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Epidemiology

Estimation of protein-energy and mineral nutritional status of flight engineers and navigators serving in the Polish Air Force

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Summary:

Introduction: The aim of the study was to assess the protein-energy and mineral nutritional status of flight engineers and navigators of military aircraft.
Material and Methods: Measurements of body weight and body height were performed in all examined subjects. The obtained results made a basis to calculate the Body Mass Index - BMI. The study also included thickness measurements of selected skin folds. Examinations of bone mineral density were also carried out using the densitometric method.
Results/Conclusion: Normal body weight was found in 24.3 % of navigators and 31.0 % of flight engineers. Overweight was found in 54.1 % of navigators and 44.9 % of flight engineers. Obese persons were also present among the examined subjects. In the group of navigators obese persons constituted 21.6 % and in the group of flight engineers – 24.1 % of the examined subjects. Normal bone calcification was found in 91.9 % of navigators and 69% of flight engineers. Among navigators, 8.1 % reported osteopaenia, while among flight engineers – 31 %. No changes indicating the occurrence of osteoporosis were found in either group. Overweight and obesity were found in both navigators and flight engineers which is not favourable from the health point of view. Correct bone calcification found among over 90 % of the examined navigators is a very positive factor.

Key words: mineral nutritional status, overweight, obesity, densitometric method.

Introduction

Nutritional status of an organism is a result of nutrition manner, absorption and utilization of nutrients, as well as the activity of many different adverse environmental factors. Both the deficiency and the excess of nutrients in a daily diet affect nutritional status, creating a risk of many diet-related diseases (Szponar *et al.* 2002). Factors such as abundance and widespread availability of food, its aggressive advertising, as well as a lifestyle restricting physical activity, are the main causes of overweight and obesity spread (Respondek 2008). Both of those phenomena originate from a prolonged state of positive energy balance (Jarosz and Respondek 2008). Currently, in 19 European Union member states the percentage of people indicating overweight and obesity in the population of adult women varies from 36.9 to 56.7 %, whereas in men those values vary from 51 to 69.3 % (http//webcache.googleusercontent.com/search 2012). Good nutritional status is not only consistent with the accepted standards of body

weight, muscle or fat content, but also with good condition of bone mineralization that limits the occurrence of fractures, especially upon the exposure to adverse environmental factors affecting the skeletal system.

Service in the Polish Air Force is highly stressful. Strong emotions associated with the responsibility for the tasks performed in the air are often reduced by excessive consumption of food, especially during standbys. Such a way of mental stress reduction leads to increased body weight (Kobos *et al.* 2003).

The aim of the study was to assess the protein-energy and mineral nutritional status of flight engineers and navigators serving in the Polish Air Force.

Material and methods

A total of 66 men performing military service in various units of the Polish Air Force and flying different aircraft types underwent the examination of protein-energy and mineral nutritional status. Nutritional status of 37 navigators and 29 flight engineers was assessed.

Measurements of body weight and body height were conducted among all examined subjects and the obtained results made a basis to calculate the Body Mass Index—BMI. In accordance with the Ferro-Luzzi classification (Ferro-luzzi et al 1992), the BMI value was the basis for the qualification of the examined subjects to the following groups: normal weight [BMI 18.5 kg/m^2 – 24.9 kg/m^2], overweight [BMI 25.0 kg/m^2 – 29.9 kg/m^2] and obesity [BMI 30.0 kg/m^2 – 39.9 kg/m^2]. Based on the thickness measurements of 4 selected skin folds (on biceps, triceps, under scapula and over iliac crest), fat content in the body was determined using the Durnin and Womersley method (Durnin and Womersley 1974). The measurements of skin fold thickness were conducted using the Holtain caliper with constant pressure of 10 g/mm^2.

The examination of bone mineral density was carried out using the DEXA densitometric method (dual energy-X-ray absorptiometry) on the nonprevailing upper limb forearm bone, using the EXA 3000 apparatus. The degree of bone mineralization was assessed based on the T-score value. The T-score value of >-1 was adopted as a normal value. T-score values between – 1 and – 2.5 are characteristic of osteopaenia, while values lower than – 2.5 are typical of osteoporosis (Blade and Fogelman 2000).

Results and discussion

The average age of the examined group of navigators was 35.2 ± 7.5, while for flight engineers it was 38.4 ± 7 years (Table 1). The group of flight engineers was taller by 1.4 cm compared to the navigators and the weight of navigators was higher by 0.8 kg. In comparison with the flight engineers, the group of navigators had approx. 1.5 cm longer arm circumference, skin fold thickness under scapula and over iliac crest greater by 2.81 mm and 0.7 mm, respectively, as well as lean body weight greater by 0.5 kg. Normal body weight was found in 24.3% of navigators and 31.0 % of flight engineers, while overweight was found in 54.1% of navigators and 44.9 % of flight engineers. In the group of navigators, 21.6% were obese, whereas in the group of flight engineers obesity occurred in 24.1% (Table 2).

Table 1: Average values of the examined parameters in the groups of navigators and flight engineers.

	Navigators	Fight Engineers
Age [years]	35.2±7.5	38.4±7.2
Body height [cm]	175.8±6.2	177.2±7.8
Body weight [kg]	85.8±10.9	85.0±11.53
Arm circumference [cm]	34.6±3.12	33.1±3.23
Skin fold on biceps [mm]	2.85±0.52	2.83±0.52
On triceps [mm]	3.05±0.51	3.07±0.50
Under scapula [mm]	23.00±6.78	20.19±6.56
Over iliac crest [mm]	28.43±8.29	27.70±6.74
Body Mass Index [kg/m^2]	27.80±3.71	27.1±3.48
% of fat content	22.9±4.51	22.87±3.33
Lean body mass [kg]	65.9±7.55	65.4±.8.42

The results of previous studies performed in 402 male aircraft crew members of the Polish Air Force revealed the percentage of

overweight and obese men increasing with age. Overweight occurred in each of the examined age groups, at the same time the percentage of subjects reporting overweight ranged from 50% in men aged up to 30 to 59.6 % in the group of men aged 41-50. Similarly, the number of obese subjects increased with age. In the group of men aged up to 30, obesity was found in 10.5%, while in the group aged 41-50 obesity was found in 20.2 % of the examined subjects (Kłos and Bertrandt 2000).

Table 2: Overweight and obesity occurrence in the examined groups (%).

BMI [kg/m^2]	Navigators	Flight engineers
Normal values 18.5-24.9	24.3	31.0
Overweight 25.0 – 29.9	54.1	44.9
Obesity 30.0 – 39.9	21.6	24.1

of overweight and obesity concerned 33 % of world population. It is estimated that in 2030 up to 58 % of the inhabitants of our planet will have abnormal body weight (IDCZAK http//www.yaacool-uroda.pl 2012).

Adequate supply of calcium is very important for proper formation and functioning of the human skeletal system. Normal bone calcification was found in 91.9 % of the examined navigators and 69% of flight engineers. In both examined groups, changes in skeleton calcification characteristic of osteopaenia were found and concerned 8.1% of navigators and 31 % of flight engineers.

Changes in skeleton calcification characteristic of osteoporosis were not found in the examined groups.

Conclusions

1) Excessive body weight found in over 75 % of navigators and 69 % of flight engineers testifies to an unfavourable, from the health point of view, and unbalanced, in terms of energy, nutrition model.

2) Changes in bone calcification characteristic of osteopaenia, found in more than 39 % of the examined subjects indicate a calcium shortage in the diet or disorders in calcium absorption and assimilation.

3) It is necessary to take extensive educative actions among the Polish military aircraft crews in correct nutrition, as well as permanent training of Air Force officers responsible for planning and implementing nutrition in the field of nutritional prophylaxis of metabolic civilization diseases.

Table 3: Bone calcification status in the groups of navigators and flight engineers compared to other groups of men (%).

T-score	Navigators	Flight engineers	Medical aircraft crew (Kłos and Bertrandt 2011)	Pilots altogether (Bertrandt et al 2005)	Inhabitants of Warsaw (Bertrandt and Kłos 2008)
Normal bone calcification up to -1	91.9	69	86.2	64.3	36.3
Osteopaenia -1 – -2.5	8.1	31	10.5	33.3	42.5
Osteoporosis ≤-2.5	-	-	3.3	2.4	21.2

Studies of nutrition in men serving as military medical aircraft crew in the Polish Air Force revealed the occurrence of overweight in 53.3 % of the examined physicians and 61.9 % of the examined medical rescuers. Obesity was found in 20 % of physicians and 16.7 % of medical rescuers (Kłos and Bertrandt 2011).

The results of another study indicated that every third Pole is overweight and 14 % of Polish citizens are obese. The authors concluded that overweight occurred more often in men than in women. (JANIK and ZATOŃSKI 2004). Studies carried out in 2006 at the University School of Public Health and Tropical Medicine in New Orleans demonstrated that in 2005 the problem

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