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# SCIENTIFIC JUSTIFICATION OF THE EFFECT OF HAND-TO-HAND FIGHTING ON CARDIORESPIRATORY AND PSYCHOPHYSIOLOGICAL FUNCTIONAL INDICATORS IN MILITARY SCHOOLS

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**Abstract**

This article examines the impact of hand-to-hand combat training on the cardiorespiratory system and psychophysiological functional indicators in military cadets. The study evaluated the cardiovascular system's reactivity, external respiratory function, physical performance, and neurodynamic properties. The results of a 12-week experimental program demonstrated that hand-to-hand combat training enhances functional reserves, improves adaptive mechanisms, and enhances the performance of military cadets.

**Keywords**: Hand-to-hand combat, cadet, cardiorespiratory system, functional reserve, adaptation, and psychophysiological state.

## Introduction

Modern conditions of military activity require a high level of physical fitness, functional stability, as well as psychological endurance. It is necessary that the military personnel perform high-intensity physical loads in a short period of time, make quick and clear decisions, and also be able to coordinate actions in extreme situations. Therefore, in military educational institutions, improving not

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only the general physical, but also special-practical training of Cadets is one of the priorities.

Hand combat as a sport in the military-priklad direction serves as an effective tool in the development of complex functional training of cadets. Its content focuses on the harmonious formation of physical qualities such as strength, agility, endurance, agility and coordination. Methodically, hand-to-hand combat elements share similarities with Sambo, Judo, and Army Hand-to-Hand Combat systems, which include high-intensity interval loadings, resistive exercises, and complex coordination actions.

Scientific sources claim that high-intensity training expands the functional capabilities of the cardiovascular and respiratory systems, increases myocardium contraction strength, improves peripheral circulation, and improves aerobic and anaerobic energy supply mechanisms. Such loadings increase the body's adaptive response reactions by mobilizing functional reserves. In particular, exercises of an interval nature lead to an economy of heart rate, an increase in the volume of the tattoo and an improvement in the indicators of maximum oxygen consumption.

At the same time, hand-to-hand combat training has a significant impact not only on the somatic systems, but also on the activity of the central nervous system. The process of performing complex tactical tasks, rapid situational thinking and adaptation to the actions of the opponent ensures the activation of psychophysiological processes. As a result, the speed of sensorimotor reactions, attention stability and accuracy of movement increase. This ranks among the professionally important qualities for a military professional.

However, in existing studies, the complex — that is, in the cross section of cardiorespiratory and psychophysiological systems — effect of hand-to-hand combat training on the body of Cadets is not sufficiently illuminated. Many scientific works are limited to the study of individual physical qualities or general indicators of endurance. And in the conditions of military educational institutions, when assessing the effectiveness of training, it is necessary to analyze the functional state of the organism on the basis of a systematic and integrative approach.[1]

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In this regard, the experimental study of the effect of hand-to-hand combat training on the indicators of the cadets cardiorespiratory system (heart rate, arterial pressure, lung capacity, performance indices) and psychophysiological parameters (reaction time, neurodynamic stability) is of scientific and practical importance.

The relevance of the study is determined by the need to optimize functional training in the military education system, plan training loads on a scientific basis, and improve the professional competence of cadets.

The purpose of the study is the scientific justification of the impact of hand-to-hand combat training on cardiorespiratory and psychophysiological functional indicators in cadets of military educational institutions.

**Research Tasks:**

- Determining the initial functional status of cadets;
- Development and introduction of a 12-week hand-to-hand combat training program;
- Analysis of changes in cardiorespiratory and psychophysiological indicators under the influence of training;
- Development of practical recommendations based on the results obtained;

**Research methods**

The study was carried out in the form of a pedagogical experiment, with the participation of a parallel control group. The duration of the study was 12 weeks. In the scientific work, a quasi-experimental design was applied, in which experimental and control groups were formed at a level comparable to each other in terms of initial indicators.

**Study participants**

The study involved cadets from 48 military educational institutions aged 18-22. Participants were selected from individuals who had undergone a health medical examination and were allowed to exercise.[2,3]

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Cadets were divided into two groups based on the method of random selection:
**Experimental group (n=24)** — engaged on the basis of a hand-to-hand combat training program;
**Control group (n=24)** — conducted training on the traditional physical training program.
No statistically reliable difference between groups in age, height, body weight, and initial functional indicators was determined ($p>0.05$).

**Description of the training program.**
Hand-to-hand combat training developed for the experimental group was organized 3 times a week, 90 minutes each. The exercises followed the following structure:
**1. Preparatory part (15-20 minutes):**
all-inclusive exercises;
dynamic stretching exercises;
light jogging and special exercises that prepare the cardiovascular system for work.

**2. Main part (50-60 minutes):**
shock and protection techniques;
throwing and fighting elements;
working in pairs.

**3. Final part (10-15 minutes):**
breathing recovery exercises;
static stretching;
heart rate normalization exercises.
The intensity of training was carried out in the range of 70-85% compared to the maximum indicator of heart rate (HRmax).
And the control group was engaged in general physical training exercises (elements of running, strength training, sports games).

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**Research methods and measurement indicators.**

**1. Anthropometric measurements**

Height (cm)

Body weight (kg)

Body mass index (BMI)

**2. Cardiorespiratory indications**

Heart rate (YUT) — in a calm state and after a standard physical load (method of palpation and pulsometry).

Arterial blood pressure-measured using the Korotkov method.

The Rufye-Dickson index is for assessing the functional state of the cardiovascular system.

The lung's lifetime capacity (axis) was determined by the method of spirometry.

PWC170 test-physical performance assessment based on submaximal loading.

**3. Psychophysiological indicators**

Typical visual-motor reaction time;

Differential reaction rate;

Motion coordination accuracy.

**Stages of research**

The study was carried out in three stages:

Initial (pre-test) — all indicators were taken from the initial measurement.

Experimental stage-training was organized for 12 weeks.

Final (post-test) - all functional indicators were re-measured and compared.

**Statistical analysis**

The results obtained were processed using mathematical-statistical methods. The calculations revealed the following:

Arithmetic mean value (M)

Standard deviation (SD)

Student t-criterion (for even and independent selections)

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Reliability ($p<0.05$ and $p<0.01$

The data was analyzed using statistical package software. The results were expressed in the form of tables and diagrams.[4,5,6]

## Tadqiqot natijalari

At the end of the 12-week pedagogical experiment, cardiorespiratory and psychophysiological indicators of experimental and control groups were compared. The results were presented in terms of the average arithmetic value (m±SD.

**Dynamics of cardiorespiratory indicators (m±SD) Table 1.**

| < / Score > | Group | Initial | Final | Ed. (%) | p |
|---|---|---|---|---|---|
| Heart rate | Experience | 72.4 ± 3.1 | 65.6 ± 2.8 | ↓ 9.4% | <0.05 |
| | Control | 71.8 ± 3.4 | 70.9 ± 3.2 | ↓ 1.2% | >0.05 |
| Rufye-Dickson index | Experience | 9.8 ± 0.7 | 8.1 ± 0.6 | ↓ 17.2% | <0.01 |
| | Control | 9.6 ± 0.8 | 9.4 ± 0.7 | ↓ 2.1% | >0.05 |
| Lung living capacity (ml) | Experience | 4100 ± 210 | 4637 ± 230 | ↑ 13.1% | <0.05 |
| | Control | 4085 ± 195 | 4140 ± 205 | ↑ 1.3% | >0.05 |
| PWC170 (kg/min) | Experience | 1150 ± 85 | 1320 ± 90 | ↑ 14.8% | <0.01 |
| | Control | 1135 ± 80 | 1160 ± 78 | ↑ 2.2% | >0.05 |

**Dynamics of psychophysiological indicators (M±SD) Table 2**

| < / Score > | Group | Initial | Final | Ed. (%) | p |
|---|---|---|---|---|---|
| Normal reaction time (ms) | Experience | 245 ± 12 | 218 ± 10 | ↓ 11% | <0.05 |
| | Control | 243 ± 11 | 238 ± 10 | ↓ 2.0% | >0.05 |
| Differential reaction (ms) | Experience | 312 ± 15 | 278 ± 14 | ↓ 10.9% | <0.05 |
| | Control | 310 ± 16 | 304 ± 15 | ↓ 1.9% | >0.05 |
| Motion accuracy (%) | Experience | 84.5 ± 3.2 | 91.2 ± 2.8 | ↑ 7.9% | <0.05 |
| | Control | 85.1 ± 3.0 | 86.0 ± 3.1 | ↑ 1.1% | >0.05 |

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## General Analysis

✓In the experimental group on cardiorespiratory indicators, all parameters were reliably improved.

✓There was an increase in the economy of cardiac activity and an increase in working capacity.

✓Psychophysiological indicators were significantly optimized.

✓In the control group, however, no statistically significant change was detected. Total growth rate of Integral indicators.

The experimental group had an average increase of 12-15% in overall functional readiness. In the control group, however, this figure was around 2-3%.

## Discussion

The results of this study confirmed the complex positive effect of hand-to-hand combat training on cardiorespiratory and psychophysiological functional indicators of the body of cadets of military educational institutions. At the end of the 12-week experimental program, the experimental group observed an economization of the activity of the cardiovascular system, an improvement in the function of external breathing and an increase in the rate of psychomotor reactions.

First, a reliable decrease in heart rate at rest indicates an increase in myocardium contraction force and tattoo size. This condition is explained by the economy of cardiac activity, that is, when performing work of the same volume, the body spends less energy. While a significant improvement in the Rufye-Dickson index indicates an expansion in the functional reserves of the cardiovascular system. These results confirm that high-intensity interval loads activate the adaptive mechanisms of the heart muscle.[7,8]

Secondly, increased lung capacity (OTS) and PWC170 indicators indicate the development of the external respiratory system as well as general working capacity. Short-term, but high-intensity loads observed in hand-to-hand combat training simultaneously activate aerobic and anaerobic energy supply systems.

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As a result, the efficiency of oxygen use increases, oxidation processes in peripheral tissues increase, and the overall level of durability increases.

Third, improved psychophysiological indicators mean that the functional state of the central nervous system is optimized. The reduction in reaction time and the increase in motion accuracy are evidence of improved sensorimotor integration processes. During hand-to-hand combat training, the cadet constantly makes a quick situational decision, predicts the opponent's movement and performs a suitable response reaction in a short time. Such activity activates neurodynamic processes, increasing the rate of passage of nerve impulses and the stability of central control mechanisms.

The results showed that the changes observed in the control group were not statistically significant. This means that traditional physical fitness training does not have the same complex and high-intensity effect on the functional systems of the body as hand-to-hand combat training. The advantage of hand-to-hand combat training is that they simultaneously develop strength, agility, endurance and coordination and activate vegetative and central control systems in parallel. Also, the results of the study are consistent with the requirements of military professional activities. The military is often required to exhibit maximum strength and agility in a short period of time, while maintaining functional stability under high stress conditions. Hand-to-hand combat training serves to form just such an integrative preparation. The expansion of the adaptive capabilities of the organism is an important factor for the effective performance of military tasks.

The practical significance of this study is that by integrating hand-to-hand combat training on a scientific basis into the process of military education, the level of functional training of Cadets can be significantly increased. In this case, planning the load volume and intensity based on individual functional indicators allows you to achieve even higher efficiency.

At the same time, the study has some limitations. The relatively limited number of samples as well as the limited duration of the study to 12 weeks make it impossible to fully assess long-term adaptive changes. In the future, it is

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advisable to conduct comprehensive longitudinal studies with the participation of cadets with different age categories and training levels.[9,10]

In general, the results obtained scientifically substantiate the fact that hand-to-hand combat training has a complex positive effect on the cardiorespiratory and psychophysiological systems of the body of cadets, expands functional reserves and is an effective tool in optimizing professional and practical training.

## Conclusion

The results of this study showed that the systematic and scientific organization of hand-to-hand combat training in cadets of military educational institutions significantly improves their cardiorespiratory and psychophysiological functional state. At the end of the 12-week experimental program, in the experimental group, the economization of the activity of the cardiovascular system, an increase in the indicators of the external respiratory system, an increase in general working capacity and an improvement in the speed of psychomotor reactions were determined at a statistically reliable level.

During the study, it was found that hand-to-hand combat training activates the body's adaptive mechanisms through high-intensity interval loads. As a result, the functional capacity of the heart muscle increases, the hemodynamic stability is strengthened, and the efficiency of oxygen use increases. This increases the resistance of cadets to physical loads and expands the body's functional reserves. Analysis of psychophysiological indicators showed that hand combat training optimizes the activity of the central nervous system. Reduction in reaction time, improved motion accuracy and coordination increase cadets ' ability to make quick decisions as well as act effectively in complex situations. This condition fully corresponds to the requirements of military professional activity.

In the control group, however, no significant change in functional performance was observed as a result of traditional fitness training. This confirms that the complex and integrative effect of hand-to-hand combat training is superior to traditional training.

Based on the results of the study, the following general conclusions were drawn:

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1. 1. Hand fight training reliably increases the functional capabilities of the cardiorespiratory system in cadets.
2. 2. The adaptive reactions of the cardiovascular system are improved and cardiac activity is more economical.
3. 3. The indicators of the external respiratory system and the overall physical work capacity increase.
4. 4. Psychophysiological processes, in particular sensorimotor reactions and coordination indicators, improve.
5. 5. Hand-to-hand combat training is an effective means of optimizing military professional training.

From a practical point of view, it is recommended to systematically introduce hand-to-hand combat training into the military training program, plan the volume and intensity of loading in accordance with the individual functional state of cadets. This approach serves to significantly increase not only physical fitness, but also professional-practical competence.

In future scientific research, it is advisable to study long-term adaptive changes, conduct large-scale research with the participation of cadets of different age and training levels, and conduct an in-depth analysis of biomechanical and neurophysiological indicators.

Thus, hand-to-hand training has proven to be a scientifically based, effective pedagogical tool for developing the functional training of cadets in the conditions of military educational institutions, expanding the Reserve capabilities of the body and increasing professional efficiency.

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