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STUDY OF THE PREVALENCE OF EXCESS BODY WEIGHT AMONG MILITARY PERSONNEL AS A LEADING RISK FACTOR OF DISEASES OF THE CARDIOVASCULAR SYSTEM

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A high prevalence of overweight 40.9 ± 4.3 % and obesity (26.0 ± 3.8 %) was established in military personnel with diseases of the cardiovascular system. A significantly higher difference in the majority of cases of obesity was established – 26.0 % in comparison with the corresponding frequency of obesity in the male population of Ukraine – 13.2 %. It was found that obesity of the III degree occurred significantly more often in the experimental group – 3.03 %, according to the group control – 0.4 %. The value of the additional risk of developing cardiovascular diseases in military personnel indicates that obesity increases the risk of developing a disease of the cardiovascular system by 2.31 times, and the presence of third-degree obesity. 7.58 times.

Key words: diseases of the cardiovascular system, servicemen, excess body weight, obesity, body mass index.

В. В. Лазоришинець, М. Л. Руденко, С. О. Сіромаха, Т. А. Андрущенко ВИВЧЕННЯ ПОШИРЕНOSTІ НАДЛИШКОВОЇ МАСИ ТІЛА ЯК ПРОВІДНОГО ФАКТОРУ РИЗИКУ ХВОРОБ СИСТЕМИ КРОВООБІГУ У ВІЙСЬКОВОСЛУЖБОВЦІВ

Встановлена висока розповсюдженість надлишкової маси тіла ($40,9 \pm 4,3$ %) та ожиріння ($26,0 \pm 3,8$ %) у військовослужбовців з хворобами системи кровообігу. Встановлено достовірно вищу різницю кількості випадків ожиріння – 26,0 % у порівнянні з відповідною частотою ожиріння чоловічого населення України – 13,2 %. З'ясовано, що ожиріння III ст. зустрічалося достовірно частіше в дослідній групі – 3,03 % порівняно з групою контролю – 0,4 %. Значення відносного ризику розвитку ХСК у військовослужбовців, вказують, що наявність ожиріння підвищує ризик розвитку хвороб системи кровообігу у 2,31 рази, а наявність ожиріння III ст. у 7,58 разів.

Ключові слова: хвороби системи кровообігу, військовослужбовці, надлишкова маса тіла, ожиріння, індекс маси тіла.

The study is a fragment of the research project “To develop and improve the organizational model of providing cardiosurgical care in the conditions of martial law in Ukraine”, state registration No. 0123U100166.

According to the data of the World Health Organization (WHO), cardiovascular diseases (CVD) are the most common cause of death in the world since 1998. According to the forecasts of WHO experts until 2030, the future of ischemic heart disease (IHD) and cerebral stroke will become the main causes of death and disability in the entire world, and the mortality rate will reach 23.4 million cases in the world [3, 9]. When assessing the risk of development of CVD, medical and social factors (smoking, eating disorder, alcohol, stress, family life, professional realization, social status,) and medical and biological factors, excess body weight (EBW), obesity, cholesterolemia, hypertriglyceridemia, hyperglycemia and others) are taken in consideration [8].

According to WHO, in 2000, 1.7 billion people on the planet may have EBW and obesity. Obesity is one of the most common diseases in the world, which is called the epidemic of the XXI century [9]. To the factors that contribute to the growth of EBW and obesity are: demographics (improved quality of life, female gender, race/nationality); social and cultural (low illuminance, low income and professional status, family status); behaviors – fat food, high intake of alcohol, low level of physical activity others). An increase in body mass by 10kg is accompanied by an increase in systolic arterial pressure (AP) by 2–3 mm/Hg, and a diastolic AP by 1–3 mm/Hg. At the same hour, a decrease in body mass by 5–15 % evenly reduces the risk of CVD development by 9 %, type II diabetes mellitus - by 44 %, in addition, the decrease in the risk of mortality in CVD is greater, lower by 30 % [2, 6, 10, 11]. The investigators established that the risk of development of CVD in mid-case in women 20–45 years of age with EBW may be 6 times higher than in cases with normal body weight [4, 5].

According to the data of the State Statistics Service of Ukraine for 2021, more than 50 % of Ukrainians of both sexes are overweight. The average height of Ukrainians (men) is 175 cm; average weight – 80 kg. At the same time, among the human population of Ukraine, the weight of the body may be lowered – 0.3 %; normal body weight – 40.7 %; EBW – 45.4 %; 13.2 % suffer from obesity, and 0.4 % are registered. According to the statistical indices for 2019, it was established that there was a two-fold change in the number of human body statistics with a reduced body weight – 0.6 % (2019) and an increase in the average body weight for both articles by 2 kg [1].

The significant prevalence of EBW in the population of Ukraine is due to excessive calories, usually low physical activity (only 38 % of men and 24 % of women regularly engage in physical culture), climatically cold winter during which the population eats calorically and does not work enough physically, low standard of living, high level stress, which leads to metabolic disorders and the development of metabolic syndrome, EBW, obesity, type II diabetes and CVD.

As war continue on the territory of Ukraine today, the majority of servicemen are performing their professional duty, therefore, an important question arises regarding the preservation and provision of their optimal state of health. As mentioned above, CVD is the most common cause of disability and reduced life expectancy, and EBW is one of the leading modifying factors in their development.

The purpose of the study was to establish the prevalence of excess body weight and obesity in military personnel, as the leading medico-biological risk factor for cardiovascular diseases.

Materials and methods. The study included military personnel, exclusively male (n=127), who made up the observation group. The age of the study participants varied from 19 to 64 years, the average age – 43.06±4.07. All study participants were undergoing inpatient examination and treatment at the State Institution “Amosov National Institute of Cardiovascular Surgery of the National Academy of Medical Sciences of Ukraine” for CVD.

The study participants underwent a clinical and anthropological study with measurement of height and body weight and subsequent calculation of the body mass index (BMI), which was determined according to formula 1.

$$\text{BMI}=\text{weight (kg)}/\text{height}^2 \text{ (m}^2\text{)} \quad (1)$$

The interpretation regarding the presence of EBW, obesity with an indication of its degree was evaluated according to the following criteria: less than 18.5 – body weight deficit; 18.5–24.9 – normal body weight; 25.0–29.9 – EBW; over 30.0 – obesity; 30.0–34.9 – first degree obesity; 35.0–39.9 – second-degree obesity; more than 40.0 – third-degree obesity (Khosla T, 1967), [7, 10].

Statistical indices of the male population of Ukraine of the State Statistical Service of Ukraine for 2021 were taken as the comparison group [9]. The calculation of the relative risk of EBW and obesity in the development of CVD was carried out using the statistical program Statistica, Excel 2000. At the same time, the probability of differences was determined by the χ^2 -criterion, the value of $p<0.05$ was considered reliable.

The association of EBW and obesity as risk markers for the development of CVD was considered by the value of OR according to formula 2, which determines how many times the chance of being in the “case” group (patients) is greater than the chance of being in the “control” group (healthy) for a person with EBW or obesity.

$$\text{OR}=[\text{A/B}]/[\text{C/D}] \quad (2)$$

where, A and B are the percentage or absolute numbers of persons with BMI or obesity in the “case” group; respectively, and C and D are the same signs in the “control” group. The OR indicates the magnitude of the association between the disease and exposure to a certain factor. A situation in which the value of OR will be greater than 1 indicates that the level of morbidity among individuals of the observation group is higher in comparison with the control group. In the case when OR is less than 1, the relationship is inverse.

The materials used do not violate the principles of bioethics and can be published, all research participants gave their consent and signed the information agreement (excerpt from the protocol No. 2 of the Meeting of the Bioethics Commission of the “Amosov National Institute of Cardiovascular Surgery of the National Academy of Medical Sciences of Ukraine”, July 2, 2022).

Results of the study and their discussion. The study included 127 military personnel with CVD who were undergoing inpatient examination and treatment at the clinic of the State institution “Amosov National Institute of Cardiovascular Surgery of the National Academy of Medical Sciences of Ukraine”. To study the frequency of CVD nosologies, study participants were divided into 13 clinical groups:

Group 1 with IHD (n=40), which was 31.5 %, mean age: 48.5±7.9; mean age of disease onset: 42.8±7.8;

Group 2 with heart rhythm disorders (n=35), which was 27.6 %, mean age: 39.1±8.2; mean age of disease onset: 33.2±7.9;

Group 3 with pathology of heart valves (n=15), which was 11.8 %, mean age: 41.4±12.7; mean age of disease onset: 34.8±12.2;

Group 4 with cardiomyopathies (n=6), which was 4.7 %, mean age: 35.3±19.5; mean age of disease onset: 31.5±18.9;

Group 5 with aortic pathology (n=6), which was 4.7 %, mean age: 44.5±20.2; mean age of disease onset: 38.2±19.8;

Group 6 with infectious endocarditic (n=4), which was 3.1 %, mean age: 39.2±24.4; mean age of disease onset: 39.2±24.4;

Group 7 with TEPA (n=1), which was 0.8 %, mean age: 57.0±13.1; mean age of disease onset: 57.0±13.1;

8–13 clinical groups with combined pathology of the CVD.

Group 8 with valve pathology and infective endocarditic (n=9), which was 7.1 %, mean age: 45.7±16.6; mean age of disease onset: 45.7±16.6;

Group 9 with IHD and heart rhythm disorders (n=5), which was 3.9 %, mean age: 47.0±22.3; mean age of disease onset: 41.6±22.0;

Group 10 with IHD and valve pathology (n=2), which was 1.6 %, mean age: 52.0±35.3; mean age of disease onset: 46.5±35.2;

Group 11 with heart rhythm disorders and valve pathology (n=2), which was 1.6 %, mean age: 30.1±32.4; mean age of disease onset: 30.1±32.4;

Group 12 with coronary artery disease and myxoma (n=1), which was 0.8 %, mean age: 45.0±49.8; mean age of disease onset: 37.0±48.2;

Group 13 with IHD and cardiomyopathy (n=1) was 0.8 %, mean age: 56.0±49.6; mean age of disease onset: 51.0±49.9.

During the study, BMI was determined and its value was interpreted in relation to the presence of BMI and obesity. It was established that in military personnel with CVD, the mean height was 179 cm, the mean body weight was 88 kg; the mean value of BMI is 27.40 (variations of BMI from 17.99 to 41.03), the data are presented in Table 1. When interpreting BMI of servicemen with CVD, it was found that underweight occurred in 1 person (0.7 %); normal body weight in 41 people (32.3 %), BMI in 52 people (40.9 %); obesity in 33 people (26.0 %), and stage III obesity was recorded in 1 person (3.03 %), the data are presented in Table 1.

Table 1

Frequency of normal body mass and its disorders in military personnel with CVD

Factor	Control group, M±m	Study group, M±m	p, χ^2 ,
Mean height, cm	175±0.02	179±10.5	p>0.05
Mean body mass, kg	80±0.01	88±0.8	p>0.05
Mean BMI	26.1±0.01	27.4±3.9	p>0.05
Insufficient body mass	0.3±0.001	0.7±0.7	p>0.05
Normal body mass	41.0±0.01	32.4±4.1	p=0.2
EBW	45.5±0.01	40.9±4.3	p=0.3
Obesity	13.2±0.01	26.0±3.8	p=0.0003, $\chi^2=17.02$
Stage III obesity	0.4±0.06	3.03±1.5	p=0.01, $\chi^2=5.73$

Analysis of the study of the EBW in military personnel with CVD showed that the prevalence of EBW in the experimental group and the control group was not characterized by significant differences (p>0.05). When determining the frequency of deviations from the norm of body weight in servicemen with

CVD, a significantly higher difference in the number of cases of obesity was established – 26.0 % in comparison with the corresponding frequency of obesity in the male population of Ukraine (according to statistical indices), which was 13.2 % ($\chi^2=17.02$; $p=0.0003$). It was also established that stage III obesity occurred significantly more often in the experimental group – 3.03 % of cases, compared to the control group – 0.4 %, ($\chi^2=5.73$; $p=0.01$).

The frequencies of EBW and obesity were analyzed together, which made it possible to establish a significantly higher difference in the number of EBW and obesity in the observation group – 66.9 %, compared to the corresponding frequency in the control group – 58.6 %, ($\chi^2=3.63$; $p=0.056$).

The next step of our study was to determine the OR of CVD development due to EBW and obesity of different degrees. OR values were determined and it was established that obesity increases the risk of developing CVD by 2.31 times (OR=2.31; 95 % CI: 1.52–3.49). And the presence of stage III obesity 7.58 times (OR=7.58; 95 % CI: 1.10–52.20). Further calculations were made and BMI values were determined in clinical groups of study participants, the results are presented in Table 2.

Table 2

Military personnel by BMI

No	Group	Factor (M±m) in groups			
		N (%) persons with:			
		↓ body mass	N body mass	EBW	Obesity (stage)
CVD					
1	IHD	0	9 (22.5)	18 (45.0)	13 (32.5) I stage – 7 (53.8); II stage – 5 (38.5); III stage – 1 (7.7)
2	Rhythm disorders	1 (2.8)	11 (31.4)	16 (45.8)	7 (20.0) I stage – 6 (85.7); II stage – (14.3);
3	Valvular pathology	0	6 (40.0)	5 (33.4)	4 (26.6) I stage – 3 (75.0); II stage – 1 (25.0)
4	Cardiomiopathy	0	1 (16.7)	4 (66.6)	I stage – 1(16.7)
5	Pathology of aorta	0	1 (16.7)	4 (66.6)	I stage – 1(16.7)
6	Infective endocarditic	0	3 (75.0)	1 (25.0)	0
7	TEPA	0	0	0	I stage – 1 (100.0)
Combined pathology					
8	Valvular pathology and Infective endocardites	0	7 (77.8)	1 (11.1)	I stage – 1 (11.1)
9	IHD and Rhythm disorders	0	2 (40.0)	1 (20.0)	II stage – 2 (40.0)
10	IHD and Valvular pathology	0	0	1 (50.0)	I stage – 1(50.0)
11	Valvular pathology and Rhythm disorders	0	1 (50.0)	1 (50.0)	0
12	IHD and mixoma	0	0	0	I stage – 1
13	IHD and cardiomiopathy	0	0	0	II stage – 1

It was established that the lowest BMI corresponding to normal body weight was in clinical groups with infective endocarditis – 23.6, and in the combination of pathologies: infective endocarditis with valvular pathology – 24.2. This fact can be explained by the etiological origin of infectious endocarditis, which is not related to eating habits and caloric content of food. At the same time, servicemen from clinical groups with coronary artery disease had the highest BMI – 29.3; and coronary artery disease in combination with cardiac myxoma – 30.4; IHD with cardiomyopathies – 35.1.

This can be explained by the pathogenetically determined mechanism of development of these pathological conditions. Namely: chronic stress, smoking, impaired nutrition and other modifying factors create prerequisites for the occurrence of myocardial metabolism disorders, heart rhythm disorders and ventricular fibrillation, which further determines the development and progress of various clinical CVDs.

From the given data, it is clear that the frequency of prevalence of EBW and obesity among military personnel with different nosological forms of CVD is almost the same. This fact can explain the high prevalence of EBW and obesity, as the leading medico-biological risk factor of CVD. First of all, this is related to the fact that eating behavior, eating high-calorie food, fast food, "stress eating" and others are behaviorally associated habits. In this regard, it is possible to think that this habit is more common in occupational groups where significant psycho-emotional tension is noted, which is formed in connection with the potential danger to life, military personnel belong to such occupational groups.

The analysis of medical and social risk factors for the development of CHD among military personnel, which include age, body mass index, stress, and eating behavior, showed that the specified medical and social factors are common not only in the general population, but also in students of higher educational institutions [8]. For example, in the studies of Ukrainian scientists the most common medico-biological risk factor for the development of CVD, EBW and obesity, was also studied [8, 11]. The data obtained as a result of research prove that simple measures for the prevention of EBW and obesity, namely: correction of eating behavior, improvement of the quality of preliminary and preventive medical examinations, physical activity are mandatory components for preventing the development of not only CVD, but also pathology from the side of others systems of the human body: gastrointestinal tract, autoimmune skin pathology, etc.

The obtained results complement the scientific data of global epidemiological studies on the determination of the role of medical and social factors in the development of CVD [2, 9, 10] and substantiate the further prospects of studying modifying and non-modifying risk factors for the development of CVD, as the most common group of non-infectious diseases.

Conclusions

1. The prevalence of EBW and obesity among servicemen with CVD is 66.9 ± 4.1 %.
2. A significantly higher difference in the number of cases of obesity in the experimental group was established – 26.0 %, compared to the corresponding frequency of obesity in the control group – 13.2 % ($\chi^2=17.02$; $p=0.0003$).
3. It was found that stage III obesity occurred significantly more often in the experimental group – 3.03 %, compared to the frequency of obesity in the 3rd century. in the control group - 0.4 % ($\chi^2=5.73$; $p=0.01$).
4. OR values indicate that the presence of obesity increases the risk of developing CVD in the cohort of military personnel by 2.31 times (OR=2.31; 95 % CI: 1.52–3.49), and the presence of stage III obesity. 7.58 times (OR=7.58; 95 % CI: 1.10–52.20).
5. The obtained results prove that simple measures to prevent EBW and obesity, namely: correction of eating behavior, high-quality food supply, improvement of the quality of preliminary and preventive medical examinations, physical activity, are a mandatory component of preventing the development of CVD.

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