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Original Article

Impact of military-applied sports on cardiorespiratory indicators of cadets in military higher education institutions

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Abstract
According to scientists, military-applied sports uniquely embody the fundamental principle of combat training, aiming to instill in servicemen the essential skills required in warfare – a facet not replicated in other forms of physical training. Through training and competitive engagement in military-applied sports (MAS), servicemen not only acquire combat techniques and enhance physical attributes pertinent to military duties but also cultivate moral and volitional qualities such as courage, determination, self-confidence, initiative, and resourcefulness. *Purpose:* to determine and compare cardiorespiratory parameters of the cadets engaged in military-applied sports and those participating in the current program of sports and general physical fitness, both at rest and under the influence of physical loads. *Material and Methods:* Objects: 81 healthy cadets of a military educational institution. Two groups of cadets were formed: Control Group (CG1; n=41) consisting of those engaged in military-applied sports (military pentathlon) and Control Group (CG2; n=40) consists of cadets who are trained under the current general physical training program. The cadets of both groups practiced 2 times for 1 hour on weekdays, and 3 hours on weekends and holidays. The age and length of military service of cadets in both groups did not differ significantly ($p>0.05$). All participants of our study gave their informed consent to participate in the experiment. Research was conducted and performed in accordance with the ethical standards of the Declaration of Helsinki.
adaptation.
Keywords: **judo, children, physical training, motor skills**

Introduction

In military-applied sports, according to scientists, the fundamental principle of combat training is realized, which is not achieved in any other means of physical training, "to teach military personnel what is necessary in war." (Prystupa Ye., Romanchuk S., 2012). During training and competitive activities in military-applied sports (MAS), military personnel not only master combat techniques, develop physical qualities necessary for their military-professional activities but also improve moral and volitional qualities (courage, determination, confidence in their forces, initiative, creativity, etc.) (Olkhovyi O., Korchagin M., Krasota V., 2010; O.Nebozhuk, A.Oderov et al., 2023; Oderov A., Babych M., Dunets-Lesko A., Shlyamar I. et al., 2023).

One of the main tasks of the Concept of Physical Training and Sports Development in the Ministry of Defense of Ukraine is the development, improvement, and increased significance of military-applied sports, military-applied exercises, as well as further popularization of those military-applied sports included in the CISM program (Romanchuk S., 2015; Lototsky I. et al., 2017; E.Anokhin, M.Kuznetsov, T.Dukh, S.Barashevskyi, N.Muzyka et al., 2022).

This Concept also emphasizes the improvement of military professional standards, the development of a typical curriculum for physical education, special physical training, and sports for the variable composition of higher military educational institutions HMEIs (Military Educational Unit of Higher Education Institution MEU

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of HEI, Professional Training Military Educational Institution PTMEI), as well as the improvement of the content of physical training curricula in the system of combat training for military personnel of all categories (Olkhovyi O., Korchagin M., Krasota V., 2010; Iedynak G., Sliusarchuk V., Mazur V., Matsuk L., Kljus O., Bozhyk M., Klymovych V., Lototskiy I., Ovcharuk I., 2020; Oderov A, Romanchuk S. et.al., 2022).

Numerous studies (Popovych O., Romanchuk S., 2010; Leshchinsky O., Pervachuk O., Babych M., Nebozhuk O., Bogdanov M., Bubon V., Abramenko O., Khachatryan A. et.al., 2023; Klymovych V., Olkhovyi O. et.al., 2016) have proven the positive impact of engaging in military-applied sports on improving the level of physical fitness, sports skills, and moral-psychological readiness of HMEI cadets. However, the physical training system of the armed forces of NATO member states aims primarily at forming and improving the cardiorespiratory indicators of military personnel, which significantly affect the performance of professional tasks for military purposes (Chaplinsky R., Babayev Y., Khachatryan A. et al., 2022; Rolyuk A., Boyarchuk A., Kyrpenko V., Afonin V., Lojko O., 2016).

In our opinion, a relevant study is the examination of the cardiorespiratory indicators of cadets engaged in military-applied sports and their comparison with the indicators of those involved in physical exercises according to the current program of sports and mass work (SMW).

In our opinion, a relevant study involves the examination of cardiorespiratory indicators in cadets engaged in military-applied sports and comparing them with the indicators of those participating in physical exercises according to the current programs of sports and mass work (SMW).

Materials and methods

Objects: 81 healthy cadets of a military educational institution. Two groups of cadets were formed: Control Group (CG1; n=41) consisting of those engaged in military-applied sports (military pentathlon, sports orientation, aeronautical pentathlon) and Control Group (CG2; n=40) consisting of cadets engaged in the current program of sports and general physical fitness (gymnastics and athletic training, accelerated movement and athletics, obstacle course and grenade throwing, hand-to-hand combat). Cadets from both groups engaged in the hours designated for Sports and general physical fitnessaccording to the academy's schedule and the instructions of the Ministry of Defense of Ukraine: twice for 1 hour on working days and 3 hours on weekends and holidays. The age and length of military service of cadets in both groups did not differ significantly ($p>0.05$).

All participants of our study gave their informed consent to participate in the experiment. Research was conducted and performed in accordance with the ethical standards of the Declaration of Helsinki.

Methods. Testing of the cardiorespiratory indicators of cadets was carried out in the medical unit of the Hetman Petro Sahaidachnyi National Ground Forces Academy during June-August 2023, with one representative form each group daily.

To assess the functional state, the methodology for evaluating cardiorespiratory indicators of cadets was applied both at rest and under load. Medical personnel conducted the investigation in the morning at the same hour. Physical exertion was carried out using a cycle ergometer according (BE-02) to the scheme: after 18-minute with zero load, a gradual increase by 30 Watts every 3 minutes up to 180 Watts began without rest intervals between stages. To measure arterial pressure (AP), electrodes for recording an electrocardiogram were fixed on the chest, and a cuff was applied to the shoulder. For the analysis of the obtained research results, mathematical statistical methods were used was carried out using Microsoft Office Excel and the computer program Statistika. Approach. The influence of military applied sports on the cardiorespiratory indicators of two formed groups of cadets of military higher education institutions is investigated.

Every minute during the 6 minutes preceding the start of the load, during the cycle ergometer test, and the first 7 minutes after its completion, physiological indicators such as expiratory volume per minute (Vc, L/min), respiratory rate (RR), oxygen consumption (VO2, L/min), carbon dioxide production (VCO2, L/min), heart rate (HR), oxygen pulse (O2/HR ml/beat), and ventilatory equivalent for oxygen (in conventional units) were recorded.

To measure arterial pressure (AP), electrodes for recording an electrocardiogram were fixed on the chest, and a cuff was applied to the shoulder.

The assessment of the reliability of differences was evaluated using Student's t-criterion to determine the difference between two means, respectively, in the case of normal and non-normal distributions of individual values in each sample. The baseline was a 5% level of significance ($p<0.05$). When analyzing data within the sample, the values of these criteria for related samples were used, and when analyzing data between different groups for unrelated samples.

Results

The results of the cardiorespiratory indicators of CG1 and CG2 cadets at rest are presented in Table 1. The results demonstrate differences in the indicators of the functional state of CG1 cadets compared to CG2 cadets, namely, their RR and Vc are lower ($p>0.05$); significantly better are VO2 and VCO2 indicators ($p<0.05$); better indicators of oxygen consumption per kilogram of weight per minute ($p<0.05$). Cardiovascular system

indicators at rest for CG1 and CG2 cadets do not significantly differ, namely: RR and HR indicators in CG1 cadets are 1-3.5% better than in CG2 cadets ($p>0.05$).

During the examination of the functional state of the body at rest in CG1 and CG2 cadets, such indicators as oxygen consumption, oxygen consumption per kilogram of weight, and ventilatory equivalent for oxygen have significant differences (12.79%, $p<0.001$; 9.54%, $p<0.05$; 8.78%, $p<0.05$). The indicators of cadets in the studied groups do not significantly differ in minute ventilation, DBP, and SBP: 3.91%, 2.77%, and 2.79%, respectively ($p>0.05$).

Table 1. Cardiorespiratory Indicators of CG1 and CG2 Cadets at Rest

Indicators	CG1 (n=41)		CG2 (n=40)		t	p
	$\bar{x}$	m	$\bar{x}$	m		
RR, cycle/min	14.99	0.50	15.89	0.50	1.248	p>0.05
Vc, L/min	9.79	0.18	10.21	0.31	1.172	p>0.05
VO_2, L/min	0.40	0.02	0.33	0.01	3.578	p<0.001
VCO_2, L/min	0.34	0.01	0.32	0.01	1.414	p>0.05
Ventilation equivalent by oxygen, con. units	28.02	0.41	30.53	1.09	2.155	p<0.05
Oxygen consumption per kilogram of weight, $ml \cdot kg^{-1} \cdot min^{-1}$	5.22	0.22	4.68	0.11	2.195	p<0.05
HR, beats/min	78.81	1.12	78.08	1.22	0.441	p>0.05
SBP, mm Hg	116.97	2.12	115.93	2.34	0.329	p>0.05
DBP, mm Hg	78.55	1.32	76.39	1.54	1.065	p>0.05
PP, mm Hg	38.48	2.07	39.64	2.34	0.371	p>0.05

Thus, some indicators of the functional state of CG1 cadets are significantly better at rest than those of CG2 cadets. After six minutes of physical exertion, the most significant differences in the indicators of the functional state of CG1 and CG2 cadets were observed in pulse pressure, oxygen consumption, carbon dioxide production, and heart rate, which constituted 11.11% ($p<0.01$), 10.61% ($p<0.01$), 10.2% ($p<0.01$), and 6.23% ($p<0.01$) respectively. The indicators of minute ventilation, respiratory rate, and ventilatory equivalent for oxygen have a moderate difference of 9.19%, 6.06%, and 8.25%, respectively ($p<0.05$). There is no significant difference in SBP and DBP indicators ($p>0.05$). These indicators differ by 5.55% and 5.01% in percentage terms, respectively.

Table 2. Cardiorespiratory Indicators of CG1 and CG2 Cadets After 6 Minutes of Load

Indicators	CG1 (n=41)		CG2 (n=40)		t	p
	$\bar{x}$	m	$\bar{x}$	m		
RR, cycle/min	18.58	0.41	19.74	0.39	2.050	p<0.05
Vc, L/min	31.55	1.12	34.8	1.04	2.126	p<0.05
VO_2, L/min	1.71	0.02	1.82	0.04	2.460	p<0.05
VCO_2, L/min	1.34	0.04	1.52	0.04	3.182	p<0.01
Ventilation equivalent by oxygen, con. units	20.5	0.5	18.7	0.7	2.092	p<0.05
Oxygen consumption per kilogram of weight, $ml \cdot kg^{-1} \cdot min^{-1}$	22.4	0.6	24.8	0.5	3.073	p<0.01
HR, beats/min	116.8	2.8	127.2	2.9	2.580	p<0.01
SBP, mm Hg	137.8	3.3	148.6	3.8	1.748	p>0.05
DBP, mm Hg	75.4	2.2	77.7	1.6	0.845	p>0.05
PP, mm Hg	60.9	2.6	69.3	2.5	2.329	p<0.01

It was found that cadets in CG1 experienced a lower minute ventilation, oxygen consumption, and carbon dioxide production during the aerobic-anaerobic transition. This was accompanied by a smaller increase in heart rate (HR) and blood pressure (BP), both systolic and diastolic. The differences between cadets from different groups were also significantly expressed in indicators such as respiratory rate, minute ventilation, oxygen consumption, oxygen consumption rate per length, ventilatory equivalent for oxygen, oxygen consumption per kilogram of body weight, HR, and pulse pressure ($p<0.05$-0.01) in this case.

In particular, in cadets engaged in military-applied sports, systolic blood pressure (SBP) and carbon dioxide production were lower than in CG2 cadets by 9.8 mm Hg and 0.18 L/min, respectively. The difference in the dynamics of blood pressure indicators in cadets during the aerobic-anaerobic transition led to significant changes in pulse pressure indicators ($\Delta X = 8.4$ mm Hg, $p<0.01$).

Thus, the results of our study justify the claim that there is a significant difference in the functional state between cadets engaged in military-applied sports and those engaged in the current program of sports and mass work, both at rest and under load. Significant differences between the indicators of CG1 and CG2 cadets were obtained when studying the indicators after the 18th minute of physical exertion at 180 W (Table 3).

Based on the test results of the functional state indicators of the respiratory and cardiovascular systems, we found that under the influence of the load, most indicators in CG1 cadets are better than in CG2 cadets. The SBP of CG1 cadets was 13.5 mm Hg lower than that of CG2 cadets ($p<0.01$). The differences in most indicators of the functional state between CG1 and CG2 cadets were also significant. The results of the analysis of carbon dioxide production at the point of maximum heart rate during physical exertion are particularly noteworthy, which in CG1 cadets were 3.2% lower than in CG2 cadets ($p<0.001$).

Table 3. Cardiorespiratory Indicators of Cadets after the 18th Minute of Physical Load

Indicators	CG1 (n=41)		CG2 (n=40)		t	p
	$\bar{x}$	m	$\bar{x}$	m		
RR, cycle/min	29.8	0.89	33.13	1.12	2.328	p<0.05
Vc, L/min	80.2	1.3	76.1	1.5	2.066	p>0.05
VO_2, L/min	3.2	0.01	3.1	0.01	7.071	p<0.001
VCO_2, L/min	3.2	0.01	3.3	0.01	7.071	p<0.001
Ventilation equivalent by oxygen, con. units	25.2	0.91	26.4	1.4	0.719	p>0.05
Oxygen consumption per kilogram of weight, ml·kg^{-1}·min^{-1}	45.88	1.13	41.8	1.25	2.421	p<0.05
HR, beats/min	169.1	2.9	181.4	2.5	3.212	p<0.01
SBP, mm Hg	158.6	2.8	178.3	4.5	3.717	p<0.001
DBP, mm Hg	63.6	3.3	77.1	2.5	3.261	p<0.01
PP, mm Hg	97.4	2.7	104.8	2.4	2.048	p<0.05

Thus, the results of the examination based on the indicators of the functional state at the 18th minute of physical exertion at 180 W indicate significantly better indicators of the functional state of CG1 cadets compared to CG2 cadets. The 18-minute load characterizes the fulfillment of most of the combat training standards and allows determining the readiness of cadets to perform their duties for combat purposes.

During the recovery process after physical exertion, differences were observed in the dynamics of functional indicators of CG1 and CG2 cadets (Table 4).

Table 4. Cardiorespiratory Indicators of CG1 and CG2 Cadets after the 1st Minute of Recovery

Indicators	CG1 (n=41)		CG2 (n=40)		t	p
	$\bar{x}$	m	$\bar{x}$	m		
RR, cycle/min	22.3	0.8	25.4	0.9	2.574	p<0.05
Vc, L/min	53.09	1.81	57	1.92	1.482	p>0.05
VO_2, L/min	2.1	0.03	2.3	0.04	4.000	p<0.001
VCO_2, L/min	2.21	0.04	2.51	0.04	5.303	p<0.001
Ventilation equivalent by oxygen, con. units	25.8	1.1	26.5	1.2	0.430	p>0.05
Oxygen consumption per kilogram of weight, ml·kg^{-1}·min^{-1}	30.4	0.9	30.5	0.9	0.079	p>0.05
HR, beats/min	137.9	2.8	150.6	3.2	2.987	p<0.01
SBP, mm Hg	149.8	3.1	158.8	3.3	1.988	p<0.05
DBP, mm Hg	67.5	1.5	65.4	2.2	0.789	p>0.05
PP, mm Hg	81.8	2.5	93.9	3.1	3.038	p<0.01

For individual cardiorespiratory indicators, these differences were more pronounced and had a significant distinction, while for other cardiorespiratory indicators, there was no significant difference between the graduates. The first group of indicators includes minute volume of ventilation, carbon dioxide production, and systolic blood pressure. For these indicators, the difference between the graduates was accordingly (5.2%, 12.3%, 5.8%) (p<0.05-0.001). After the first minute of recovery, the functional indicators of cadets in the studied groups did not have a significant difference in the indicators of ventilatory equivalent for oxygen (p>0.05) and oxygen consumption per kilogram of body weight (p>0.05). In percentage equivalent, the difference is 2.71% and 0.03%, respectively.

A significantly greater difference was observed in the investigated indicators of respiratory rate, carbon dioxide production, and pulse pressure —13.68%, 13.53%, and 14.87%, respectively (p<0.01-0.001).

In indicators such as oxygen consumption and heart rate, the difference between CG1 and CG2 cadets is 10% and 9.22%, respectively (p<0.01-0.001).

This regularity persisted on the 3rd minute of recovery after physical exertion (Table 5).

Table 5. Cardiorespiratory Indicators of CG1 and CG2 Cadets after the 3rd Minute of Recovery

Indicators	CG1(n=41)		CG2(n=40)		t	p
	$\bar{x}$	m	$\bar{x}$	m		
RR, cycle/min	18.5	0.6	20.5	0.8	2.000	p<0.05
Vc, L/min	22.6	0.6	24.6	0.7	2.169	p<0.05
VO_2, L/min	0.62	0.01	0.64	0.02	0.894	p>0.05
VCO_2, L/min	0.73	0.04	0.87	0.04	2.475	p<0.05
Ventilation equivalent by oxygen, con. units	39.9	1.5	39.2	1.1	0.376	p>0.05
Oxygen consumption per kilogram of weight, ml·kg^{-1}·min^{-1}	8.8	0.3	8.5	0.3	0.707	p>0.05
HR, beats/min	111.9	2.1	114.3	2.4	0.753	p>0.05
SBP, mm Hg	127.2	3.6	133.4	3.7	1.201	p>0.05
DBP, mm Hg	75.5	2.4	69.8	2.1	1.787	p>0.05
PP, mm Hg	62.1	2.4	67.7	3.4	1.346	p>0.05

In this case, the values of the indicators of ventilatory equivalent for oxygen, oxygen consumption per kilogram of body weight, and diastolic blood pressure are better in CG2 cadets compared to CG1 cadets by 1.79%, 4.70%, and 6.67%, respectively (p>0.05). The most significant differences were observed in the carbon

dioxide production ($p<0.05$), respiratory rate ($p<0.05$), and minute ventilation ($p<0.05$), which constitute 17.4%, 10.89%, and 8.94%, respectively.

The indicators obtained afer the 7th minute of recovery (Table 6) after physical exertion did not show differences in functional indicators between CG1 and CG2 cadets.

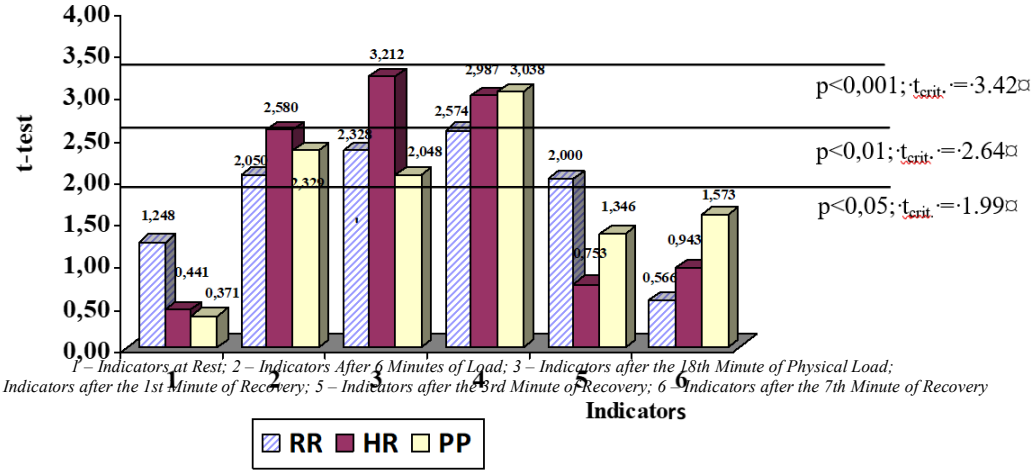
Table 6. Cardiorespiratory Indicators of CG1 and CG2 Cadets after the 7th Minute of Recovery

Indicators	CG1 (n=41)		CG2 (n=40)		t	p
	$\bar{x}$	m	$\bar{x}$	m		
RR, cycle/min	19.1	0.5	18.7	0.5	0.566	p>0.05
Vc, L/min	15.2	0.6	15.3	0.7	0.108	p>0.05
VO_2, L/min	0.47	0.02	0.46	0.02	0.354	p>0.05
VCO_2, L/min	0.46	0.02	0.47	0.03	0.277	p>0.05
Ventilation equivalent by oxygen, con. units	34.6	0.9	34.7	1	0.074	p>0.05
Oxygen consumption per kilogram of weight, $ml \cdot kg^{-1} \cdot min^{-1}$	6.6	0.2	6.3	0.2	1.061	p>0.05
HR, beats/min	98.4	2.9	102.2	2.8	0.943	p>0.05
SBP, mm Hg	116.4	1.7	112.8	2.4	1.224	p>0.05
DBP, mm Hg	79.9	1.5	78.7	1.2	0.625	p>0.05
PP, mm Hg	37.4	2.23	30.7	3.63	1.573	p>0.05

Certain indicators, such as oxygen consumption per kilogram of body weight, systolic blood pressure, and diastolic blood pressure in CG1 cadets differ from the indicators of CG2 cadets by a percentage of 8.06%, 2.11%, and 2.19%, respectively, corresponding to the baseline values ($p>0.05$).

The remaining indicators, including minute ventilation, carbon dioxide production, ventilatory equivalent for oxygen, and heart rate, have statistically similar results and differ by 0.66%, 4.45%, 0.28%, and 0.18%, respectively ($p>0.05$).

Thus, we have determined that the most significant and reliable differences between the cardiorespiratory indicators of cadets engaged in military-applied sports and cadets following the sports and mass work program were obtained after the 6-minute load and at the 3rd minute of the 180 Watt load (fig. 1).



1 – Indicators at Rest; 2 – Indicators After 6 Minutes of Load; 3 – Indicators after the 18th Minute of Physical Load; 4 – Indicators after the 1st Minute of Recovery; 5 – Indicators after the 3rd Minute of Recovery; 6 – Indicators after the 7th Minute of Recovery

Figure. 1. Dynamics of Student's t-test RR, HR, PP of cadets of CG1 (n=41) and CG2 (n=40) during the study period

Despite the absence of significant differences in most indicators, trends in cardiorespiratory indicators were identified after the 3rd minute of the recovery period after physical exertion, indicating a better functional state of CG1 cadets.

Discussion

During the research, we refined the scientific results of A.Oderov, S.Romanchuk, O.Olkhovyi et al. (Oderov A, Romanchuk S. et.al., 2022; Popovych O., Romanchuk S., 2010; Oderov A., Nebozhuk O., Lesko O., Pylypchak I., Olkhovyi O., Poltavets A. Romanchuk V., 2022) which demonstrated the need to improve the physical fitness of military personnel for effective task performance. A sufficient level of physical fitness reveals their functional capabilities, and regular physical exercises lead to the economization of energy resources during combat tasks, significantly increasing the efficiency of combat activities (Romanchuk S., 2012; Romanchuk S., Afonin V. et al., 2022; Malikov M., Bohdanovska N., Svatyev A., 2006).

Changes in the indicators of the functional functions of the human body during various work processes, which are indirect indicators of activity, determine the "physiological cost," which depends on the volume of

functional reserves (A.Oderov, I.Fishchuk, Y.Svyshch, I.Pylypchak, T.Dukh, V.Lashta., 2022; Oderov A., Klymovych V., Korchagin M., Olkhovyi O. et al., 2019; Matveiko O., Olkhovyi O., Oderov A. et. al., 2022).

From these methodological positions, the functional state during the bicycle ergometric test of cadets engaged in military-applied sports and cadets following the sports and general physical fitness program was determined. Our obtained results do not significantly differ from the results of the studies conducted by Malikov M., Bohdanovska N., Matveiko O., who conducted bicycle ergometric tests on 300 miners [Iedynak G., Sliusarchuk V., Mazur V., Matsuk L., Kljus O., Bozhyk M., Klymovych V., Lototskiy I., Ovcharuk I., 2020; Malikov M., Bohdanovska N., Svatyev A., 2006; Matveiko O., Olkhovyi O., Oderov A. et.al., 2022).

The cardiorespiratory indicators of the cadets at the moment of aerobic-anaerobic transition coincide with the data of Romanchuk S., Oderov A., Klymovich V., Olkhovyi O., [Olkhovyi O., Korchagin M., Krasota V., 2010; E.Anokhin, M.Kuznetsov, T.Dukh, S.Barashevskyi, N.Muzyka et al., 2022; Iedynak G., Sliusarchuk V., Mazur V., Matsuk L., Kljus O., Bozhyk M., Klymovych V., Lototskiy I., Ovcharuk I., 2020): the absolute oxygen consumption for untrained young men during bicycle ergometry was 8.2% lower compared to trained individuals. It has been proven that the heart rate in the examined groups at the moment of aerobic-anaerobic transition was lower by 12% and 19.5%, respectively. co-authors indicate that the heart rate at the moment of aerobic-anaerobic transition in young healthy men is in the range of 119 to 149 beats/min, which is consistent with our results. According to the qualification of absolute oxygen consumption at the moment of aerobic-anaerobic transition developed by Malikov M., Bohdanovska N., Svatyev A. the results of the cadet group are characterized as average (Olkhovyi O., Korchagin M., Krasota V., 2010; Popovych O., Romanchuk S., 2010; Malikov M., Bohdanovska N., Svatyev A., 2006).

The results of the cardiorespiratory indicators of all cadets at the last minute of the load (18th minute, 180 W) were compared by us with the scientific results of Malikov M., Bohdanovska N., Svatyev A., Romanchuk S., Oderov A. (Iedynak G., Sliusarchuk V., Mazur V., Matsuk L., Kljus O., Bozhyk M., Klymovych V., Lototskiy I., Ovcharuk I., 2020; Popovych O., Romanchuk S., 2010; Malikov M., Bohdanovska N., Svatyev A., 2006). Respiratory rate, minute ventilation, and ventilatory equivalent for oxygen in the examined group were higher by 29.0%, 32.4%, and 16.3%, respectively. Oxygen consumption and oxygen consumption rate compared to the norm were also higher by 28.1% and 24.6%, respectively. The heart rate did not differ.

Functional system indicators during the recovery process were also compared with the data of Malikov M., Bohdanovska N., Svatyev A. (Popovych O., Romanchuk S., 2010; Malikov M., Bohdanovska N., Svatyev A., 2006). According to the scientific results, in relatively healthy men, most indicators should return to the level of rest from the 6th minute of recovery. An analysis of the results of cadets of both groups determined that by the 1st minute of recovery, blood pressure indicators returned to the level of rest, and partially, respiratory rate (19.7% from the initial level), oxygen consumption (17.5%), and ventilatory equivalent for oxygen (15.0%) approached the indicators of rest. Indicators such as minute ventilation constituted 33.6% of the rest indicators, carbon dioxide production - 32.2%, and heart rate - 25.4%.

Thus, after the 7th minute of recovery, the indicators of cadets engaged in military-applied sports did not return to the initial level of carbon dioxide production, minute ventilation, and heart rate, in comparison with the data of other authors. The research results allow us to assert that the cardiorespiratory indicators of cadets engaged in the sports and general physical fitness program are characterized by an average level of performance. At the moment of aerobic-anaerobic transition, their cardiorespiratory indicators are close to the indicators of untrained young men. After the 18th minute of the load at 180 W, their indicators reached the level of maximum physical load. After the cessation of the load on the 7th minute, the indicators of respiratory rate, carbon dioxide production, minute ventilation, and heart rate did not return to the indicators at rest.

Thus, the differences in the functional capabilities of cadets engaged in the sports and general physical fitness program compared to cadets engaged in military-applied sports were determined not only by studying the dynamics of oxygen consumption during maximum physical load but also by the significantly higher values of DBP. The basis for this statement is the opinion of H.Korobeynikov (G.Korobeynikov, L.Korobeynikova, T.Rychok, V.Mischenko, O.Dudnik, 2014), M.Korolchuk (Korolchuk M., 2002), who convincingly proved that the magnitude of DBP is an indicator of the state of the circulatory system, and its increase indicates a decrease in the functional state of the cardiovascular system.

Conclusions

According to the results of scientific research, we have found that in order to improve the effectiveness of the professional activity of cadets-future officers, the program of sports and mass work should be formed taking into account the theory of adaptation to physical activity. It is proved that applied physical exercises are the main means of training all functional systems of the human body. This is due to the fact that adaptation mechanisms are formed as a result of the interaction of physical and mental stress and recovery: "The more trained a serviceman's body is, the faster the adaptation process is." It has been determined that the most significant and reliable differences between the indicators of cadets engaged in military applied sports and cadets engaged in the program of sports and mass work were obtained after a 6-minute load and at the 3rd minute of a 180 Watt load.

Thus, the differences in the functional capabilities of cadets engaged in the SMR program compared to cadets engaged in the PFM program were determined not only by the results of studying the dynamics of oxygen consumption during maximum physical activity, but also by the significantly high values of DBP. It is proved that the value of DBP is an indicator of the state of blood circulation and its increase indicates a decrease in the functional state of the cardiovascular system.

We have proved that military applied sports in the training of future officers contribute to an increase in the level of physical fitness, functional readiness, increased resistance to adverse conditions, and accelerated adaptation.

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