

# Evaluation of overweight and obesity in Helicopter Emergency Medical Service (HEMS) worker

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## Abstract

**Introduction.** Obesity now affects people from all walks of life, including those who work in the field of medical aid provision on a daily basis. So far, there has been no research assessing the nutrition status of Helicopter Emergency Medical Service (HEMS) crews.

**Objectives.** To evaluate the degree to which overweight and obesity prevail among Helicopter Emergency Medical Service Air Ambulances (HEMS LPR) crew members, and determine the overall excess body fat and fatty tissue distribution in the subjects.

**Material and methods.** In order to evaluate the prevalence of overweight and obesity in HEMS crew members, the following anthropometric measurements were used: height, body mass, waist and hip circumferences. Assessment of their nutritional status was made by using some generally used indicators, i.e. calculating the subjects' BMI, WHR and WHtR.

**Results.** Pilots were older than the paramedics in a statistically significant way. On the basis of using the BMI indicator, it was shown that only 36% of HEMS crew members had normal body weight. Analysis of the percentage of body fat determined that 61.5% of the paramedics and 39.4% of the pilots had normal weight. 26.2% paramedics and 28.8% pilots were diagnosed as overweight. Obesity characterised 12.3% of paramedics and 31.8% of pilots. The above were statistically significant differences ( $p=0.0117$ ). Waist circumference exceeded 102 cm in 25.9% of the subjects and  $WHR>1$  characterised 20.6% of those examined.

**Conclusions.** Analysis of the results obtained revealed that an alarmingly high percentage of crew members suffer from excessive body mass and fat, particularly in the group of pilots. Immediate action should be taken in order to reduce the body mass and introduce preventive measures among the subjects.

## Key words

HEMS, overweight, obesity, BMI, WHR

## INTRODUCTION

All over the world, including Poland, obesity has become one of the major social and personal problems [1]. In spite of the progress made in its treatment, obesity now occurs three times as frequently as twenty years ago. Most epidemiological surveys show that over 50% of the population suffers from overweight or obesity [1, 2, 3]. Obesity is a pathological condition in which body fat exceeds the norm to the extent it has an adverse effect on the human organism, leading to increased health risks and mortality [4].

There are a few methods for assessing correct body mass. The one that is most frequently used is BMI (Body Mass Index) [5], which is determined on the basis of the individual's body mass and height using the formula  $BMI = \text{body mass (kg)} / \text{height (m)}^2$ . The World Health Organization regards a BMI of 25–29.9  $\text{kg/m}^2$  as overweight and a BMI  $>30 \text{ kg/m}^2$  as obesity. This is broken down into three classes: I class (BMI 30.0–34.9), II class (BMI 35–39.9) and III class (BMI  $>40$ ) [1]. The latter class of obesity is also sometimes referred to as extreme or morbid [5].

BMI does not specify either the distribution or the amount of body fat in the organism. Therefore, use is also made of the WHR indicator, which is the ratio of the circumference of the waist to that of the hips (waist to hip circumference ratio). The waist circumference is measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest, and the hip circumference at the level of the greater trochanters. [6]. On the basis of this ratio, two types of obesity are identified: abdominal (visceral) and lower-body/peripheral (gluteal-femoral). Abdominal obesity is diagnosed when  $WHR \geq 0.8$  in women and  $\geq 1.0$  in men [4]. Lower body/peripheral obesity is diagnosed when  $WHR$  is  $WHR < 0.8$  in women and  $< 1.0$  in men [4].

According to some researchers, the circumference of the waist itself is an easy indication of overall body fat. It has been shown that it has a close correlation with the risk of heart disease, hypertension and diabetes [7, 8, 9]. Men whose waist exceeds 102 cm have an increased risk of metabolic complications in comparison to those with a waist circumference measuring 94 cm [10].

Obesity affects people from all walks of life, including those who provide medical aid to others on a daily basis. The Polish Air Ambulance works in the field of providing emergency and sanitary services in the country's health service. It works now from seventeen permanent bases. The crew of the Helicopter Emergency

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Medical Service consists of: a pilot, paramedic/nurse and doctor.

Up to now there has been no assessment of the nutritional status of HEMS crews.

## OBJECTIVES

The aim of the work was to evaluate the degree to which overweight and obesity prevail among the members of the HEMS Air Ambulances and to specify overall body fat and the distribution of body fat, measured by means of selected somatic and anthropometric indicators.

## MATERIALS AND METHOD

Towards the end of 2012, all HEMS pilots and paramedics aged 27–59 were examined (66 pilots, 65 paramedics). Most of them were men, with women accounting for only 3.8% (exclusively paramedics). None of the respondents had taken earlier action to improve their health behaviours to reduce body weight. The following anthropometric measurements were evaluated in order to check if they suffered from overweight or obesity: height, body mass, waist and hip circumference. Generally used nutrition status indicators were calculated on the basis of the data obtained:

- BMI = body mass (kg)/height (m<sup>2</sup>), which were interpreted on the basis of the WHO classification [1];
- WHR [waist circumference (cm)/hip circumference (cm)];
- WHtR [waist circumference (cm)/ height (cm)];

The parameters of electrical impedance indicating the amount of total body fat in the organism were measured using an impedance analyser (Tanita SC-330).

Statistical analyses were made using R software (2.15.1 version). Comparative analyses between the groups were measured using chi<sup>2</sup> and Mann-Whitney U tests. Statistical significance was assumed at the level of  $p < 0.05$ .

## RESULTS

The average age of those examined was  $42.73 \pm 9.58$ . Pilots were older than paramedics in a statistically significant way ( $49.12 \pm 7.52$  vs.  $36.23 \pm 6.64$  years;  $p < 0.0001$ ). Moreover, there were statistically significant differences between paramedics and pilots in all the parameters tested, apart from height, e.g.: body mass  $83.10 \pm 11.81$  vs.  $89.20 \pm 16.75$  kg ( $p = 0.0478$ ), BMI  $25.84 \pm 3.17$  vs.  $28.27 \pm 4.95$  kg/m<sup>2</sup> ( $p = 0.0023$ ), the percentage of body fat  $21.38 \pm 5.81$  vs.  $24.88 \pm 6.18$  % ( $p = 0.0012$ ), waist circumference  $96.95 \pm 11.38$  vs.  $99.55 \pm 12.86$  cm ( $p = 0.02$ ) (Fig. 1).

On the basis of BMI, it was shown that only 36% of HEMS crews had normal body mass. Over 20% were diagnosed with obesity, while 3% with extreme obesity. (BMI >> 40). The results are shown in Figure 1.

Moreover, an analysis was made of the degree of overweight and obesity depending on the job being performed by the subjects. It was found that 46.2% of the paramedics and 25.8% of the pilots had correct body mass. Those with overweight accounted for 43% paramedics and a similar number of pilots (43.9%). Obese crew members accounted for 10.8 %

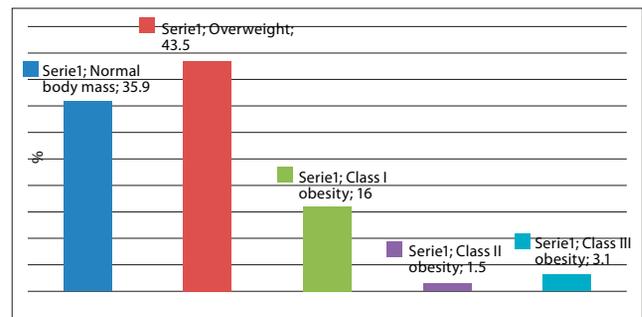


Figure 1. Assessment of overweight and obesity among all subjects on the basis of BMI (acc. to WHO classification, %)

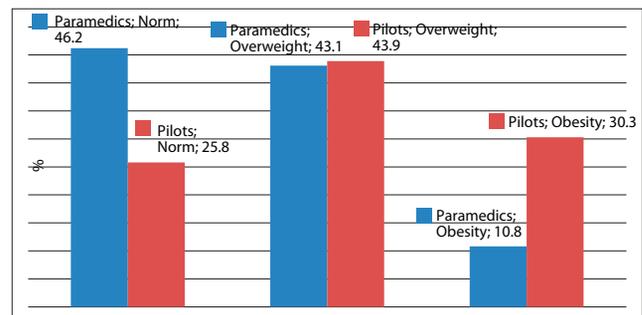


Figure 2. Nutritional state based on BMI with a breakdown taking into account pilots and paramedics (acc. to WHO classification, %)

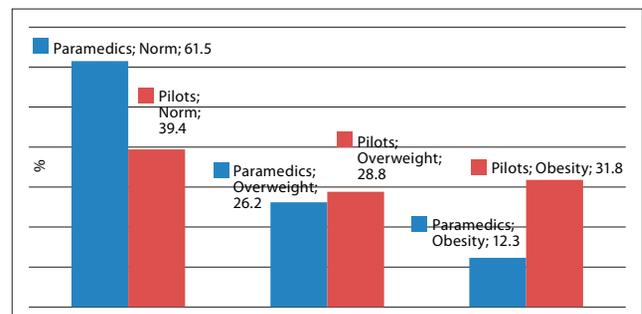


Figure 3. Nutritional status according to percentage of body fat in the organism

of the total number of paramedics and 30.3% of the pilots (Figure 2).

The percentage analysis of body fat in the subjects showed that 61.5% of the paramedics examined and 39.4% of the pilots obtained normal results. 26.2% paramedics and 28.8% pilots were overweight, while 12.3% paramedics and 31.8% pilots obese. The differences were statistically significant ( $p = 0.0117$ ).

The WHR and waist circumference can be significant indicators of cardiovascular risk and type II diabetes. Among those examined, waist circumference was over 102 cm in 25.9%, and in 20.6% the WHR exceeded 1, which indicates excessive body fat accumulation in the abdominal area.

The WHtR makes it possible to assess the risk of diet-related diseases, which can be prevented or minimised by making appropriate dietary and lifestyle changes. The result of WHtR  $\geq 0.56$  (29% of those examined) signals the risk of type II diabetes, and the result of  $\geq 0.59$  (17.6% of those examined) indicates a risk of hypertension [11].

**Table 1.** Anthropometric measurements of the subjects with a breakdown by job performed

Variables	Subjects overall		Paramedics		Pilots		p
	N	X±SD	N	X±SD	N	X±SD	
Age [years]	131	42.73±9.58	65	36.23±6.64	66	49.12±7.52	<0.0001
Height [cm]	131	178.36±5.86	65	179.23±6.09	66	177.50±5.53	0.0712
Weight [kg]	131	86.17±14.78	65	83.10±11.81	66	89.20±16.75	0.0478
Body fat [%]	131	2.14±6.23	65	21.38±5.81	66	24.88±6.18	0.0012
BMI [kg/m <sup>2</sup> ]	131	27.07±4.32	65	25.84±3.17	66	28.27±4.95	0.0023
WHR	131	0.96±0.06	65	0.94±0.05	66	0.97±0.07	0.0184
Watr	131	0.54±0.06	65	0.53±0.05	66	0.56±0.07	0.0036
Waist circumference [cm]	131	96.95±11.38	65	64.3±9.01	66	99.55±12.86	0.0212

N – number of subjects; X – mean value; SD – standard deviation; p – statistical significance value; BMI – Body Mass Index; WHR – Waist to Hip Ratio; WATR – Waist to Height Ratio

## DISCUSSION

Performing the tasks that are required of HEMS crews makes it important that they should be healthy and extremely fit, the precondition of which is maintaining correct body mass. It has been proved that people with overweight are less fit than those with normal weight [12]. Moreover, it has been observed that there is an inversely proportional dependence between physical fitness, the BMI indicator and age [13].

On the basis of analysing BMI, it was shown that over 40% of HEMS crew members were overweight, while over 20% obese, with 3% of the latter suffering from extreme obesity defined as BMI>40. When analysing the particular groups, it was determined that overweight paramedics accounted for 43% of this profession among the crews and 43.9 % of the pilots, while obesity affected 10.8 % of the paramedics and 30.3% of the pilots.

Examinations of the nutritional status of Polish military flying personnel in the Polish army showed that overweight prevails among over 50% of those examined, both in the under 30 year-old group, as well as in those over 30, while obesity was diagnosed in 10.5% of those under 30 years old and in 18.9% of the older subjects [14]. It must be noted, however, that the subjects were older people, and the problem of overweight and obesity increases with age, which has been proved by numerous studies [15, 16, 17].

The results of examining the nutritional status of the military medical flying personnel obtained by Klos et al. showed that 53.3% of the doctors and 61.9% of the paramedics were overweight, while obesity was diagnosed in 20 % of the doctors and 16.7% of the paramedics [18]. These values were higher than those obtained when evaluating the degree of overweight and obesity among the paramedics working on HEMS crews.

Although BMI is a useful tool to determine overall body fat, it does not reflect non-fat body mass, which is a disadvantage of this indicator, because it does not reflect the distribution of fatty tissue in the body, and therefore does not precisely assess the risk connected with overweight. Diagnosing overweight on the basis of BMI only is burdened with the risk that such people as, for example, muscular athletes, who have little fat, can fall into the overweight category. Another risk is

that people with excessive body fat may not be diagnosed as obese, and in spite of the excessively high percentage of body fat in their organism, their BMI may fall in the under 30 kg/m<sup>2</sup> class [19].

Bearing in mind that obesity is defined as the pathological accumulation of excess body fat, the main assessment criterion should therefore not be body mass but the percentage of body fat in relation to total weight. The average percentage of body fat in the European population is 15% – 18% in men and 22–25% in women, while the optimal values, i.e. those that do not carry the risk for complications, are in the range of up to 5% and 12%, respectively [20]. If body fat exceeds 20% in men and 30% in women, they are diagnosed as obese [21].

Body fat was also evaluated in the study of the nutritional status of HEMS crews. Judging on the basis of generally accepted norms, the normal amount was diagnosed in 61.5% of the paramedics examined and 39.4% of the pilots. Overweight was found in 26.2% of paramedics and 28.8% of pilots. Obesity characterised 12.3% of the paramedics and 31.8% of the pilots. Body fat percentage significantly increased with age. Research conducted among military pilots also showed that body composition is adversely affected by weight [16].

In both groups, the paramedics as well as the pilots, a lower percentage of those with overweight and obesity were found than shown by the results obtained by applying BMI.

For many years, epidemiological data have shown that in Western societies the most frequent causes of death are cardiovascular diseases, the development of which is mainly brought on by excessive body fat. The high metabolic activity of fat tissue is one of the factors increasing the risk of oxidative stress which, in connection with lipid disorders and chronic inflammation, constitutes the basic mechanism of the initiation of atherogenesis [22, 23]. Moreover, the inflammation process, which is connected with the increase of metabolic activity of fat cells, plays a role in insulin resistance, which is one of the main mechanisms in the development of the metabolic syndrome [22, 23]. Additionally, some authors suggests that obesity may be one of the risk factors for dementia [24].

One of the basic criteria of diagnosing metabolic syndrome is abdominal obesity. Analysis of indicators based on measuring the waist and hips showed that with age the risk of the overall accumulation of body fat in men is not only higher, but most importantly, there is an increase in the central belt around the stomach, characteristic of abdominal or visceral fat. Similar results were shown by the research of Socha et al. [15]. The authors explain the rising values of WHR and waist circumference indicators by the existence of a process of body fat redistribution in male organisms in such a way that the trunk of the body accumulates more fat in relation to the decreasing fat of the extremities.

Increasing body mass leads to deterioration of the quality of life, shortens life expectancy, and undoubtedly worsens the quality of one's work. Fogelholm et al. [25] maintain that besides suffering from a lower efficiency of the cardiovascular system, people with a higher percentage of body fat also suffer from the impairment of motor skills, which makes it more difficult for them to perform their tasks at work. This problem is particularly significant in relation to the Helicopter Emergency Medical Service, where the crew must react quickly and be on permanent alert to perform their tasks.



## CONCLUSIONS

1. Analysis of the results obtained shows an alarmingly high percentage of subjects with excessive body mass and body fat, particularly in the group of pilots.
2. Immediate action should be taken to reduce the body mass among the subjects in the group examined and introduce preventive measures to decrease the number of people with excessive body mass.

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