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**Original Article**

# Peculiarities of officers' fitness shape

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**Abstract:**
Objective: To explore the participation and attitude of institutionalised elderly towards Physical Activity.
The aim of the research is to study functional fitness shape of officers who are graduates from both higher military educational establishments and higher educational establishments.
The article presents results of research on assessment of body's adaptation abilities of officers from both higher military educational establishments and higher educational establishments. Fitness shape parameters of graduate officers at rest and after muscle loading have been determined. This has shown that for such parameters as oxygen consumption, oxygen consumption for every kilogram of body mass and oxygen ventilation equivalent there exist significant differences in fitness shape of officers from higher military educational establishments and from higher educational establishments which make up 12,82%, 9,61%, and 8,61% correspondingly. After muscle loading the difference is evident for such parameters as pulse pressure, oxygen consumption, and carbon dioxide emission (11,09%, 10,57% and 10% correspondingly). It has been found that higher educational institutions do not pay enough attention to improvement of level of fitness and performance efficiency which has negative effect on graduate officers' physical condition. Four tendencies have been specified and theoretical grounding has been provided for the main methods of increasing officers' performance efficiency and their adaptation in extreme environment conditions.
**Key words**: officers, adaptation abilities, physiological data, fitness shape.

**Introduction**

Experience has proven that pattern of life changes drastically after young people join the army. The changes refer to two aspects. Firstly, great efforts are needed to rebuild the stereotype and digest specific material to the extent required pertaining to military service. In addition to that service members must meet high requirements connected with adjustment to military way of life. That is officers during their service get double load, within the power of a person with high level of fitness and adaptive ability.

It has to be stated that all levels of functionality are involved in the process of military professional adaptation, namely: main physiological mechanisms, social and psychological qualities, mental processes, physical fitness. Due to this, on the basis of concept of body response integrity, when conducting the research on assessment of the interrelation between fitness shape and tasks accomplishment efficiency, all the levels of functioning must be considered.

Scientists argue that nervous system balances body reactions on the impact of not only external but also internal environment connected with it. Human is not able to resist some of the factors and may crumble, some of the factors have pathological consequences, and some foster adaptation and body adjustments to new functioning conditions. It has been discovered that adaptation mechanisms are set in gene potential to a different extent and become the domain of succeeding generations, increasing the reserves of resilience towards the environment extreme factors. A.I. Popovych, Y.S. Finohenov, S.S. Fedak have studied body reactions as for the possibility of its initial adaptation to plausible extreme triggers (anxiety, fatigue, stress, cold, heat, oxygen deprivation, etc.) and their successful overcoming, namely in the process of specifically directed training. One of the important factors of service members' adaptation acceleration and enhancing body resilience to adverse environment is their fitness.

According to the leadership of the Ukrainian Armed Forces, military exercises of the recent past show that the success of service members' actions is affected by the functional abilities of their bodies and are determined by physical endurance parameters.

Specialists S.V. Romanchuk, V.M. Romanchuk, and others showed that military professionals efficiency depends on two conditions:

- Ability of sustained and accurate combat maneuvers and techniques execution under muscle and neuropsychic loading;
- Body resilience to influence of adverse factors of combat activity and environment.


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- Moreover, Pechuhin and others show that mastering combat maneuvers and techniques occurs during the learning process. Subsequently combat efficiency is determined by functional abilities, body resilience to the whole complex of factors that go along with it (load, environment, etc.).

As in the period of modern combat activity, according to the research, service members' load can increase more than twice compared to usual values, extreme changes of body functions emerge accompanied by performance decrement.

Thus, the significance of functional abilities in military specialists' physical readiness provision is obvious.

It should be noted that human functional abilities restrict successful mission accomplishment, especially under unusual circumstances. That is why it is rational to consider selection of complex muscular endurance tests for assessment of military specialists' physical readiness, as they are based on principles of physiologic adaptations. Biologically adaptation is adjustment of body functions and anatomy to environment conditions or activity. The success of adaptation to activity and external environment, especially under unusual circumstances (which is typical for current combat training), is defined by functional reserves of immediate adaptation. Thus, if functional abilities ensure moderate stress for the body, adaptation to combat activity or external environment occurs faster and with relatively high level of efficiency.

The aim of the research is to study functional fitness shape of officers who are graduates from both higher military educational establishments and higher educational establishments.

**Material and methods**

The following methods were applied: theoretical analysis; pedagogical observation; measurement of cardio respiratory parameters; methods of mathematical statistics.

The method of cardio respiratory parameters assessment included their analysis both at rest and during muscle loading assessment.

Muscle loading was done using stationary bicycle according to the following pattern: after 6 min. of no load its gradual rise by 30 watt every 3 min up to 180 watt with no rest periods in between started. With this aim we carried out the research on the base of the 184$^{th}$ Training Centre throughout 2014. 158 officers, including 81 graduates of higher educational institutions and 77 – graduates of higher educational institutions aged 22-27 were involved. Every minute for 6 minutes before the start of muscle loading, during the stationary bicycle test and first 7 minutes after the end of the test such physiological parameters as expiratory volume per minute (Vc, l / min.), breathing rate (FR), average expiratory volume per minute (VT, l./min.), $CO_2$ concentration in the air (% $CO_2$), oxygen consumption ($VO_2$, l / min.), respiratory coefficient (R), heart rate (HR), oxygen pulse ($O_2$/HR ml/beats), oxygen ventilation equivalent.

Time tested and widely used statistic characteristics such as arithmetic mean value (X); mean square deviation (); error of the mean (m). Differences confidence rating has been estimated by Student criterion (t).

**Results**

Table 1. Physiological parameter of officers graduates from higher military educational establishments and higher educational establishments at rest

| Parameters | n=158 | | graduates of higher military educational establishments | | graduates of higher educational | | t |
|---|---|---|---|---|---|---|---|
| Breathing rate BR)(cycl/min) | 15,30 | 0,40 | 15,00 | 0,50 | 15,90 | 0,50 | 1,272 |
| Minute breathing volume (Vc) (BR)(cycl/min) | 10,30 | 0,21 | 9,80 | 0,18 | 10,20 | 0,31 | 1,115 |
| Oxygen consumption ($VO_2$) (l/min) | 0,37 | 0,01 | 0,39 | 0,02 | 0,34 | 0,01 | 2,236* |
| Carbon dioxide emission, (l/min) | 0,32 | 0,03 | 0,33 | 0,01 | 0,31 | 0,01 | 1,414 |
| Degree of oxygen consumption with the respect to the length (standard unit) | 1,47 | 0,03 | 1,5 | 0,02 | 1,40 | 0,03 | 2,773* |
| Oxygen ventilation equivalent (standard unit) | 29,10 | 0,69 | 28,01 | 0,40 | 30,50 | 1,10 | 2,127* |
| Oxygen consumption for 1 kilo of mass (ml·kg$^{-1}$·min$^{-1}$ | 5,10 | 0,10 | 5,20 | 0,20 | 4,70 | 0,10 | 2,236* |
| HR (beats/min) | 79,10 | 0,80 | 78,80 | 1,10 | 78,00 | 1,20 | 0,491 |
| Systolic blood pressure (CBP) (mm Mercury) | 115,60 | 1,20 | 117,20 | 2,10 | 116,40 | 2,30 | 0,256 |
| Diastolic blood pressure (DBP) (mm Mercury) | 78,30 | 0,90 | 78,60 | 1,30 | 76,40 | 1,50 | 1,108 |
| Pulse pressure (mm Mercury) | 39,10 | 2,20 | 38,50 | 2,10 | 39,60 | 2,40 | 0,344 |

*- validity of differences between graduates of higher military educational establishments and reserve officers, graduates of higher educational establishments ($p<0,05$).

Table 2. Physiological parameter of officers graduates from higher military educational establishments and higher educational establishments after muscle loading

| Parameters | n=158 | | graduates of higher military educational | | graduates of higher educational establishment | | t |
|---|---|---|---|---|---|---|---|
| Breathing rate (BR) BR)(cycl/min) | 14,20 | 0,30 | 18,60 | 0,40 | 19,80 | 0,40 | 2,121* |
| Minute breathing volume (Vc) (BR)(cycl/min)X | 33,50 | 0,60 | 31,60 | 1,10 | 34,80 | 1,10 | 2,057* |
| Oxygen consumption ($VO_2$) (l/min) | 1,80 | 0,10 | 1,70 | 0,02 | 1,80 | 0,04 | 2,236* |
| Carbon dioxide emission, (l/min) | 1,45 | 0,03 | 1,35 | 0,04 | 1,50 | 0,03 | 3.000* |
| Degree of oxygen consumption with the respect to the length (standard unit) | 6,90 | 0,30 | 7,10 | 0,03 | 6,90 | 0,03 | 4,714 |
| Oxygen ventilation equivalent (standard unit) | 18,90 | 0,40 | 20,60 | 0,60 | 18,90 | 0,50 | 2,176 |
| Oxygen consumption for 1 kilo of mass ($ml \cdot kg^{-1} \cdot min^{-1}$) | 23,90 | 0,50 | 22,00 | 0,60 | 24,60 | 0,50 | 3,328 |
| HR (beats/min) | 119,00 | 1,50 | 117,30 | 2,00 | 125,1 | 2,90 | 2,214 |
| Systolic blood pressure (CBP) (mm Mercury) | 142,50 | 1,60 | 138,30 | 2,80 | 145,6 | 3,20 | 1,716 |
| Diastolic blood pressure (DBP) (mm Mercury) | 76,60 | 1,00 | 76,40 | 2,10 | 78,70 | 1,60 | 0,871 |
| Pulse pressure (mm Mercury) | 66,10 | 2,60 | 61,70 | 2,30 | 69,40 | 2,30 | 2,367 |

It has been determined that human body's functional state defines vegetative support of activity, which has great effect on performance. That is why the analysis of physiological parameters, both at rest and under muscle loading (professional) allows to discover physiological mechanisms of ensuring professional efficiency of graduates of both higher military educational establishments and higher educational establishments.

Results of recording physiological parameters of graduates at rest are presented on table 1. Data received show that fitness shape of officers-graduates of higher military institutions and higher institutions differs substantially, especially in terms of breathing. In particular, their breathing frequency index is lower ($p < 0,05$); as well as respiratory minute volume, respectively ($p < 0,05$), but oxygen consumption is higher, and the efficiency of oxygen emission is better ($p > 0,05$).

Differences have been also discovered in oxygen consumption indexes in equivalent to a kilogram of weight per minute ($p < 0,05$), which is higher in graduates of civilian institutions than military institutions.

On examination of body functional state at rest such parameters as oxygen consumption, oxygen consumption for a kilogram of mass, and oxygen ventilation equivalent are slightly different from the rest of the parameters and make up 12,82%, 9,61% и 8 ,61% correspondingly. Average parameter of difference is observed by the parameters of breathing rate, carbon dioxide emission, and degree of oxygen consumption with regard to the length with the difference in per cent 5,66%, 6,00% и 6,66% correspondingly. Less prominent difference in the results at rest is observed in respiratory minute volume, diastolic blood pressure, and pulse pressure: 3,92%, 2,79% and 2,77% correspondingly. By the parameters of HR and CBR the smallest percentage difference has been received 1,01% and 0,68% correspondingly. Thus, officers' body functional state has been proven much better than civilian institutions' graduates.

The results of physiological parameters of graduates after muscle loading which consisted of pull-ups, 100 m run, 3 km run are presented on Table 2.

Thus, after muscle loading the biggest difference in functional state parameters is observed in the results of pulse pressure, oxygen consumption and carbon dioxide emission and makes up 11,09%, 10,57%, and 10% correspondingly. Mean difference is observed in the respiratory minute volume and oxygen ventilation equivalent parameters as 9,19% and 8,25% correspondingly. Smaller difference has been received on measuring Hr and BR, oxygen consumption, and CBP. These parameters are 6,23%, 6,06%, 5,55%, and 5,01% correspondingly. The smallest difference between the parameters of graduates was determined when measuring DBP and oxygen consumption degree with regard to the length, being 2,92% and 2,81% correspondingly.

It has been determined that aerobic-anaerobic period occurs in officers with smaller minute breathing volume, oxygen consumption and carbon dioxide emission. It is also characterized by smaller parameters of HR and both CBP and DBP. The differences between different groups were also prominent, in such parameters as breathing rate, respiratory minute volume, oxygen consumption, degree of oxygen consumption with regard to the length, oxygen ventilation equivalent, oxygen consumption for kilo of mass, HR, CBP, and DBP, pulse pressure ($p < 0,05$-$0,01$).

In particular officers-graduates of the military institutions had SBP carbon dioxide emission parameters smaller than officers-graduates of the civilian institutions by 46% correspondingly. The difference in blood pressure parameters dynamics in aerobic anaerobic transition led to large parameters of pulse pressure ($p < 0,05$). Thus, officers' graduates of military institutions pulse pressure was higher by 11,3% compared to graduates of non-military institutions ($p < 0,05$).

**Discussion**

Consequently, the results of our research give us right to assert that there is a significant difference between the functional state of officers- graduates from the military higher institutions and officers graduates of civilian higher institutions both at rest and after muscle loading. So, civilian institutions do not work effectively on improvement of their graduates' fitness shape, which negatively affects functional state of future reserve officers. Physical training programme for officers-graduates must be enhanced in order to increase their fitness shape and performance efficiency.

Analysis and consolidation of reference sources as well as our observations allow us to specify a number of patterns and provide theoretical grounds for main methods of enhancing officers' performance characteristics in various conditions of environment.

The first pattern is the increase in the role of adaptation abilities to provide performance characteristics with the growth of work severity or complication of working conditions. In this case the advantage of adaptation abilities provides a deeper range for compensation for negative effects on the body. In addition to that wide range of psychological reserves allows to mobilize physiological reserves more densely when needed and also to retain performance efficiency during homeostasis; that is to endure the state of inner discomfort.

The second pattern is alteration when doing hard or sustained work at professional activity (while expending physiological reserves) – etopological adjustments caused by body aiming to keep homeostasis and avoid compensation break down. The restructuring of activity occurs by elements more energetically convenient for the body.

The third pattern is heterochronia of physiological activity of body system during hard work and under the influence of adverse environment conditions. The intensification of the systems activity which play the main role in ensuring working efficiency in given conditions is observed. Physiological activity decreases or is even suppressed.

The fourth pattern is the close interconnection between physiological and psychological reserves with body's adaptation abilities, officers' physical fitness by means of special physical training. Special physical training substantially changes adaptation abilities, fostering their improvement. Broadening of body adaptation abilities in the process of physical training is the theoretical base to increase working capacity of physically trained people as a result of successful adaptation to the adverse environment factors and professional activity. Thus, the training aimed at development of speed performances broadens physiological speed reserves; training aimed at strength development – physiological strength reserves, due to which advantage is gained later when performing any kind of work, requiring given physical qualities demonstration. To broaden physiological reserves of the entire body, its adaptation abilities, training aimed at development of general and speed endurance that affects cardio-vascular and respiratory system reserves enhancement is effective.

Thus, the results of our research show that body adaptation abilities, being the theoretical base that ensures officers' stable working efficiency and their adaptation to extreme conditions of environment deserve special consideration.

**Conclusions**

On examination of body functional state at rest of military and civilian higher educational institutions graduates the following parameters have been discovered: oxygen consumption, oxygen consumption for a kilo of weight and oxygen ventilation equivalent have the biggest difference from all the other parameters and make up 12,82%, 9,61% and 8,61% correspondingly.

After muscle load the biggest difference in the functional state is observed in such parameters as pulse pressure, oxygen consumption, and carbon dioxide, and makes up 11,09%, 10,57% и 10% correspondingly. So, there is a significant difference between the sbody functional state of officers, graduates' of military and civilian higher educational institutions both at rest and after muscle loading. It has been discovered that not enough attention is paid to the improvement of physical fitness level and working efficiency in civilian institutions which has negative effect on officers-graduates functional state parameters.

Four patterns have been specified and theoretical grounding for main methods of increasing officers' working efficiency enhancement and their adaptation in the extreme conditions of environment has been provided. It is planned to provide grounds for and develop program for improvement of physical fitness of officers-graduates from civilian higher educational institutions.

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