

The impact of controlled physical loads on the level of resilience of cadets

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ABSTRACT

Aim: To investigate the impact of controlled physical loads on the level of resilience of cadets.

Materials and Methods: The study lasted for one academic year (September 2024–June 2025) and had a longitudinal design. It involved 127 cadets divided into an experimental group (EG, N=65) and a control groups (CG, N=62). Cadets of the EG, during sports and mass work (SMW), engaged according to the developed programme, whereas cadets of the CG followed the current programme of SMW. The programme of controlled physical loads included breathing exercises, progressive muscle relaxation, exercises for developing psychophysiological endurance, as well as exercises for maintaining the balance of the neuromuscular system. The resilience of the cadets was assessed using the Connor-Davidson Resilience Scale (CD-RISC-10).

Results: The results of the study of the impact of controlled physical loads on the level of resilience of cadets demonstrated statistically significant differences between the EG and CG at the end of the study ($|t|=3.63>1.96$; $p<0.001$), which confirmed the effectiveness of the proposed programme. In the EG, there was a substantial increase in the number of cadets with a high level of resilience (from 27% to 45%), whereas in the CG this indicator remained unchanged.

Conclusions: The practical significance of the obtained results lies in the possibility of integrating the programme of controlled physical loads into cadet training curricula as a means of purposefully developing their psychological readiness to act under extreme conditions.

KEYWORDS: resilience, controlled physical loads, physical activity, stress resistance, cadets, psychophysiological adaptation

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INTRODUCTION

The Russian armed aggression has significantly transformed all spheres of peaceful life of the population of Ukraine, destroying the basic sense of security and causing profound psychological distress, the consequences of which are dangerous for both children and the adult population. The war has become an extreme, and in some cases hyper-extreme, factor for certain social groups, as the internal psycho-emotional loads it generates often exceed the limits of human adaptive capacities [1, 2].

Armed aggression has led to substantial psychological consequences, in particular a decrease in stress resistance among higher education students and an increase in the intensity and frequency of experiencing stress-related conditions [3, 4]. According to research findings [5, 6], more than half of cadets affected by the war experience manifestations of stress, and about two thirds of them report difficulties in coping with it.

Cadets of higher education institutions are, on the one hand, active students and, on the other, future military personnel.

Thus, in the course of their studies, cadets encounter a multidimensional spectrum of stressors that require targeted intervention in order to optimise the emotional-volitional sphere, reduce the level of psychophysiological tension, and prevent destructive manifestations of stress [7, 8]. The multidimensionality of stress loads is determined by the complex system of social and professional roles combined within the cadet. They simultaneously act as a student mastering an educational programme under conditions of high academic intensity; as a citizen of a state under armed aggression; and as a future officer entrusted with responsibility for fulfilling military duty and readiness to participate in combat operations. Such a combination of roles creates a specific psychological burden that requires targeted psychological support and systematic preparation for overcoming stress [9, 10].

According to scholars [11–14], one of the methods of preventing stress conditions and coping with stress is the use of controlled physical loads. From a practical perspective on the training of future officers, the greatest interest

lies not in the direct struggle against stress, but in the possibility of teaching cadets to counteract the negative effects of stress and to strengthen their resistance to its consequences. Therefore, the main objective of this study is to investigate the impact of controlled physical loads on the resilience of cadets. Resilience, or psychological stability, in contemporary scholarship is defined as the ability of an individual to restore effectiveness after exposure to stressors while maintaining cognitive and emotional balance [15, 16]. For future officers, the development of resilience is critically important, as it determines not only professional reliability but also the ability to maintain viability under combat conditions [17-19].

According to studies [20, 21], physical activity acts as a powerful regulator of emotional states, levels of anxiety, and biochemical indicators of stress. In this context, physical exercise may be considered not only as a means of physical training, but also as an instrument of preventive psychophysiological stabilisation that shapes adaptive behaviour in extreme situations.

AIM

The aim is to investigate the impact of controlled physical loads on the level of resilience of cadets.

MATERIALS AND METHODS

The study involved 127 second-year cadets enrolled in various faculties of the Kruty Heroes Military Institute of Telecommunications and Information Technology (Kyiv, Ukraine). The participants were divided into control groups (CG1, N=32; CG2, N=30) and experimental groups (EG1, N=33; EG2, N=32). In total, the groups comprised 110 males and 17 females. Within the framework of the study, the cadet was considered as a future combat unit; therefore, gender specificity was not analysed. Differences by sex influenced only the selection of exercises during physical training in accordance with the current regulatory documents.

To confirm the homogeneity of the groups at the ascertaining stage, a comparative analysis of the physical fitness and resilience levels of the cadets was conducted. The results of cadets' performance in physical exercises were examined (for males: 100 m sprint, combined strength exercise on the horizontal bar, 3 km run, shuttle run 6 × 100 m; for females: 100 m sprint, trunk flexion and extension, 3 km run, agility exercise), and the level of resilience was assessed using the Connor–Davidson methodology (CD-RISC-10).

The level of physical fitness of the cadets was assessed using a 12-point scale (rating system – RS) and interpreted as follows: 11-12 points – high level, 8-10 – sufficient, 5-7 – satisfactory, <5 – unsatisfactory). Resilience was measured according to the standard scale of the Connor–Davidson methodology (CD-RISC-10): low; below average; average; above average; high [22, 23].

The study of the level of development of physical qualities of cadets in different groups at the ascertaining stage showed that none of the cadets had a low level of physical fitness. The differences between the achievements of cadets in

the respective groups (CG1 vs CG2 and EG1 vs EG2) were not statistically significant. Thus, the mean RS score for CG1 was 8.99 compared to approximately 8.44 in CG2. The difference between the mean scores was $|8.99-8.44|=0.47$ points. The calculation of Student's t-test ($df=60$) showed $|t|=1.005722 < 1.96$ ($\alpha=0.05$). Similarly, the calculation of Student's t-test for the experimental groups showed $|t|=0.963 < 1.96$ ($\alpha=0.05$). Thus, no statistically significant differences were found between the experimental groups or between the control groups, which allowed us, at the ascertaining stage of the experiment, to combine both control groups into a single sample CG (N=62), and to consider the experimental groups as a single group EG (N=65). A comparison between EG and CG using Student's t-test also showed that the differences between them were not statistically significant $|t|=0.763 < 1.96$ ($\alpha=0.05$).

The generalised results of the physical fitness of cadets in the CG and EG are presented in Table 1. The results indicate that 59.2% of cadets in the EG and 59.3% of cadets in the CG were at sufficient and high levels, which confirms the statistical homogeneity of the groups at the initial stage of the study.

STUDY OF THE LEVEL OF RESILIENCE AT THE ASCERTAINING STAGE

The initial measurement of resilience using the CD-RISC-10 scale also confirmed the similarity of the groups. In the CG (N=62) and EG (N=65), the distribution of cadets across categories was similar, with a predominance of the 'average' and 'above average' levels. The mean values made it possible to test the hypothesis of equality of means: $df=123$, $|t|=1.52 < 1.96$ ($\alpha=0.05$), which also confirms the statistical homogeneity of the groups prior to the experimental intervention.

Thus, at the ascertaining stage, the two groups did not differ in terms of the level of physical fitness and resilience, which is a necessary condition for further comparative analysis of the results of the experimental programme.

Both groups performed physical exercises in accordance with the approved physical training programmes and regulatory documents of the Ministry of Defence of Ukraine. The results were conditionally assessed according to four levels: low, satisfactory, sufficient, and high, corresponding to the rating scale (RSO 1-4, 5-7, 8-10, 11-12).

The level of resilience was assessed using the short version of the Connor–Davidson Resilience Scale (CD-RISC-10). This version comprises 10 of the most informative items from the original CD-RISC-25, selected on the basis of factor analysis to ensure validity and reliability [24]. The purpose of applying this instrument was to determine the individual level of stress resistance and the capacity for adaptation under stress, which is essential for preparing cadets to perform combat tasks.

The experimental programme of controlled physical loads included three stages:

Adaptive-toning stage (first 2 months): breathing regulation exercises, stretching, static body holds, and post-tension relaxation.

Table 1. Generalized results of the physical fitness of cadets in the CG and EG, %

Exercise	Level of Physical Fitness					
	Satisfactory		Sufficient		High	
	CG	EG	CG	EG	CG	EG
100 m run	11.3	12.3	11.3	15.4	77.4	72.3
Combined strength exercise (sit-ups)	37.1	33.8	4.8	9.3	58.1	56.9
3 km run	27.4	27.7	12.9	13.8	59.7	58.5
Shuttle run 6×100 m	32.3	33.8	67.7	66.2	0.0	0.0
Agility exercise	30.6	30.8	21.0	21.5	48.4	47.7
Integral assessment	27.74	27.68	23.54	25.24	48.72	47.08

Source: compiled by the authors of this study

Regulatory-dynamic stage (from the 3rd to the 6th months): a combination of aerobic (running, swimming, loaded marches) and moderate-intensity strength exercises with heart rate monitoring (HR=60-70% of the maximum value).

Stabilisation–resilience stage (months 7-9): stress-modelling exercises (training under conditions of noise, time constraints, and temperature variation), short sessions of body-based meditation and self-mobilisation.

The duration of each session was 90 minutes, with a frequency of three times per week. The programme was structured as a controlled intervention: physiological parameters (heart rate, blood pressure, and level of tension) were monitored using portable biomonitors, and the load was adjusted individually.

The main exercises included a 100 m sprint, a combined strength exercise on the horizontal bar, trunk flexion and extension, a 6 × 100 m shuttle run with a rifle and magazine pouch, as well as a complex agility exercise.

Relaxation and psychophysiological stability exercises. The process of practising relaxation techniques involved performing a set of specially selected exercises aimed at the gradual relaxation of the muscles of the arms, legs, trunk, neck, and face. Each exercise was performed sequentially in order to develop the ability to consciously alternate between muscle tension and relaxation, which constitutes a fundamental condition for achieving psycho-emotional balance and maintaining optimal combat readiness.

- The progressive muscle relaxation complex included:
- relaxation of the arm muscles – tension from the shoulders to the hands followed by relaxation and concentration on sensations of warmth and vibration;
 - relaxation of the leg muscles – tension in both legs with simulated pressure of the feet against a surface, followed by complete relaxation and awareness of changes in sensation;
 - relaxation of the trunk muscles – tension of the abdominal and back muscles followed by gradual release of tension;
 - relaxation of the neck muscles – drawing the head into the shoulders to create tension followed by relaxation;

- relaxation of the facial muscles – sequential tension and relaxation of individual muscle groups (forehead, eyes, lips, jaw, tongue) to reduce emotional tension.

Additional exercises were aimed at detailed work with the hands, forearms, shoulders, lower legs, and thighs, performed according to a scheme of short-term (4-5 s) tension followed by rapid relaxation, which contributes to the development of conscious control of bodily states and enhances psychophysiological resilience.

The study was conducted from September 2024 to May 2025. The level of resilience was assessed twice: at the beginning and after completion of the experimental programme. The CD-RISC-10 scale was used to evaluate the dynamics of the results, along with rating systems for assessing the physical performance of cadets.

The procedure for organizing the study and the topic of the article were previously agreed with the Committee on compliance with Academic Integrity and Ethics of the Heroes Military Institute of Telecommunications and Information Technology. Also this study followed the regulations of the World Medical Association Declaration of Helsinki. Informed consent was received from all cadets who took part in this study.

FRAMEWORK

The study was conducted within the framework of the Scientific Research Plan of the Department of Physical Culture and Sports of the National University of Life and Environmental Sciences of Ukraine for 2023-2026 within the framework of the scientific research work «Theoretical and methodological foundations of educational work in environmental and agricultural higher educational institutions». State registration number 0115U003561.

RESULTS

The study of cadets’ resilience levels at the end of the research period demonstrated a pronounced positive dynamic in the experimental group (EG), whereas in the control group (CG) the indicators remained almost unchanged (Table 2).

Table 2. Results of the study of resilience levels in cadets of the EG and CG at the end of the research period, %

Level of Resilience	CG (N = 62)	EG (N = 65)
Low (0-15)	0	0
Below Average (16-20)	6.2	1.3
Average (21-25)	29.0	20.4
Above Average (26-30)	36.6	32.9
High (31-40)	28.3	45.4

Source: compiled by the authors of this study

The calculation of the significance of differences using Student's t-test showed that its value substantially exceeds the critical threshold: $|t|=3.63 > 1.96$. Thus, the obtained t-value is statistically significant at the level of $p < 0.001$. This indicates that the level of resilience in the experimental group (EG) after the implementation of the exercise complex is significantly higher than in the control group (CG) following the experimental programme. The differences exceed the threshold of statistical significance ($\alpha=0.05$), confirming the effectiveness of the proposed intervention.

To assess the stability of changes and the internal consistency of the data, a Pearson correlation analysis was conducted between the mean resilience scores at the baseline and formative stages within each group (assuming normal distribution of the data, as confirmed by the Shapiro-Wilk test at the sample level).

CG: M1const=21.62 points, M1form=28.12 points;

EG: M2const=22.78 points, M2form=30.34 points.

Let us consider the increase in resilience:

$\Delta CG = 28.12 - 21.62 = 6.50$ points;

$\Delta EG = 30.34 - 22.78 = 7.56$ points.

The difference in increase: $7.56 - 6.50 = 1.06$, which constitutes approximately a 16% relative excess of the increase in the EG compared to the CG. This further confirms the effectiveness of the experimental intervention.

Thus, at the beginning of the study, the differences between the results of the CG and EG were not statistically significant; however, after the formative stage, a statistically significant increase in the level of resilience was recorded in the EG.

DISCUSSION

The findings of the study are consistent with the conclusions of scholars [19, 25, 26], who demonstrate that regular physical activity stimulates hormonal regulation of the stress system, particularly through the normalisation of cortisol levels. In the context of military education, the obtained data indicate that systematic physical exercises structured according to the principle of controlled load can enhance cadets' adaptability to psycho-emotional overload and contribute to the development of confidence in their own capabilities.

The results show that controlled physical loads have a significant impact on increasing the level of resilience in cadets. Repeated measurement demonstrated that after the implementation of the experimental programme, the mean level of resilience in the EG increased from 22.78 to

30.34 points, whereas in the CG the increase was smaller, from 21.62 to 28.12 points. The absolute increase in the EG was 7.56 points, compared to 6.50 points in the CG; the relative excess of increase in the EG compared to the CG was approximately 16%, indicating the additional effectiveness of the applied exercises.

Statistical analysis confirmed the significance of the differences. The calculation of Student's t-test yielded $|t|=3.63$ with $df=123$, exceeding the critical value of 1.96 for $\alpha=0.05$ ($p < 0.001$). This indicates that the mean level of resilience in the EG after the experimental programme is significantly higher than in the CG. To assess the effect size, Cohen's d was calculated ($d \approx 0.44$). This value corresponds to a 'moderate effect' according to Cohen's classification, underscoring the practical significance of the intervention. The 95% confidence interval for the difference between means was $CI \approx (2.22 \pm 1.16) \rightarrow [1.06; 3.38]$, which confirms the statistical significance and reliability of the results.

The mechanism of the influence of physical loads on psycho-emotional stability can be explained by both physiological and psychological factors. Physical exercise contributes to the normalisation of cortisol levels and other stress-related hormones, as confirmed by numerous studies [27]. At the same time, regular training enhances brain neuroplasticity, promotes the release of endorphins, and stimulates systems responsible for mood regulation and emotional stability [28]. Psychologically structured physical exercises also function as a form of "controlled stress", preparing individuals for rapid adaptation to extreme situations, which is particularly relevant for cadets [29].

It should be noted that controlled physical loads represent one of the most accessible methods of enhancing resilience, though not the only one. The optimal development of psychological stability requires a comprehensive approach that includes psychological training, cognitive self-regulation techniques, and social support [8, 9, 30].

Thus, the obtained results confirm the effectiveness of implementing structured physical exercises in the educational process of cadets to enhance their psycho-emotional stability and resilience, highlighting the need for a comprehensive and systematic approach to the development of psychophysiological readiness for stressful situations.

CONCLUSIONS

It has been demonstrated that the targeted implementation of a system of controlled physical loads in the process of

cadets' physical training significantly increases their level of resilience. In contrast to the existing physical training programme, the specially designed complex, which combines physical exercises with breathing regulation techniques and progressive muscle relaxation, ensures a statistically significant increase in the individual's adaptive potential.

A comparative analysis of the CD-RISC-10 scale indicators after the completion of the longitudinal study (September 2024 – June 2025) revealed statistically significant differences between the experimental and control groups ($|t|=3.63$, $p<0.001$). The calculation of the effect size (Cohen's $d \approx 0.44$) indicates a moderate yet practically significant impact of the proposed intervention on the psycho-emotional state of cadets.

In the experimental group, a substantial increase in the number of cadets with a high level of resilience was recorded (from 27% to 45%), whereas in the control group this indicator remained almost unchanged. This confirms that controlled physical loads contribute not only to the overall improvement of the psycho-emotional state but also to the transition of the individual to a qualitatively

higher level of stress resistance required for functioning in extreme conditions.

It has been established that the positive dynamics are determined the complex impact of the exercises on the neuromuscular system and hormonal balance. The combination of aerobic loads, balance exercises, and relaxation techniques acts as 'controlled stress', training self-regulation mechanisms, reducing anxiety levels, and enhancing the capacity for rapid recovery after psychophysiological strain.

The obtained results substantiate the feasibility of integrating elements of the controlled physical loads programme into cadet training curricula. The proposed programme may be recommended as a means of preventing professional burnout and enhancing cadets' combat readiness under martial law conditions, and may also be adapted for other categories of individuals exposed to chronic stress.

PROSPECTS FOR FURTHER RESEARCH

Prospect for further research is to investigate the impact of controlled physical loads on the level of cadets' somatic and mental health under martial law.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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