Journal of Learning Theory and Methodology
Журнал теорії та методології навчання

ISSN 2708-7581 (Online)
ISSN-L 2708-7573

Original Scientific Article

Improving the Level of Physical Preparedness of Female Cadets During Studying at a Specialized Higher Military Educational Institutions

Oksana Blavt[1ACD], Gennadii Iedynak[2BCDE] and Tetiana Liudovyk[3,4 BCD]

[1]Lviv Polytechnic National University
[2]Kamianets-Podilskyi National Ivan Ohiienko University
[3]Hetman Petro Sahaidachny National Army Academy
[4]Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies of Lviv

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

DOI: 10.17309/jltm.2025.6.2.04

Abstract

Objectives. The purpose of the study was to evaluate the effectiveness of an experimental physical education program designed to optimize the development of physical fitness in female cadets – future officers during their final year of study at a specialized military higher education institution.

Material and Methods. Fifty-four female cadets (mean age at baseline: 17.4 ± 0.2 years) participated in the pedagogical experiment. The participants were assigned to an experimental group (EG) and a control group (KG), both beginning their fourth year of study at the Hetman Petro Sahaidachnyi National Army Academy. The research design included the implementation of an experimental physical education program in the EG, while the KG followed the standard curriculum. General scientific methods (analysis and systematization), pedagogical testing, a forming pedagogical experiment, and methods of mathematical statistics were used. Physical fitness was assessed using standard tests for strength, speed, power, flexibility, and endurance, as well as indicators of special physical preparedness.

Results. Analysis showed that in the KG, only aerobic endurance improved significantly over the academic year, as evidenced by the 12-minute run performance. In contrast, the EG demonstrated statistically significant improvement in all indicators of general physical fitness. Regarding special physical preparedness, four indicators in the EG were significantly higher at the end of the experiment compared with the KG, while no such advantages were observed in the KG.

Conclusions. The experimental program used to organize and implement the content of physical education proved effective in enhancing all studied indicators of physical fitness in female cadets – future officers. The improvements observed in the EG confirm the positive impact of the structured and targeted measures incorporated into the experimental program throughout the academic year.

Keywords: female cadets, future officers, physical education, physical fitness, physical preparedness.

Introduction

The activity of a military officer at the present stage is marked by increasing demands and challenges due to the prolonged military aggression of russia against Ukraine. In this context, the modernization of methods, approaches, and strategies to ensure a high level of competence among future officers during their professional training becomes particularly important (Khotin, 2022).

It is essential to note that physical education continues to hold a leading position in this educational process (Sliusarchuk, V., & Iedynak, 2023). Its implementation enables the achievement of a high level of preparedness among military personnel and future officers for performing their professional duties and operational tasks (Klymovych et al., 2020; Jamro et al., 2021).

According to the Ministry of Defence of Ukraine (mod.gov.ua), as of January 1, 2025, over 70,000 women are serving in the Armed Forces of Ukraine, and this number continues to grow. Therefore, the scientific problem, supported by the practical realities of professional military service, concerning the training of women for military service in general and future female officers for fulfilling their professional duties in particular, gains special relevance. This includes the use of forms, means, and methods of physical education during

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Corresponding Author: Oksana Blavt,
e-mail: oksanablavt@ukr.net

their training in specialized higher military educational institutions (Sliusarchuk et al., 2022).

Achieving a high level of individual military-professional mastery in the modern soldier is largely determined by the development and implementation of the organizational principles and content of physical education (Duncan, 2016; Melnykov et al., 2018; Oderov et al., 2022).

Considering the necessity of solving the tasks defined by the theory and practice of modern warfare, and the urgent need to strengthen national defense capacity during prolonged war, it is essential to improve the organization and content of physical education in specialized institutions of higher military education. This aims to achieve the maximum possible positive outcomes in enhancing the professional preparedness of women – future officers.

Analysis of recent research and publications. Physical preparedness as a fundamental quality required for military personnel has been the focus of numerous studies (Haddock et al., 2016; Ojanen et al., 2018; Iedynak et al., 2020; Rebryna et al., 2022; Yahodzinskyi et al., 2022; Vaara et al., 2023). Other works (Aandstad et al., 2020; Smith et al., 2022; Oja & Piksööt, 2023; Coge et al., 2024) have emphasized the importance of physical preparedness for developing the physical condition of future officers.

In studies by Petrachkov et al. (2024), Vantarakis et al. (2022), Banakh, Iedynak, & Blavt, (2025) and Pietiläinen et al. (2024), the role of physical preparedness in enhancing psycho-emotional resilience and developing key physical abilities is highlighted. Scholars argue (Oliver et al., 2017; Vasiliki, 2021; Sliusarchuk et al., 2021) that all aspects of military tasks can be successfully performed on the basis of high-quality physical preparedness.

Various aspects of special physical preparedness in future female officers are examined in the studies of Grier et al. (2015); Knapik, Sharp, & Steelman (2017); Schram et al. (2022); Slyusarchuk (2020), and Sliusarchuk et al. (2022). Some authors focus specifically on the impact of specialized training programs for female military personnel (Santtila et al., 2022), as well as strategies for improving both physical (Schram et al., 2022) and physiological readiness (Jamro et al., 2021; Sliusarchuk et al., 2022).

International sources highlight the existence of several key approaches to organizing physical education in NATO armies. One approach involves joint training of men and women (Aandstad et al., 2012; Santtila et al., 2022), while another provides distinct organizational conditions, means, and methods tailored specifically for women (Greeves, 2015; Chassé et al., 2019). In particular, works by Grier et al. (2015), Nindl (2015), and Zurek et al. (2022) explore individualized physical training programs using various types of physical activity for female officers in NATO forces.

Researchers (Haddock et al., 2016; Slyusarchuk, 2020) acknowledge the lack of studies aimed at modernizing physical education for future female officers in specialized military educational institutions. This modernization is especially necessary in light of growing demands for their physical preparedness, and it requires appropriate methods and means to maximize both general and special physical preparedness. Data on the actual indicators and dynamics of physical preparedness among future female officers remain scarce, which hinders the evaluation of the current approach to organizing and implementing physical education, as well as the formation of appropriate physical activity content during their training.

The purpose of the study is to determine the effectiveness of an experimental approach to organizing and implementing the content of physical education for female cadets during their training at a specialized higher military educational institute.

Materials and Methods

Research methods

The research methodology employed a set of appropriate research methods, including general scientific methods such as analysis and systematization, as well as pedagogical experiments, pedagogical testing, and methods of mathematical statistics.

The pedagogical testing method involved the use of a battery of tests, each of which met the existing metrological requirements (Thomas et al., 2022). Testing was conducted in the first and last months of training, using tests that allowed for the assessment of the development of basic motor skills.

The motor characteristics were motor qualities that were considered physical fitness at all stages of the study. At the same time, general physical preparedness combined a set of motor qualities, which were assessed using the following tests: speed – 30 m sprint from a high start, absolute hand muscle strength (dynamometry of the dominant hand), explosive strength of the lower limb muscles (standing long jump), mobility in the lumbar spine (forward bend while sitting), coordination in cyclic locomotion (4x9 m shuttle run), aerobic endurance (12-minute run for maximum distance), static strength endurance (pull-ups on bent arms, bent at the elbow joints).

Special physical preparedness was studied using a battery of tests that allowed assessing the state of strength endurance development in a dynamic mode (exercise #7 – a complex strength exercise). The exercise consists of two parts: the first is bending and unbending the torso, the second is bending and unbending the arms from a lying position. The exercise is performed on any flat surface for one minute without interruption), speed (anaerobic) endurance (exercise #10 – 100 m run), coordination («exercise #10a – 10x10 m shuttle run) and aerobic-anaerobic endurance (exercise #14 – 1000 m run). All tests used were in line with recommendations in scientific literature (Duncan, 2016; Pichugin et al, 2011; US Army, 2022).

Study Participants

Fifty-four girls participated in the experiment; at the start of the experiment, the average age of the sample was 17.4 ± 0.2 years. All participants in the study sample were divided into experimental (EG) and control (KG) groups, which began their final year (4th year) of study at the Hetman Petro Sahaidachny National Army Academy.

The study was planned and carried out following the principles of bioethics set forth by the World Medical Association (WMA-2013) in the Helsinki Declaration «Ethical Principles of Medical Research Involving Humans» and UN-

ESCO in the «General Declaration on Bioethics and Human Rights».

Research Organization

To obtain objective data on the effectiveness of the author's development, a pedagogical experiment was conducted. The formative experiment was carried out over the course of one academic year. In the EG, an experimental physical education program was tested, while in the KG, traditional organizations, content, and methods of physical activity implementation in the process of physical education in a higher military educational institutions, were used.

The subject of the study of women – future officers – was the quantitative values of motor characteristics. In particular, these values were established at the beginning and end of the academic year, and then compared within the year of study. An increase, decrease, or maintenance of a certain characteristic under study was determined.

The results of the study were based on empirical data obtained at the beginning and end of a one-year formative experiment in research groups of female future officers who were pursuing specialized higher education during their first and fourth years of study at a higher military educational institutions.

Statistical Analysis

Using adequate methods of mathematical statistics, the mean, standard deviation, mean error, asymmetry, excess, and Student's t-test were determined for each characteristic under study. The following probability levels were used to indicate statistical significance: 0.05; 0.01; 0.001 (Dawson, 2019).

Mathematical statistics methods were used to process, analyze, and interpret the experimental data using SPSS Version 22.0 (IBM Corporation).

Results

In organizing physical education for female future officers during their professional training at specialized higher education institutions, it was taken into account that the duration of physical education in various forms should not exceed the duration specified in the current working program for this academic discipline, which is approved at certain higher military educational institutions (Working program of the academic discipline, 2020). According to the provisions of the «Instructions on physical training in the system of the Ministry of Defense of Ukraine» (Ministry of Defense of Ukraine, 2021): the planning of this pedagogical process should ensure the implementation of physical training programs taking into account training (combat) tasks, the even distribution of physical training activities throughout the week, month, and year, and provide for a specified number of hours for physical training classes.

The distinctive features of the experimental physical education program are the determination of its structure by a set of factors, namely external (the optimality of the content of physical education for the maximum possible promotion of physical fitness, the adequacy of physical fitness assessment standards to the capabilities of modern girls, taking into account individual characteristics during the implementation of physical education classes and other forms of physical activity in a specialized higher education institution, the presence of a conscious and responsible attitude towards the fulfillment of requirements regulated by professional activity; monthly complication of the content of basic movements and exercises for the development of functional abilities and motor qualities, adequate distribution of all specified forms of physical activity in the daily and weekly routine of girls; taking into account the structural features of each form of such activity; effective organization of girls' activities in each of these forms; practical ensuring of the integrity of physical education.

The results of the use of the experimental development by female cadets – future officers during the last year of study in higher military educational institutions– showed certain features of changes in the values of the studied indicators.

General Physical Preparedness. At the beginning of the experiment, the values of the studied indicators in the EG and the CG were practically identical, indicating their homogeneity. Moreover, it was noted that individual values for all indicators followed a normal distribution, which allowed for the appropriate use of mathematical and statistical methods in comparative analysis.

Based on these considerations, the analysis of the obtained data revealed that in the control group over the academic year, only one physical preparedness indicator changed to a statistically significant degree. This was aerobic endurance, which improved by 6% based on the results of the 12-minute run for maximum distance ($t=5.35$; $p<0.001$) (Table 1). Additionally, it was observed that changes in the remaining indicators reflected the following trends: the development of two motor qualities – absolute muscular strength and flexibility – remained at the same level, albeit with a negative trend. The decline amounted to 2.2% based on the handgrip dynamometry of the dominant hand ($t=1.02$; $p>0.05$), and 3.6% based on the sit-and-reach flexibility test ($t=1.54$; $p>0.05$).

As for the development of other studied motor qualities, there was a significant decrease in indicator values. Specifically, static muscular endurance declined by 18.7%, speed qualities by 3.9%, explosive power of the lower limbs by 3.5% ($p<0.001$), and coordination in cyclic locomotions by 2.4% ($p<0.01$).

In the EG, the implementation of the experimental intervention led to a completely different outcome. Over the course of the academic year, all assessed indicators of general physical preparedness showed significant improvement. The greatest increase was observed in static muscular endurance, which improved by 55.3% ($t=8.95$; $p<0.001$). The smallest, yet still statistically significant improvement, was recorded in speed qualities, which increased by 2.9% ($t=2.2$; $p<0.05$).

Another confirmation of the effectiveness of the experimental intervention and its advantage over the traditional approach to physical education for women – future officers – was the final assessment of indicators in the study groups at the end of the experiment. In all cases, significantly better values of general physical preparedness indicators were recorded in the EG.

Special Physical Preparedness. At the beginning of the experiment, the values of the studied indicators in both the

Table 1. Changes in indicators of general physical preparedness of female cadets (N-54)

Indicator	Group	At beginning		t between EG and CG	At the end		Change value ($X_1 - X_2$)		t	t between EG and CG
		X_1	m_1		X_2	m2	in absolute values	y, %		
30 m sprint from a high start, s	CG	7.48	0.07	0.09	7.78	0.05	0.3	- 3.9	3.49***	7.29***
	EG	7.49	0.08		7.27	0.06	- 0.22	2.9	2.2*	
Dynamometry of the dominant hand , kg	CG	27.9	0.41	0.45	27.3	0.43	- 0.6	- 2.2	1.02	5.49***
	EG	28.2	0.52		31.2	0.57	3.0	10.6	3.9***	
Standing long jump, cm	CG	188.4	1.27	0.33	182.1	1.31	- 6.3	- 5.1	3.46***	2.2*
	EG	187.7	1.72		197.3	1.74	9.6	3.5	3.92***	
Forward leansitting, cm	CG	17.4	0.28	0.79	16.8	0.37	- 0.6	- 3.6	1.54	3.49**
	EG	16.9	0.57		19.5	0.68	2.6	15.4	3.26**	
4×9 m shuttle run	CG	11.59	0.07	0.57	11.88	0.06	0.29	- 2.4	3.11**	11.0***
	EG	11.61	0.09		10.5	0.11	- 1.11	9.6	7.82***	
12-minute run for maximum distance	CG	2021.7	18.25	0.51	2151.1	15.85	129.4	6.4	5.35***	7.36***
	EG	2007.3	21.32		2354.8	22.7	347.5	17.3	11.2***	
Pull-ups on bent arms, bent at the elbow joints, c	CG	15.68	0.48	0.04	13.21	0.5	- 2.47	- 18.7	3.58***	11.8***
	EG	15.71	0.52		24.4	0.82	8.69	55.3	8.95***	

Table 2. Changes in indicators of special physical preparedness of female cadets (N-54)

Indicator	Group	At beginning		t between EG and CG	At the end		Change value ($X_1 - X_2$)		t	t between EG and CG
		X_1	m_1		X_2	m_2	in absolute values	y, %		
Exercise #7	КГ-4	33.68	0.43	0.84	33.11	0.41	- 0.57	- 7.2	0.97	10.9***
A complex strength exercise, n	ЕГ-4	34.21	0.46		42.31	0.39	8.1	23.7	13.5***	
Exercise #10	КГ-4	16.04	0.08	0.18	15.75	0.08	- 0.29	1.8	2.57*	5.82***
100 m run, s	ЕГ-4	16.02	0.08		15.11	0.08	- 0.91	5.7	8.27***	
Exercise #10a	КГ-4	35.67	0.22	1.03	35.45	0.25	- 0.22	0.6	0.67	8.16***
10x10 m shuttle run, s	ЕГ-4	36.01	0.25		34.12	0.31	- 1.89	5.2	4.73***	
Exercise #14	КГ-4	254.5	2.56	1.61	244.5	2.42	- 10.0	3.9	2.84**	4.56***
1000 m run, s	ЕГ-4	260.7	2.87		227.8	2.75	- 32.9	12.6	8.29***	

Note: The value of t-critical for related samples at n=24: at the level of p <0.05 – 2.064, at the level of p <0.01 – 2.797, at the level of p <0.001 – 3.745; at n=108 – respectively 1.984; 2.626; 3.391; marked "*" – p <0.05; "**" – p <0.01; "***" – p <0.001

EG and the CG were compared. It was found that all indicators showed virtually no differences between the groups, as evidenced by the t-test values, which ranged from 0.18 to 1.61 (Table 2).

An analysis of the data obtained at the end of the pedagogical experiment in the EG confirmed changes across all studied indicators. In every case, the changes were positive, with gains ranging from 5.2% to 23.7%. The greatest improvement was observed in dynamic muscular endurance, assessed based on the results of Exercise #7, which increased by 23.7% (p<0.001). A high level of improvement was also recorded in aerobic-anaerobic endurance, with a gain of 12.6% (p<0.001). Smaller, yet statistically significant improvements were noted in speed endurance (5.7%), measured by Exercise #10, and in coordinative endurance (5.2%), assessed by Exercise #10a (p<0.001).

The presented data differed significantly from those obtained in the CG. This was particularly evident in the indicators of dynamic muscular endurance (Exercise #7) and coordinative endurance (Exercise #10a), the development of which remained at the previously achieved level. In the former, a negative trend was observed, with a 7.2% decrease in performance (t = 0.97; p > 0.05), while in the latter, a slight positive trend was recorded, with a 0.6% increase (t = 0.67; p > 0.05).

As for the other studied indicators, the changes demonstrated modest but notable improvements: speed endurance increased by 1.8% (t = 2.57; p < 0.05), and aerobic-anaerobic endurance by 3.9% (t = 2.84; p < 0.01).

Analyzing the data from the perspective of how many indicators had higher final values in one group compared to the other, the results showed the following: in the EG, there were four such indicators, while in the CG, there were none.

Thus, the results obtained using both assessment criteria confirmed a greater improvement in special physical preparedness among women in the EG compared to those in the CG.

Discussion

Scientific research on the modernization of the content of physical preparedness for future officers is driven by its critical role in shaping their professional readiness amid prolonged

combat operations. This aligns with a number of recent scientific studies (Marić et al., 2013; Vantarakis et al., 2022; Bahas, Nikolaienko, & Hlivinska, 2025). Physical preparedness is recognized as one of the defining components of a young officer's readiness for high-quality professional service (Klymovych et al., 2020; Oliver et al., 2017; Vasiliki, 2021).

The conducted experiment expands the existing body of knowledge regarding the role of physical preparedness in shaping general combat readiness (Ojanen et al., 2018; Haddock et al., 2016; Jamro et al., 2022; Vaara et al., 2022). We support the scholarly view that this can be achieved through adherence to modern physical activity guidelines (Haddock et al., 2016; Smith et al., 2022; Oja, & Piksööt, 2023), adapting female military physical training to the contemporary demands of warfare (Greeves, 2015), and incorporating various forms of physical activity (Iedynak et al., 2020; Rebryna et al., 2022; Yahodzinskyi et al., 2022).

The obtained results are attributed to a combination of factors. One of the main factors is the effectiveness of all physical education activities developed and implemented within the framework of the experimental program for female cadets undergoing training in specialized higher military institutions. This conclusion is partially supported by the findings of other researchers (Greeves, 2015; Nindl, 2015; Santtila et al., 2015; Coge et al., 2024), which emphasize that optimal individualized training programs – empirically validated – provide effective preparation, including for women in military service.

This is also consistent with scientific perspectives (Aandstad et al., 2020; Melnykov et al., 2018; Coge et al., 2024) highlighting the need for ongoing monitoring of physical preparedness parameters throughout training in specialized military educational institutions.

Our study confirms the effectiveness of specially developed training programs for female military personnel, which can influence adaptation to training during military service (Jamro et al., 2021; Santtila et al., 2022) and improvement in physical condition (Grier et al., 2015). It also supports the formulation of physical preparedness programs based on women's military specialization as a key criterion for determining training direction (Nindl, 2015), within specific areas of military activity, considering sex-specific characteristics and physical attributes (Coge et al., 2024), as well as the defined structure of changes in general physical preparedness among female cadets (Sliusarchuk et al., 2022).

Moreover, it highlights the importance of adjusting training curricula based on gender differences (Bustamante-Sánchez, Nikolaidis, & Clemente-Suárez, 2022; Zurek et al., 2022), and accounting for the dependency between combat readiness and the level of physical preparedness (Jamro et al., 2022; Oderov et al., 2022).

Conclusions

Physical education remains one of the key factors determining the high level of professional preparedness of young officers upon graduation from military academies, as well as the maintenance of this level throughout their professional careers. At present, there is insufficient data on the dynamics of general and specialized physical preparedness indicators among female cadets – future officers – during their studies at higher military educational institutions.

The current approach to organizing and implementing physical education programs for female cadets – future officers promotes the development of only certain motor qualities, while others show only a positive trend without significant improvement. The implementation of an experimental framework for organizing, structuring, and delivering physical activity content over the course of one academic year enabled female cadets to achieve results that significantly improved all examined physical preparedness indicators. Comparative analysis between corresponding experimental groups confirmed statistically significant differences.

These outcomes are attributed to the effectiveness of the measures proposed by the experimental program, which were implemented within the military academy's physical education system for female cadets. The obtained findings should be considered in the planning and execution of physical education programs in higher military educational institutions, as they contribute to enhancing the overall efficiency in achieving the intended objectives.

Informed Consent

Informed consent was obtained from all participants.

Data Availability

The data are not publicly available due to ethical or privacy restrictions; anonymized data may be provided upon reasonable request.

Conflict of Interest

The authors declare no conflicts of interest.

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Підвищення рівня фізичної підготовленості курсанток під час навчання у спеціалізованому військовому закладі вищої освіти

Оксана Блавт[1ACD], Геннадій Єдинак[2BCDE], Тетяна Людовик[3,4BCD]

[1]Національний університет «Львівський політехніка»
[2]Кам'янець-Подільський національний університет імені Івана Огієнка
[3]Національна академія сухопутних військ імені гетьмана Петра Сагайдачного
[4]Львівський національний університет ветеринарної медицини та біотехнологій імені С. З. Ґжицького

Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 8 с., 2 табл., 15 джерел.

Мета дослідження полягала у визначення ефективності експериментального підходу до організації та реалізації змісту фізичного виховання курсанток – майбутніх офіцерів під час навчання у спеціалізованому військовому закладі вищої освіти.

Матеріал та методи. В експерименті взяли участь 54 курсантки, вік у вибірці становив 17,4 ± 0,2 років. Усі учасники досліджуваної вибірки було розподілено на експериментальну та контрольну групи, які розпочали останній рік навчання (4 курс) у спеціалізованому військовому закладі вищої освіти. Методологія дослідження передбачала використання комплексу адекватних методів дослідження, зокрема, загальнонаукових, а саме аналізу, систематизації, а також педагогічного експерименту, педагогічного тестування, методів математичної статистики. Метод педагогічного тестування передбачав використання батареї тестів.

Результати. Результати використання експериментальної розробки курсантками – майбутніми офіцерами протягом останнього року навчання у спеціалізованому військовому закладі вищої освіти засвідчили певні особливості зміни значень досліджуваних показників. На початку експерименту значення досліджуваних показників у ЕГ та КГ були практично однаковими, що свідчило про їхню однорідність.

Згідно аналізу одержаних даних щодо загальної фізичної підготовленості, встановлено, що у КГ протягом навчального року на статистично значущу величину змінилися значення тільки одного показника. Таким була аеробна витривалість дівчат, а її поліпшення за результатом 12-хвилинного бігу на максимальну відстань. У ЕГ реалізація експериментального чинника призвела до суттєвого поліпшення усіх досліджуваних показників загальної фізичної підготовленості. Аналізуючи дані спеціальної фізичної підготовленості з позиції кількості показників, значення яких наприкінці експерименту в одній групі були вищими, аніж у іншій, засвідчили таке. У ЕГ таких показників було 4, тоді як у КГ– жодного.

Висновки. Використання експериментальної розробки до організації, формування й реалізації змісту фізичного виховання у спеціалізованому військовому закладі вищої освіти забезпечує курсанткам – майбутнім офіцерам досягнення результатів, що сприяло суттєвому поліпшенню всіх досліджуваних показників фізичної підготовленості, які при порівнянні у відповідних дослідних групах засвідчують розбіжність на статистично значущу величину. Одержаний результат пов'язували з ефективністю передбачених експериментальною розробкою заходів, що були зреалізовані у спеціалізованому військовому закладі вищої освіти під час фізичного виховання курсанток – майбутніх офіцерів.

Ключові слова: курсантки, майбутні офіцери, фізичне виховання, фізична підготовленість, фізична підготовка.

Information about the Authors:

Blavt Oksana: oksanablavt@ukr.net; https://orcid.org/0000-0001-5526-9339; Department of PE, Lviv Polytechnic National University, Bandera St., 12, Lviv, 79013, Ukraine.

Iedynak Gennadii: yedinak.g.a@gmail.com; https://orcid.org/0000-0002-6865-0099; Kamianets-Podilskyi National Ivan Ohiienko Universit, Department of Theories and Methods of Physical Education; 32301, Kamianets-Podilskyi, Ohiienko Street, 62, Ukraine

Liudovyk Tetiana: tluidovyk@gmail.com; https://orcid.org/0000-0002-2407-0447; Hetman Petro Sahaidachny National Army Academy, 79012, Lviv, Heroes of Maidan Street, 32, Ukraine.

Department of PE, sports and health Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies of Lviv; St. Pekarska, 50 Lviv, 79010, Ukraine.

Cite this article as: Blavt, O., Iedynak, G., & Liudovyk, T. (2025). Improving the Level of Physical Preparedness of Female Cadets During Studying at A Specialized Higher Military Educational Institutions. *Journal of Learning Theory and Methodology, 6*(2), 86-93. https://doi.org/10.17309/jltm.2025.6.2.04

Received: 15.07.2025. Accepted: 16.08.2025. Published: 30.08.2025