (n=58)		The authenticity of difference
	n	X±m	n	X±m	
1 <sup>st</sup> year	62	3.80±0.25	16	3.72±0.71	$P>0.05$
2 <sup>nd</sup> year	112	4.25±0.22	9	6.94±0.74	$P<0.001$
3 <sup>rd</sup> year	91	5.18±0.24	14	8.77±0.69	$P<0.001$
4 <sup>th</sup> year	76	7.04±0.31	12	10.05±0.82	$P<0.001$
5 <sup>th</sup> year	65	7.43±0.34	7	11.89±0.67	$P<0.001$

The analysis of the physical health level dynamics of the cadets from the examining groups during the study revealed that both groups tend to the cadets' health improving – the cadets of the 5<sup>th</sup> grade have the highest and credibly higher PHL than the cadets of the 1<sup>st</sup> grade ( $P<0.001$ ). But if the difference between the indicators of the graduate cadets and ones of the 1<sup>st</sup> grade is 3.63 points in the group A, then there is 8.17 points in the group B, that confirms the results of our previous investigations about the positive influence of the kettlebell lifting activities on the cadets' health improvement. The evaluation of the cadets' physical health level in conformity with the table of levels grading according to the H. L. Apanasenko's method reveals that the PHL corresponds to below the average level in the 1<sup>st</sup>–3<sup>rd</sup> grades and to the average in the 4<sup>th</sup> and the 5<sup>th</sup> grades in the group A. Whereas the cadets-kettlebell lifters' PHL corresponds to below the average only in the 1<sup>st</sup> grade in the group B; it is estimated as the average in the 2<sup>nd</sup>–4<sup>th</sup> grades, and as above the average in the 5<sup>th</sup> grade.

The analysis of the correlation of the cadets' from both groups physical health levels reveals that the highest percentage of the cadets in the 1<sup>st</sup> grade has the low and below the average PHL (48.4% and 41.9% in the group A and 43.7% and 37.5% properly in the group B) (Fig. 2). The group A tends to the increasing of the percentage of the cadets who have the average health level till the 5<sup>th</sup> grade (from 9.7% in the 1<sup>st</sup> grade to 58.5% – in the 5<sup>th</sup> grade), and the biggest percentage of the cadets who have above the average level of physical health is stated in the group B in the 5<sup>th</sup> grade (42.9%). Also the authentic reduction of the number of cadets who have the low PHL in both groups during studying should be noted: from 48.4% to 6.2% in the group A and from 31.3% to zero in the group B (Fig. 2). And we should note that the least percentage of the cadets who have above the average and the high health level is in the group A in the 5<sup>th</sup> grade (4.6%) – totally the number of cadets who are in the safe zone (according to the H. L. Apanasenko's method these are 12 points) is 9.2%, and the number of such cadets is 57.2% in the group B, that credibly emphasizes the effectiveness of the kettlebell lifting activities on the cadets' health improvement during studying.

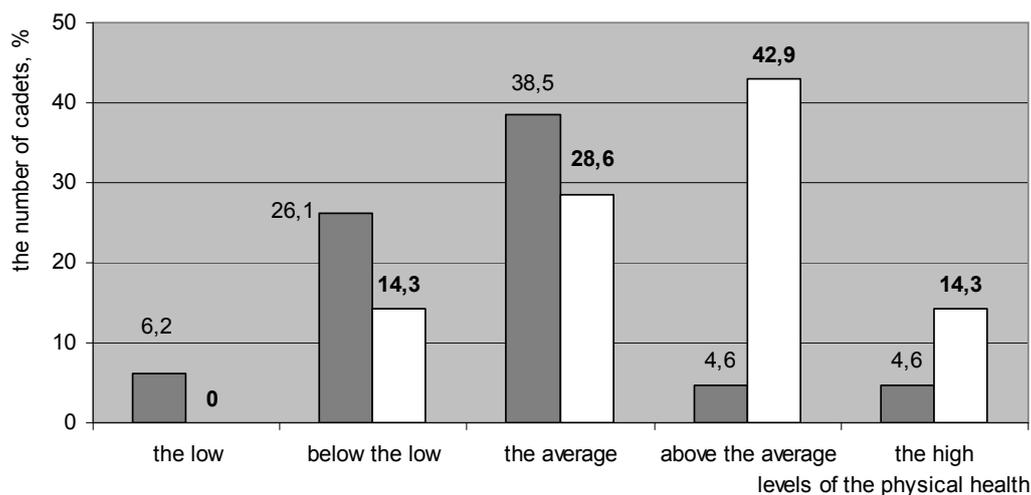


Fig. 1. The correlation of the physical health levels of the cadets from the groups A and B in the 5<sup>th</sup> year of study (n=474, %):

 – the correlation of the cadets from the group A;  
 – the correlation of the cadets from the group B

## Discussion

The conducted investigations of the quantitative characteristics of the physical health through the body mass index, life, power, Robinson's indexes and Heart rate recovery time after after standard exercises, the level of the physical health allow to make the conclusion that the kettlebell lifting activities conduce to the cadets' high health level formation more effectively in comparison to the current system of physical training at the HMEI. The kettlebell lifting activities influenced the activity of the cardio respiratory system of the cadets-kettlebell lifters the most – the indicators of the life and Robinson's indexes. The indicators of the cadets from the group B in contrast to the group A, are credibly better in the 5<sup>th</sup> grade than in the 1<sup>st</sup> grade ( $P<0.05-0.001$ ). Also the kettlebell lifting activities have the obvious advantage in the development of the osteomuscular apparatus of cadets in contrast to the current system of physical training – in the senior grades the power index of the cadets from the group B is credibly better than from the group A ( $P<0.001$ ). Besides, the attending of the kettlebell lifting class provided the stabilization of the indicators of the body weight of the cadets during all the study – the body mass index of the cadets from the group B is the same in the every grade ( $P>0.05$ ), and it credibly changed for the worse for the cadets from the group A during the study ( $P<0.05$ ). Concerning the investigations of the physical health level according to the H. L. Apanasenko's methody, we should mention that starting with the 2<sup>nd</sup> grade the credibly highest health level was stated in the group B ( $P<0.001$ ). Besides, 57.2% of the cadets who reached the safe health level (12 points) were revealed in the 5<sup>th</sup> grade in the group B, and 9.2% – in the group A. So, we can state that the kettlebell lifting activities will conduce to the increasing of the resistance to unfavourable factors of the studying and professional activities, the disease prevention, the extension of the active longevity, the improvement of the studying success and the effectiveness of the future military vocational (combat) activity of the cadets – future officers of the Ukrainian Armed Forces.

## Conclusions

1. The health level of the cadets who attended a kettlebell lifting class is better credibly than the cadets who studied according to the current system of physical training in the 2<sup>nd</sup>–5<sup>th</sup> years for 2.69 – 4.46 points ( $P<0.05$ ), that corresponds to 38.7 – 62.5 %.

2. The number of the cadets who have above the average and the high health level is 9.2% in the group A and 57.2% in the group B in the 5<sup>th</sup> year that means the effectiveness of the kettlebell lifting activities for the health improvement of the cadets during the study period.

## References

- Amosov, M. M. (2002). The Amosovs' encyclopaedia. Algorithm of health. Man and society, AST; Stalker, 464 p.
- Apanasenko, H. L. (2007). Book about health, *Medkniga*, 132 p.
- Bolotin, A., Bakayev, V., Vazhenin, S. (2016). Factors that determine the necessity for developing skills required by cadets in higher education institutions of the Aerospace Forces to organize their kettlebell self-training. *Journal of Physical Education and Sport*, 16 (1), pp. 102–108.
- Griban, G. P., Romanchuk, S. V., Romanchuk, V. M. (2014). Physical education in military subunits, *ASV*, 540 p.

- Kyslenko, D., Prontenko, K., Bondarenko, V., Iukhno, Iu., Radzievskii, R., Prontenko, V., Kizyun, O. (2017). Development of the physical qualities of future specialists in protective activities due to the use of the kettlebell sport during studies. *Journal of Physical Education and Sport*, 17 (2), pp. 789–794.
- Oleshko, V. G. (2011). The preparedness of sportsmen in the power types of sport, *DIA*, 444 p.
- Prontenko, K., Bezpaliy, S., Mihalchuk, R., Popov, S. (2014). Morfofunctional state of graduating cadets of higher military educational establishments, which went in for weight sport during studying. *Slobozhanskyi herald of science and sport*, 3 (41), pp. 92–98.
- Prontenko, K., Prontenko, V., Bondarenko, V., Bezpaliy, S., Bykova, G., Zeleniuk, O., Dvoretzky, V. (2017). Improvement of the physical state of cadets from higher educational establishments in the Ukrainian Armed Forces due to the use of the kettlebell sport. *Journal of Physical Education and Sport*, 17 (1), pp. 447–451.
- Prontenko, K., Griban, G., Prontenko, V., Bezpaliy, S., Bykova, G., Zeleniuk, O., Dvoretzky, V. (2017). Level and dynamics of functional preparedness indexes of kettlebell sportsmen. *Journal of Physical Education and Sport*, 17 (2). pp. 712–716.
- Prontenko, K., Griban, G., Prontenko, V., Bezpaliy, S., Bondarenko, V., Andreychuk, V., Tkachenko, P. (2017). Correlation analysis of indicators of athletes' readiness and their competitive results in kettlebell sport. *Journal of Physical Education and Sport*, 17 (Supplement issue 4). pp. 2123–2128