
INDICATORS OF OBESITY IN VARIOUS AGE GROUPS OF THE FEMALE POPULATION IN THE CZECH REPUBLIC

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Abstract

In this paper the authors deal with the obesity of the Czech female population. As a basic criterion for the evaluation of obesity, several standard parameters used worldwide were selected. These include the body mass index (BMI), %body fat, and the “fitness score”. For the inclusion among the female obese population, these following threshold parameters were chosen: BMI ≥ 25 kg/m², fitness score (FS) ≤ 70 points, body fat (%) ≥ 30 . The research sample consisted of 319 women divided into 6 age groups. The results show that in the studied women ($p < 0.05$) BMI increases with increasing age. For example, the percentage of women who fall into the category of overweight or obese according to BMI is 16.7% in the age group 18 – 29 years, 25.8% in the group 30 – 39 years, 32.7% in the group 40 – 49 years, 45.5% in the group 50-59 years, 66.0% in the group 60-69 years, and 85.7% in the group 70+ years. The percentage of fat increases with increasing age as well. The fitness score starts to drop since the age of 50 years and slightly rises in the age groups 30 – 39 and 40 - 49.

1. Introduction

Obesity is a phenomenon of this century, affecting lives of many people around the world. According to WHO (World Health Organization), global prevalence of obesity more than doubled since 1980. In 2008, more than 1.4 billion of adults aged over 20 years were overweight. Out of this number, more than 200 million men and nearly 300 million women were obese (<http://www.who.int/mediacentre/factsheets/fs311/en/index.html>).

In Europe, the prevalence of obesity has increased significantly over the past several decades, a phenomenon that is corroborated by data from other industrialized countries. In the mid-1980s, 15% of the male and 17% of the female population in Europe had a BMI ≥ 30 kg/m², which means that the rate of obesity

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has increased by approximately 30% over the past 10-15 years. Overall, in the central, eastern, and southern regions of Europe, the prevalence of obesity in adults is higher than in the western or northern regions (Klein S., et al. 2007).

Reports on the increase of obesity in the Czech population tend to have an alarming tinge during the recent years, but detailed studies indicate that it is a more complex phenomenon and the key issue is not the obesity in adolescents, but rather in adults. According to the study "Obesity and Lifestyle 2005" (Kunešová M., et al. 2006; 2007), 10% Czech children aged 6-12 years fall into the category of overweight and 10% into the obese category. During the adolescent years, obesity further decreases. A survey from the years 2001-02 (Mulvihill C., et al. 2004) demonstrated that in the category of 15-year olds, only 0.5% Czech girls and 1.6% boys are obese ($BMI \geq 30 \text{ kg/m}^2$), and 5% girls and 11.5% boys are overweight ($BMI 25-29,9 \text{ kg/m}^2$). These are all figures below the average of studied countries.

In adults, the percentages of individuals with excessive weight again dramatically increase. According to Kunešová et al. (2007), in 2005, 35% Czech adults suffered from overweight and 17% were obese. These figures would place the Czech population among Top Ten most obese nations in the world (<http://www.oecd-ilibrary.org>). (However, this rate of obesity is still negligible when compared to the U.S., where in 2006 34.3% adults were obese!). In Czech men, average BMI has increased from 26.04 kg/m^2 in 2001-02 to 26.47 kg/m^2 , and in women, there was a shift from the zone of normal weight (24.83 kg/m^2) to overweight (25.65 kg/m^2). The prevalence of excess weight in adults has increased by 3%. Most of these overweight people are men (almost 60%) and older people.

At present, we more frequently encounter the idea that human populations are exposed to far greater health risks than in previous years due to the sedentary lifestyle. These health risks mostly consist of the already mentioned threat of increasing obesity and the associated risk of cardiovascular disease, hypertension, type 2 diabetes, stroke and many other diseases and health complications.

As means of preventing obesity, there are different methods of medical examination, which may reveal these threats. One of the specialized apparatuses is the device InBody 720. This device is able to determine body composition in the general population within a very short period of time and detect possible overweight or obesity.

One of the most common indicators used for the evaluation of overweight or obesity is the *BMI (body mass index)*. Body Mass Index is a weight - height index, which assesses the adequacy of weight to height. The resulting value indicates the likelihood of malnutrition, overweight, obesity, or if the tested person is in the range of ideal weight. The device InBody 720 uses the standards of the World Health Organization (WHO), according to which the BMI ranging from 18.5 to 24.9 kg/m^2 is considered normal. Persons with a BMI greater than 25.0 kg/m^2 are considered overweight and people with a $BMI >30.0 \text{ kg/m}^2$ are considered obese (<http://apps.who.int/bmi/index.jsp>). This classification is based on observations from epidemiological studies showing that mortality increases significantly above the value of 25 kg/m^2 (Snitker 2010).

BMI can be useful as an indicator of obesity in studies involving larger population samples, but in individual cases it is unreliable because in physically active individuals it can't determine the proportion of muscle (Colombo O., et al., 2008). 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, a large number of obese women is mistakenly classified as normal. The opposite is frequent in men (mainly young men) who have a higher proportion of muscle than women (Burkhauser R. V. & Cawley J., 2008). In the elderly, we find more fat at the same BMI than in young people (Gallagher et al. D., 1996). Consequently, it is very difficult to determine specific BMI threshold values for different age and sex categories (De Lorenzo A., et al. 2003). Despite that, BMI is the fastest "indicative" indicator of obesity in the general population.

Another important parameter for the assessment of obesity is *body fat*. It shows not only risks related to the health status of individuals, but also their physical fitness and performance. Although body fat generally shows high correlation with BMI, this applies more to absolute fat mass than to the percentage of fat (Gallagher et al. D., 1996; Larsson I., et al. 2004; Sun Q., et al., 2010). With increasing age, the proportion of body fat on body weight gradually increases. In hypothetical cases of 23 kg/m² BMIs for men and women, there is an increase in body fat percentage of approximately 1.0-1.1% and 0.7-1.0% per decade, respectively (Gallagher D., et al. 1996). However, some studies indicate that from the 5th to 6th decade of life, absolute fat mass - as well as the weight of lean body mass - decreases (Li C., et al. 2009).

Considerable variations in the proportion of body fat - whether it is its excessive or conversely its significant deficiency in the human body - usually lead to health complications. *"Both high and low amount of fat constitutes a risk for an individual. A low proportion of subcutaneous fat carries health risks in the form of various dysfunctions, because a certain amount of fat is necessary to maintain basic physiological functions."* (Riegerová J., 2006). A drop of fat below 3% in men and less than 12% in women is thus unhealthy a risky. On the other hand, this high variability implicates that the amount of body fat in the body is susceptible to nutritional changes and physical activity.

The harmful effects of an excess of body fat very likely follow a continuum rather than a specific threshold. Unfortunately, neither the World Health Organization nor any major scientific society involved in the study of obesity has defined a normal value for %body fat (Ho-Pham L.T., et al. 2011). Romero-Corral et al. (2010) used tertiles of %body fat distribution in the American population from NHANES III, and defined men with >23.15% body fat and women with >33.3% body fat as obese. Gallagher et al. (2000) established approximate cut-off points of percentage body fat ranges corresponding to published BMI guidelines for the assessment of obesity (see Table 1).

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
<i>Women</i>			
BMI \leq 18.5	21	23	24
BMI \geq 25.0	33	34	36
BMI \geq 30.0	39	40	42
<i>Men</i>			
BMI \leq 18.5	8	11	13
BMI \geq 25.0	20	22	25
BMI \geq 30.0	25	28	30

According to InBody 720, women with a ratio of body fat in the range 18-28% are considered normal, while women with 28-33% body fat are considered obese and those that have more than 33% body fat are extremely obese (www.inbody.7x.cz).

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

Objectives of the work

The objective of this work was to present findings from the evaluation of body composition of the Czech female population that concern the risk of obesity. As basic criteria, we selected body composition parameters with which we can describe the degree of obesity in different age groups of the examined population sample.

Methodology and the organization of the measurements

This research was realized within project "Creating a research team for the purpose of determining the level of physical activity (inactivity) in selected age groups of the population of men and women in the Czech Republic" (CZ.1.07/2.3.00/20.0044). The project's coordinator is the Faculty of Sports Studies at the Masaryk University in Brno. The project is aimed at determining the level of physical activity in selected age groups of men and women in the Czech Republic. The actual measurements were undertaken between 2011 and 2012 in different regions of the Czech Republic.

The research group consisted of 319 women divided into 6 age groups: Group 1: 18-29 years (n=96), Group 2: 30-39 years (n=66), Group 3: 40-49 years (n=49), Group 4: 50-59 years (n=44), Group 5: 60-69 years (n=50), Group 6: 70+ years (n=14). These basic indicators of obesity were chosen: Body Mass Index - BMI \geq 25kg/m², the percentage of body fat - PBF \geq 30% and a fitness score (FS) <70

points.

These predefined indicators of obesity were measured using the bioimpedance device InBody 720. It is a reliable tool for the diagnosis and analysis of body composition, which, like other models, works with the technology DSM-BIA (www.inbody.cz). Measurements were carried out in the laboratory under standard conditions. The analysis of the data was made by software Statistica 10 (StatSoft company).

3. Results and Discussions

Results were assessed at $p < 0.05$ significance level. The data indicate that average BMI (kg/m^2) in each category rises with increasing age: Group 1: 22.2; Group 2: 23.8; Group 3: 24.3; Group 4 : 25.5; Group 5: 27.4; Group 6: 27.9. (Figure 1) According to BMI, the average body weight of women in the first three groups is normal, but women in groups 4, 5, and 6 are located in the overweight zone. None of the groups got beyond the threshold of obesity according to the average values of BMI. The average BMI of all measured women was $24,4 \text{ kg}/\text{m}^2$, which is a value within the normal range. Differences in BMI between all age groups were statistically significant ($p \leq 0.05$), except groups 2 and 3, 3 and 4, and 5 and 6.

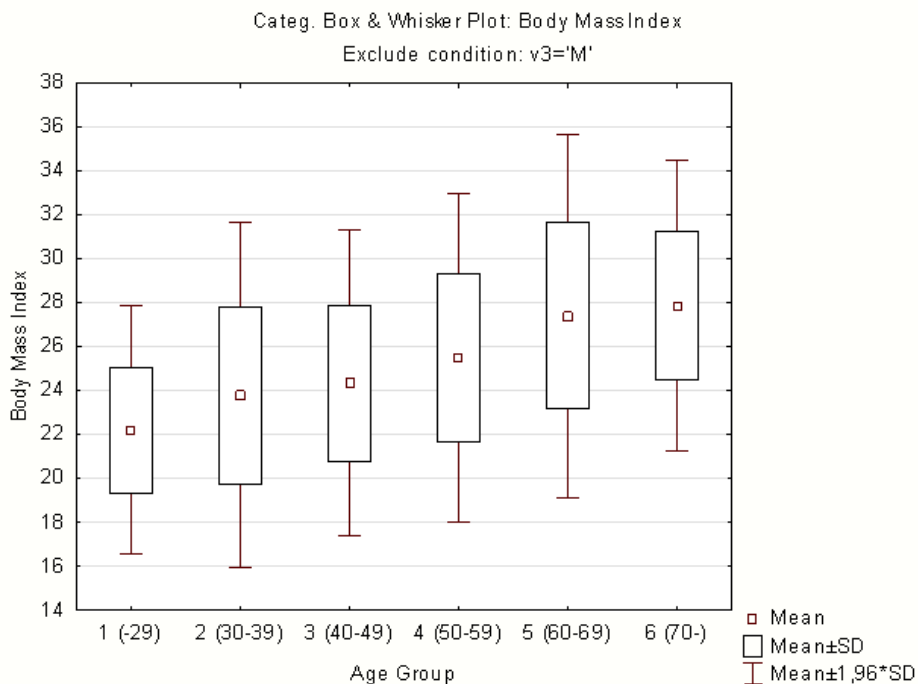


Figure 1. Average BMI in 6 age groups of measured women.

The percentage of body fat (PBF) also rises with increasing age in each category: Group 1: 25.5; Group 2: 27.5; Group 3: 28.5; Group 4: 32.9, Group 5: 35.5; Group 6: 37.9. (Figure 2) The results show that the first three groups have

normal body fat levels, while groups 3, 4 and 5 are located in the area of obesity. The average % body fat in all measured women was 29.5%, which is a slightly lower value than the predefined cut-off point of obesity (30%). Differences in %body fat between the six age groups were statistically significant ($p \leq 0.05$), except groups 1 and 2, 2 and 3, 4 and 5, and 5 and 6.

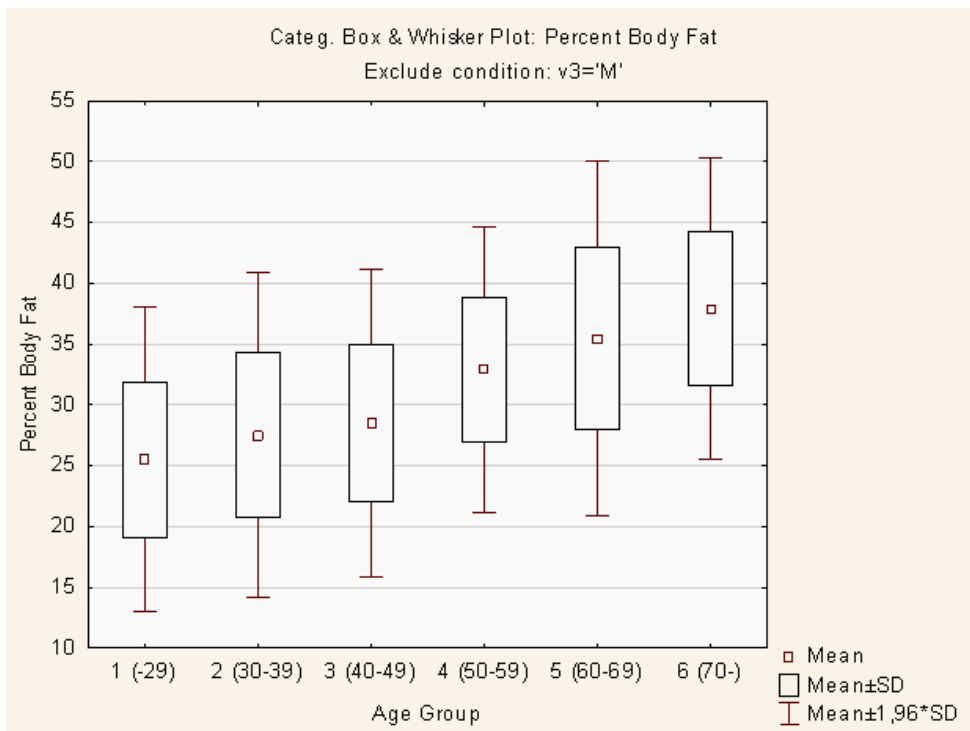


Figure 2. Average body fat percentage in 6 age groups of measured women.

Values of fitness score (FS) in our samples decrease since the age of 50 years (Group 4). In groups 2 and 3, we noticed a slight increase in fitness score points: Group 1: 75.3; Group 2: 75.4; Group 3: 75.7; Group 4: 72.0; Group 5: 70.2, Group 6: 67.7. (Figure 3) The results of the FS indicate that the first five groups have averages above 70 points, which is a range of normal and healthy persons. Only the last 6th group can be regarded as weak or obese. The average value of the fitness score in all measured women was 73.8 points, which indicates normal physical condition. There were no statistically significant differences among the first three youngest age groups, as well as between groups 4 and 5, and 5 and 6. Differences in other age groups were statistically significant ($p \leq 0.05$).

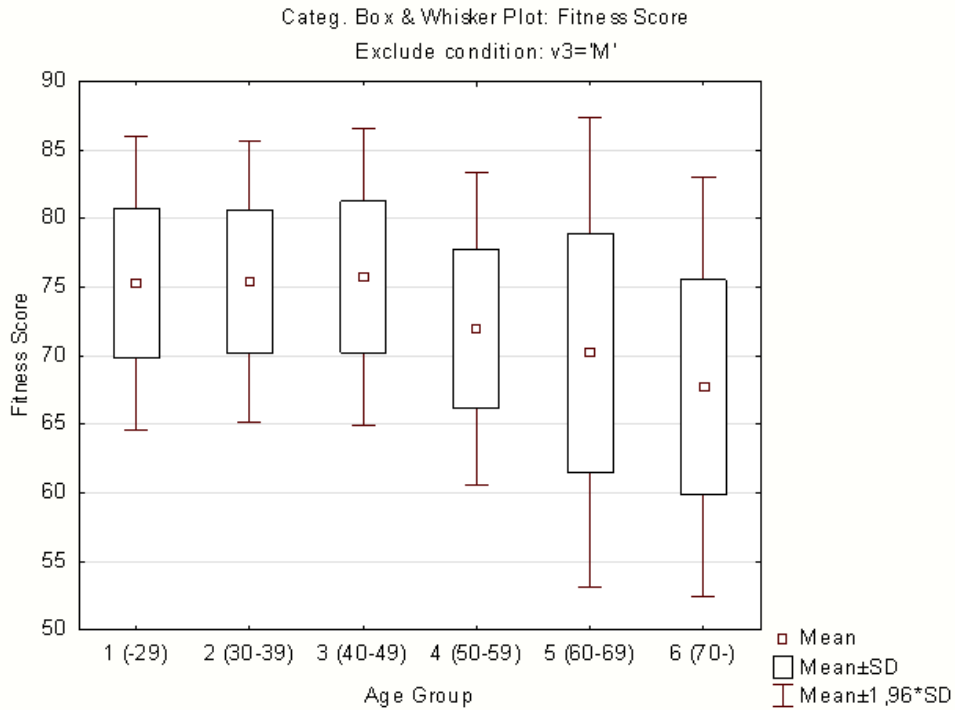


Figure 3. Average fitness scores in 6 age groups of measured women.

Based on other results, we can conclude that according to BMI, the average number of persons belonging to the category of overweight/obesity rises with age (see Table 2). The same results can be demonstrated by the parameters PBF and FS. The only exception is a fitness score in the age group 3.

Table 1. Percentage of overweight/obesity in different age categories according to parameters BMI, PBF and FS

Age Group	N	Low FS (%)	Obesity Fat (%)	Obesity BMI (%)
1	96	13,5%	27,1%	16,7%
2	66	13,6%	36,4%	25,8%
3	49	10,2%	42,9%	32,7%
4	44	34,1%	70,5%	45,5%
5	50	44,0%	78,0%	66,0%
6	14	57,1%	85,7%	85,7%

4. Conclusions

Based on the measured results, we can conclude that:

- Older age groups of women have higher average BMI than younger age groups
- The Czech female population aged over 50 years has BMI in the

overweight zone

- No age group has BMI values above the threshold of obesity.
- Older age groups have a higher average value of %body fat than younger age groups
 - Except the two youngest age groups, the Czech female population has a higher percentage of fat than recommended as the optimum by manuals of the Biospace company (manufacturer of the device In Body).
 - According to the values of %body fat, Czech women older than 40 years are located in the area of obesity, and women older than 60 years are located in the zone of extreme obesity.
 - Older age groups of women have an average FS value that is lower than in younger age groups. The only exception is Group 3 (40-49 years), in which we documented a slight (statistically insignificant) increase of the fitness score.
 - In any age group, the Czech female population does not score above 80 points, which is a normative value of the Biospace company. However, the first five age groups have average values above 70 points.

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