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OBESITY AS AN INDICATOR OF FITNESS OF DIFFERENT AGE GROUPS OF MEN OF THE CZECH REPUBLIC

Cacek Jan[1]*,
Hlavoňová Dita[2],
Grasgruber Pavel[3],
Kalina Tomáš[4]
[1,2,3,4]*Faculty of Sports Studies, Czech Republic*

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Abstract

The objective of this study was to assess the fitness of the male population in the Czech republic, based on different indicators of obesity. The research sample consisted of 284 men, divided into 6 age groups. To identify the average degree of obesity in different age groups of the male population, several indicators of obesity were used: BMI, %body fat, visceral fat, fitness score. The results show that with increasing age ($p < 0.05$) the fitness score decreases, while the amount of visceral fat, the percentage of fat and BMI increases. Depending on the used criteria, the number of people falling into the category of obese differs significantly. The standard criterion recommended for the assessment of obesity (WHO) is "subcutaneous fat" or "BMI". However, standard criteria can't reflect the proportion of the muscular component; therefore, in our view they are inappropriate for the assessment of obesity and fitness. For the evaluation of obesity we recommend the fitness score.

1. Introduction

During the last decades, obesity is becoming a serious health problem not only in the developed world. In the Czech republic, about 35% adults were overweight and 17% were obese according to a survey made in 2005 (Kunešová M., et al. 2007). These figures would place the Czech adult population among Top Ten most obese nations in the world (http://www.oecd-ilibrary.org). At the same time, the percentage of overweight/obese individuals shows a continuous tendency to increase. In this paper we want to describe current fitness and the prevalence of obesity in the male population from the Czech Republic, using the bioimpedance device InBody 720. Several parameters were selected as a basic criterion for the evaluation of fitness and the description of obesity in different age groups.

The most widely used indicator of excessive weight is *BMI (body mass index)* computed from body height (in meters) and weight (kg/m^2). The World

* *E-mail*: cacek@fsps.muni.cz, tel. +420 777 876 428

Health Organization (WHO) has established standards, according to which a BMI range between 18.5-24.9 kg/m^2 is considered normal, values between 25.0-29.9 kg/m^2 indicate overweight, and BMIs ≥30 kg/m^2 are a sign of obesity (http://apps.who.int/bmi/index.jsp). This classification is based on observations from epidemiological studies (Snitker S., 2010).

In praxis, BMI turns out to be quite a useable indicator of obesity in large population samples, but considering that it can't reflect the proportion of muscle mass (or lean body weight, respectively) on body weight, it is unreliable in individual cases (Colombo O., et al., 2008). BMI actually correlates more with the total amount of fat mass than with %fat (Sun Q., et al. 2010). Likewise, BMI is not able to take into account important factors such as age and gender. Women at the same BMI have about 10% more fat than men (Gallagher D., et al. 1996; Jackson A.S., et al. 2002; Larsson I., et al. 2004), and this difference increases with increasing BMI (Heymsfield S.B., et al., 2009). Consequently, it is very difficult to determine specific BMI threshold values for different age and sex categories (De Lorenzo A., et al. 2003). In this study, we chose BMI 25 kg/m^2 as a cut-off point of excessive weight.

A more accurate indicator of obesity is the *percentage of body fat*. However, WHO hasn't defined any international stardards of %body fat that would serve for the assessment of obesity. Perhaps the most frequently quoted cut-off points are those of Gallagher et al. (2000). (Table 1) Based on the manual of InBody 720, we set the cut-off point determining obesity in men at 25% body fat, which also agrees with Gallagher's recommendations for the youngest age category.

Table 1. *Cut-off points of %body fat corresponding to BMI values that are used as guidelines for assessing obesity (after Gallagher D., et al. 2000)*

Sex and BMI	*20-39 y*	*40-59 y*	*60-79 y*
Women			
BMI □18.5	*21*	*23*	*24*
BMI ≥25.0	*33*	*34*	*36*
BMI ≥30.0	*39*	*40*	*42*
Men			
BMI □18.5	*8*	*11*	*13*
BMI ≥25.0	*20*	*22*	*25*
BMI ≥30.0	*25*	*28*	*30*

Besides the proportion of body fat on body weight, a similarly important factor is the distribution of fat in the body. In particular, abdominal *visceral fat (*i.e. fat located around the internal organs) is associated with an elevated risk of morbidity (Bray G.A., et al., 1998). Measurements of visceral fat are a standard component of the device InBody.

Another indicator of obesity may be the value of the *"fitness score" (FS).* The fitness or body condition score is Biospace specific index, which is calculated from the ratio of muscle and fat, and is intended to supplement the result of the overall health status of the examined person. Values below 70 points indicate a

weak or obese type, the range between 70-90 points is typical for normal, healthy people, and individuals with values above 90 points are power, athletic types (www.biospace.co.kr, Users' manual)

2. Material and methods

The objective of the research can be summarized into these following points:

• To identify differences in the average degree of obesity in different age groups of the male population according to various indicators: Body Mass Index (BMI), % body fat, visceral fat, fitness score. For the inclusion among the obese population, these following threshold parameters were chosen: BMI $\geq$ 25 kg/m^2, fitness score (FS) $\leq$ 70 points, body fat (%) $\geq$ 25%.

• To assess the fitness of the population based on different indicators of obesity.

The implementation of this research was realized within the project CZ.1.07/2.3.00/20.0044. The survey took place in 2011 and 2012. The research sample consisted of 284 men, divided into 6 age groups: Group 1: 18 - 29 years (n = 119); Group 2: 30 - 39 years (n = 68); Group 3: 40 - 49 years (n = 46); Group 4: 50 - 59 years (n = 22); Group 5: 60 - 69 years (n = 20), Group 6: 70+ years (n = 9). The predefined indicators of obesity were measured by the bioimpedance device InBody 720.

3. Results

The results are presented on Figures 1-4 and were assessed at p <0.05 significance level.

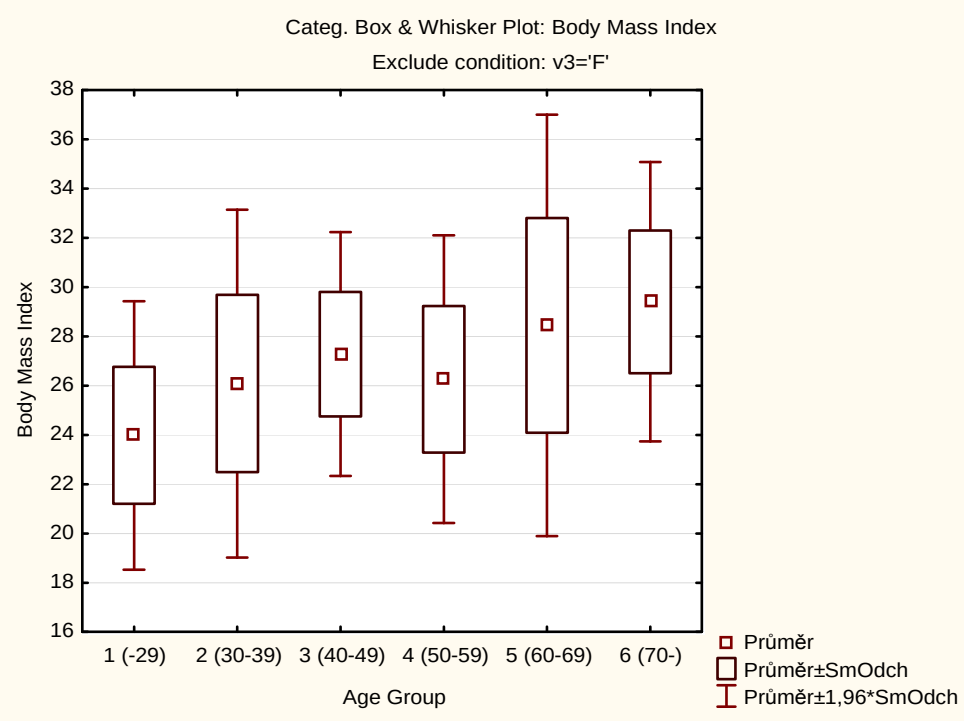

Figure 1. *Average BMI in 6 measured age categories.*

Figure 2. *Average percentage of body fat in 6 measured age categories.*

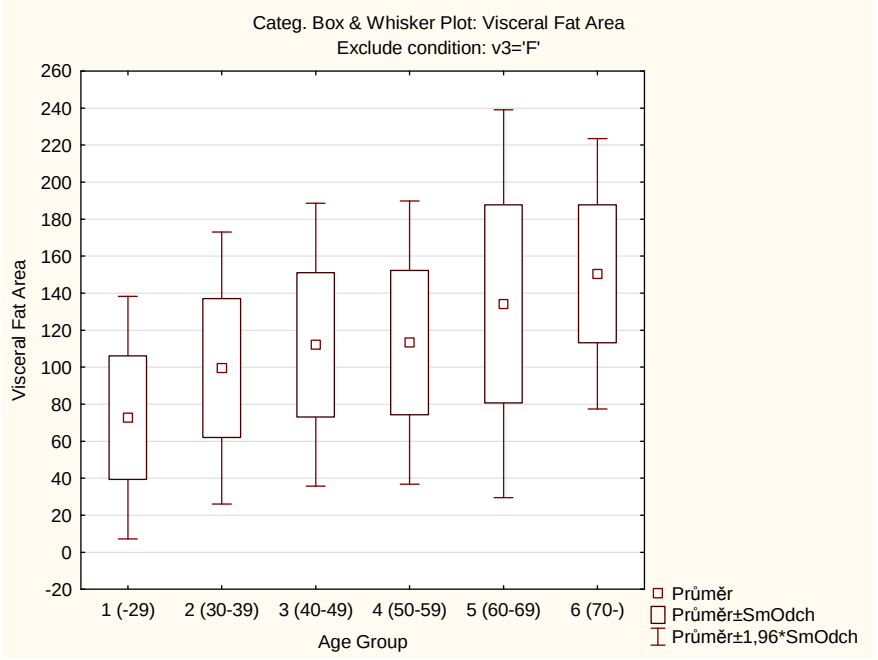

Figure 3. *Average area of visceral fat in 6 measured age categories.*

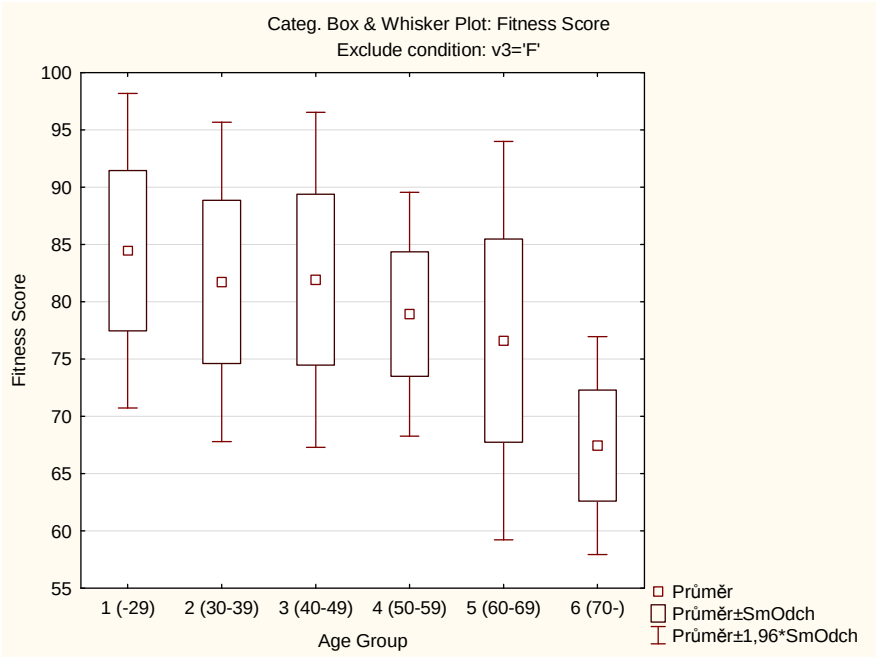

Figure 4. *Average fitness score in 6 measured age categories.*

Based on our findings, we can state that with increasing age:

• BMI increases,

• the percentage of body fat increases,

• the amount of visceral fat increases,

• fitness score decreases,

Further, we can say that the number of people falling into the category of obese or overweight:

• increases with age according to BMI, except Group 4: Group 1: 30.3%; Group 2: 54.4%; Group 3: 78.3%; Group 4: 63.6%; Group 5: 80.0%; Group 6: 100.0%.

• increases with age according to levels of subcutaneous fat: Group 1: 2.5%; Group 2: 17.6%; Group 3: 19.6%; Group 4: 27.3%; Group 5: 45.0%, Group 6: 100.0%.

• increases with age according to values of the fitness score (FS), except Group 3: Group 1: 1.7%; Group 2: 4.4%; Group 3: 0.0%; Group 4: 4.5%; Group 5: 20.0%; Group 6: 66.7%.

Other results show that:

• On average, higher age groups of Czech men don't reach the normative value of 80 points in the fitness score. Only three youngest age groups show higher average values than this normative value.

• Except the first two youngest groups, the Czech male population has a higher percentage of fat than recommended by manuals of the company Biospace

(the manufacturer of InBody).

• The Czech male population shows a tendency towards higher levels of visceral fat with increasing age. Average values of visceral fat in the studied age groups meet the usual standards of the "normal", non-risk population.

4. Conclusions

• Depending on the used criteria, the number of people falling into the category of obese or overweight differs significantly.

• The standard criterion recommended for the assessment of obesity (e.g. by WHO) is "subcutaneous fat" or "BMI". However, these standard criteria can't reflect the proportion of the muscular component; therefore, in our view they are inappropriate for the assessment of obesity and fitness. The same applies for the amount of visceral fat.

• For the evaluation of obesity we recommend the fitness score, which works with both the fat and muscular component. Nevertheless, we think that the limits of normality of this criterion are inappropriately defined.

• None of the parameters reflects differences in age, which we regard as illogical and incorrect. Therefore, different standards must be established for each age category (cf. Gallagher D., et al. 2000).

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