

# Indicators of obesity and the educational attainment of the Czech female population

DITA HLAVONOVA , JAN CACEK, MARTIN SEBERA

Faculty of Sports Studies, Masaryk University, Brno, Czech Republic

## ABSTRACT

Hlavonova, D., Cacek, J. & Sebera, M. (2014). Indicators of obesity and the educational attainment of the Czech female population. *J. Hum. Sport Exerc.*, 9(Proc1), pp.S388-S397. The aim of this paper was to evaluate the relationship between selected indicators of obesity and the highest completed level of education in the adult female population of the Czech republic. As basic indicators of obesity, these following parameters were selected and measured via the bioimpedance method on the device InBody 720: BMI, WHR (waist-to-hip ratio), % body fat, % skeletal muscle mass, fitness score. The educational attainment of the tested women was inquired by a questionnaire. Based on the responses, we subsequently divided our sample into four categories according to the level of education: primary education, secondary education-apprenticeship, secondary education-graduate diploma, and university. The research was realized within the project CZ.1.07/2.3.00/20.0044. The measurements on the device InBody 720 and the accompanying survey were conducted between 2011-2013 in different regions of the Czech Republic. The sample consisted of 754 women divided into 3 age groups (18-39, 40-59, 60+ years). Based on the results ( $p < 0.05$ ), we can say that average values of the indicators obesity (BMI: 22.76, 24.88, 26.49 kg/m<sup>2</sup>, WHR: 0.85, 0.88, 0.90 and % body fat: 25.76, 30.23, 34.62%) increase with the increasing age of examined women. The average values of the fitness score (75.53, 73.86, 70.04 points) and % skeletal muscle mass (40.78, 38.15, 33.95%) decrease with increasing age. With regard to the educational attainment, women with secondary education-apprenticeship achieved the worst results. In contrast, the values in university educated women were the best in most indicators of obesity. **Key words:** WOMEN, OBESITY, AGE, EDUCATION.



**Corresponding author.** Faculty of Sports Studies, Masaryk University, Brno, Czech Republic.

E-mail: hlavonova@fsps.muni.cz

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## INTRODUCTION

In the Czech Republic, as well as in most European countries, obesity is seen as a big problem today. In the last three decades, we have seen a sharp increase in the levels of overweight and obesity. This indicates a worsening trend of poor diets and low physical activity levels of the EU populations, which can increase the incidence of various diseases in the future (White Paper, 2007).

Many experts and international organizations such as the WHO describe factors that are responsible for the increase of obesity rates in the recent years. Among the most important factors we can include genetic predispositions, a lack of physical activity, an increased consumption of fat, overeating and also socio-economic factors.

Socio-economic factors that are most commonly examined in relation to increased risks of obesity are: the main source of the household income, marital status, occupation, the size of the place of residence and educational level (SES).

Out of all socio-economic factors examined in connection with overweight and obesity, some studies (Faeh et al., 2010) found the strongest correlation with educational attainment. Especially in women, it was demonstrated that the higher education they achieved, the less risk of overweight and obesity they had.

Even Fillol et al. (2011) found a strong, inverse relationship between the level of education and obesity (expressed as BMI) in women. The authors confirmed that lower levels of SES (education, occupation and household wealth) corresponded with a higher prevalence of obesity in women.

The same results were also documented by Pol (2009). In their study they came to the conclusion that less educated women had a higher average BMI and a greater risk of overweight and obesity.

Therefore, the aim of our study was to evaluate selected indicators of obesity in relation to age and the highest completed level of educational attainment in the adult population of Czech women.

## MATERIAL AND METHODS

### *Participants*

The sample consisted of 754 randomly selected women with the average age of 38.7 years (SD 15.5), weight 66.7 kg (SD 11.2), body height 166.4 cm (SD 7.2), and was divided into 3 age groups: Group 1: 18 - 39 years (n = 379); Group 2: 40 - 59 years (n = 238); Group 3: 60+ years (n = 137).

### *Measurements*

The selected parameters of body composition consisted of BMI (body mass index)  $\geq 25\text{kg/m}^2$ , WHR (waist-to-hip ratio)  $\geq 0.85$ , % body fat (PBF)  $\geq 28\%$ , % skeletal muscle mass, FS (fitness score). These predefined indicators of obesity were measured under standard conditions using the bioimpedance device InBody 720 (6-frequency bioimpedance). The highest attained level of education was documented via a questionnaire. Based on the responses, the tested individuals were subsequently divided into four categories: primary education (n = 29), secondary education-trained (n = 59), secondary education-with GCE (the General Certificate of Education) (n = 327) and university education (n = 338). The actual measurements took place between 2011 and 2013 in different regions of the Czech Republic.

### Analysis

The analysis of the data was made by the software Statistica 12 (made by Statsoft). The level of statistical significance was set at  $p < 0.05$ .

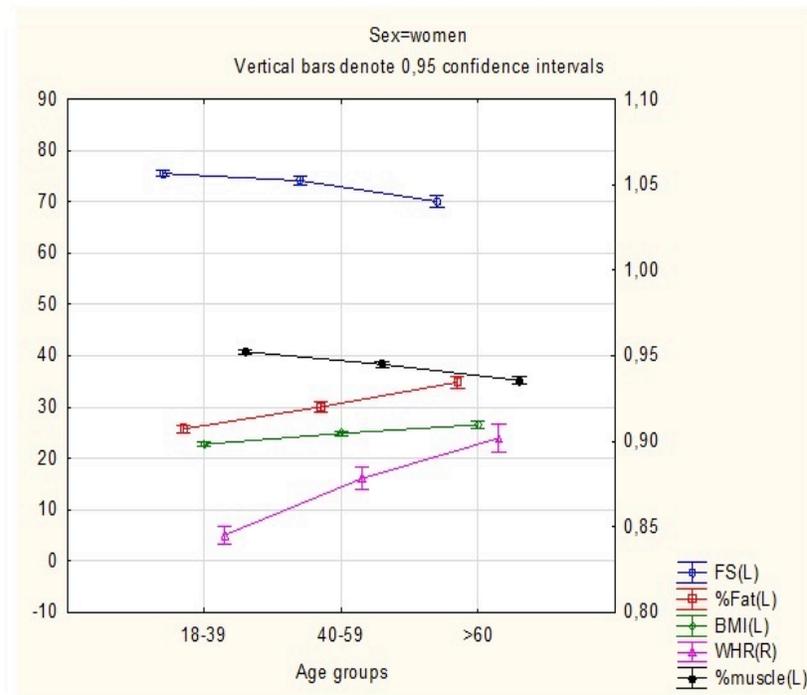
### Funding

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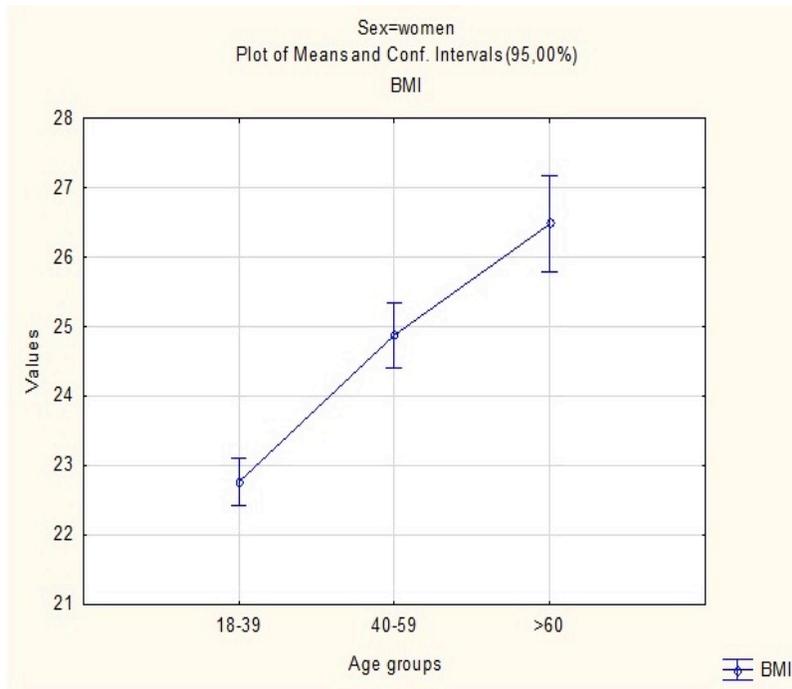
## RESULTS

### 1. Comparison of the indicators of obesity in different age groups of Czech women

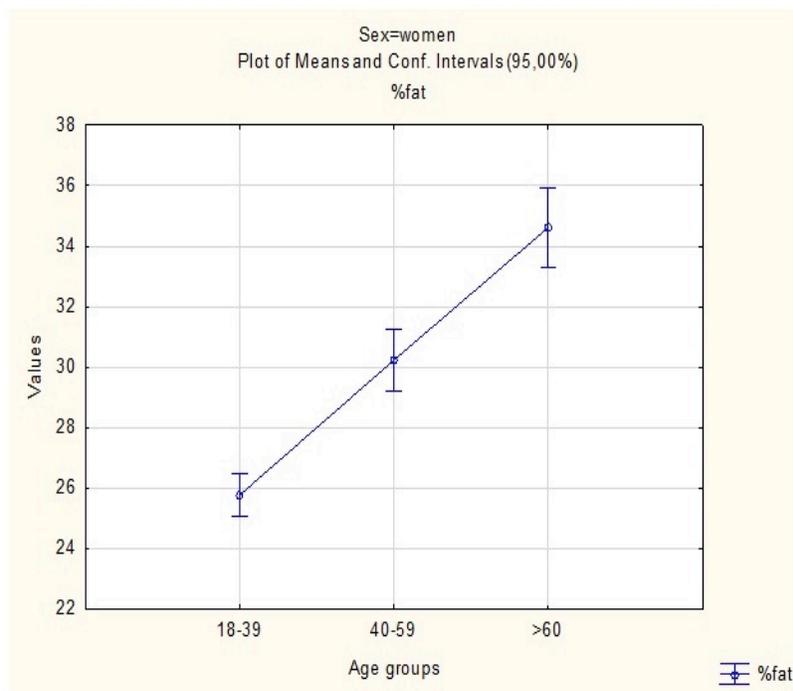
The results of the measurements show that the basic indicators of obesity vary depending on age (Fig.1). We can conclude that the average values of BMI, PBF and WHR increase with an increasing age and the percentage of skeletal muscle mass and the index of fitness score (FS) decrease with an increasing age (Tab. 1).



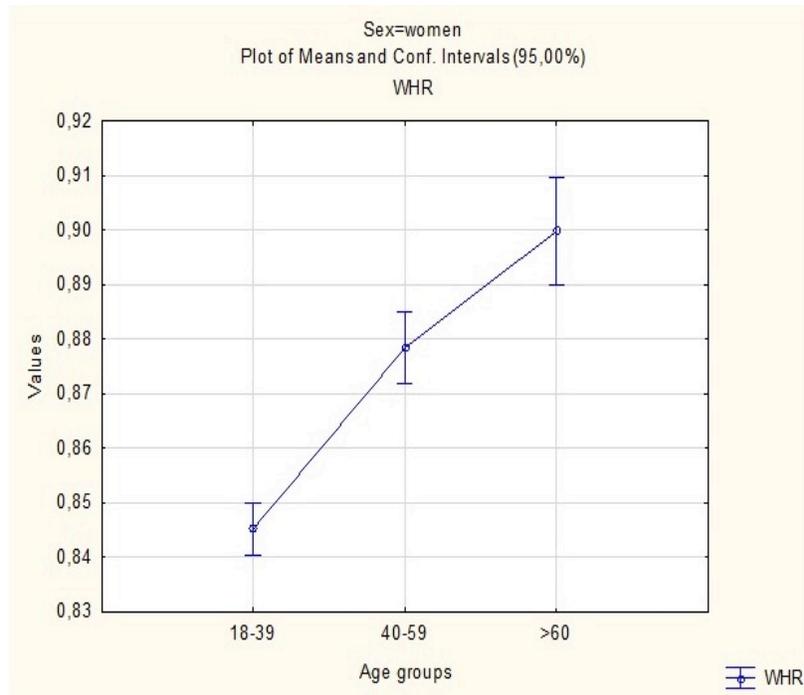
**Figure 1.** Graphical representation of the age-related changes in the indicators of obesity



**Figure 2.** Graphical representation of BMI changes in different age groups



**Figure 3.** Graphical representation of PBF changes in different age groups



**Figure 4.** Graphical representation of WHR changes in different age groups

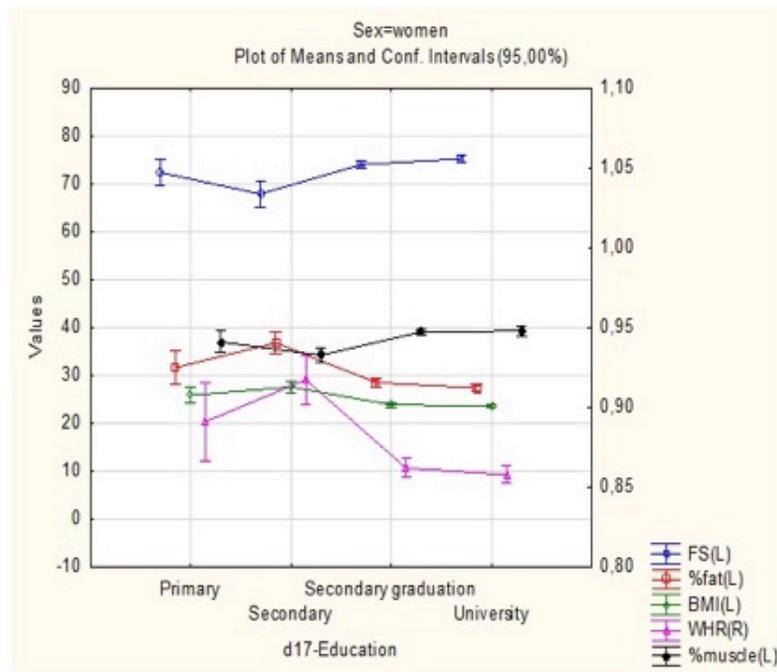
Figure 2 shows that the average BMI value (kg/m<sup>2</sup>) increases with an increasing age – Group 1 22.76 kg/m<sup>2</sup> (SD 3.41); Group 2 24.88 kg/m<sup>2</sup> (SD 3.69); Group 3 26.49kg/m<sup>2</sup> (SD 4.09). These values indicate that average body weight in the two youngest age groups is normal, but the oldest group is in the area of overweight. The average BMI of all measured women was 24.12 kg/m<sup>2</sup>, which betrays normal body weight. Statistically significant differences were found between groups 1 and 2, and 1 and 3. A significant increase of BMI occurs around the 40th year of age.

**Table 1.** Average values of the selected indicators obesity in different age categories

Sex=women											
Breakdown Table of Descriptive Statistics											
Smallest N for any variable: 754											
Age groups	N	BMI		%fat		WHR		%muscle		FS	
		Means	Std.Dev.								
18-39	379	22.7609	3.41022	25.7615	7.1251	0.8452	0.04765	40.7801	4.02625	75.5251	5.99879
40-59	238	24.8817	3.69123	30.2315	8.09836	0.87845	0.05215	38.1504	5.09765	73.8613	7.85857
>60	137	26.4864	4.09999	34.6154	7.73711	0.89985	0.05815	33.9534	15.1605	70.0438	7.46942
All Grps	754	24.1072	3.91077	28.7812	8.26956	0.86562	0.05551	38.7096	8.01253	74.004	7.18352

**Table 2.** Average values of the indicators of obesity in different groups divided by the educational attainment

Education	N	BMI	BMI	WHR	WHR	%fat	%fat	%muscle	%muscle	FS	FS
		Mean	Std.Err.								
Primary	29	25.8703	1.02697	0.89103	0.01079	31.6359	1.42821	36.9989	1.21804	72.3793	1.47087
Secondary	59	27.5893	0.72	0.91729	0.00756	36.808	1.0013	34.2307	0.85395	67.8814	1.03121
Secondary graduation	327	23.861	0.30583	0.86187	0.00321	28.5085	0.42532	39.0797	0.36273	73.9939	0.43803
University	338	23.5801	0.30081	0.8579	0.00316	27.3646	0.41834	39.2973	0.35678	75.2574	0.43084



**Figure 5.** Graphical representation of changes in the indicators of obesity in dependence on the educational attainment

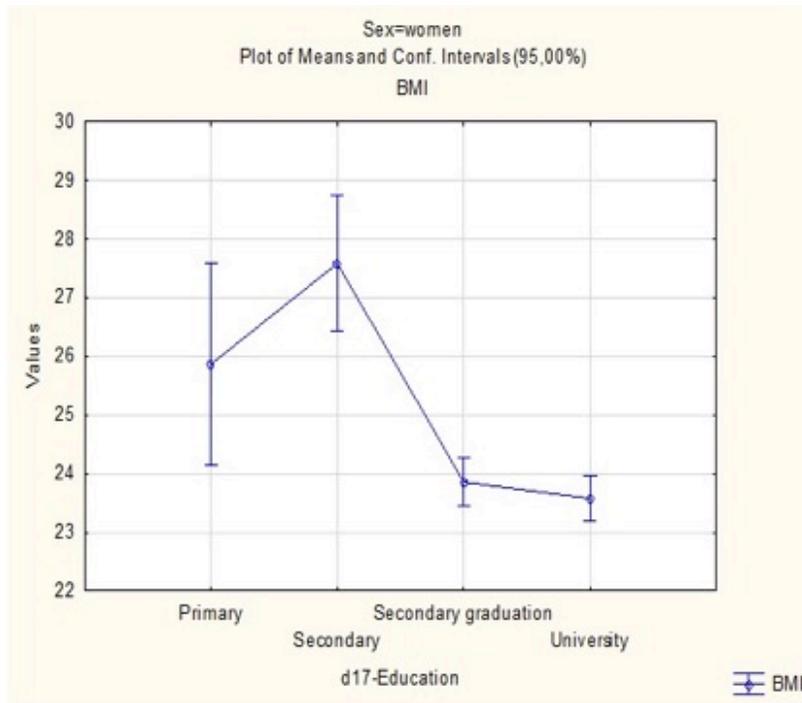


Figure 6. Graphical representation of changes in BMI in dependence on the educational attainment

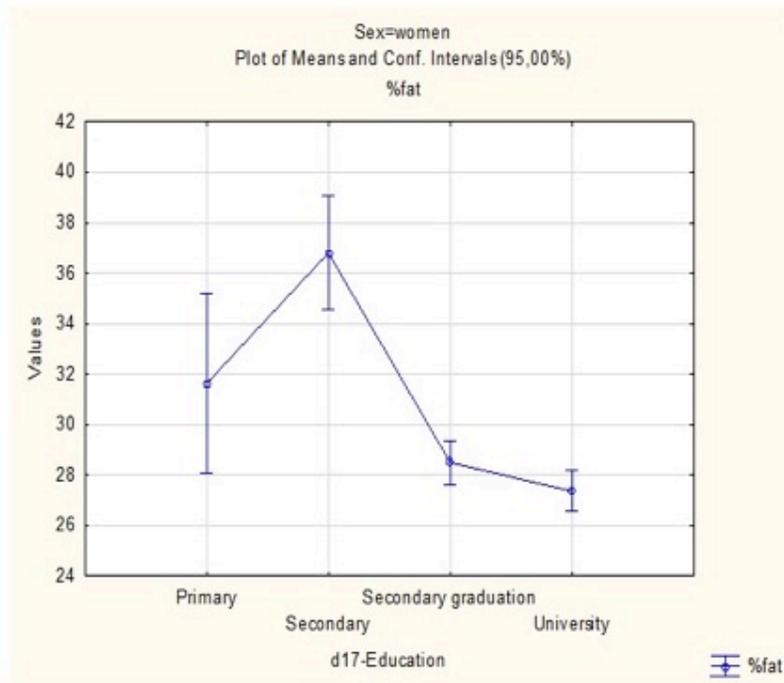
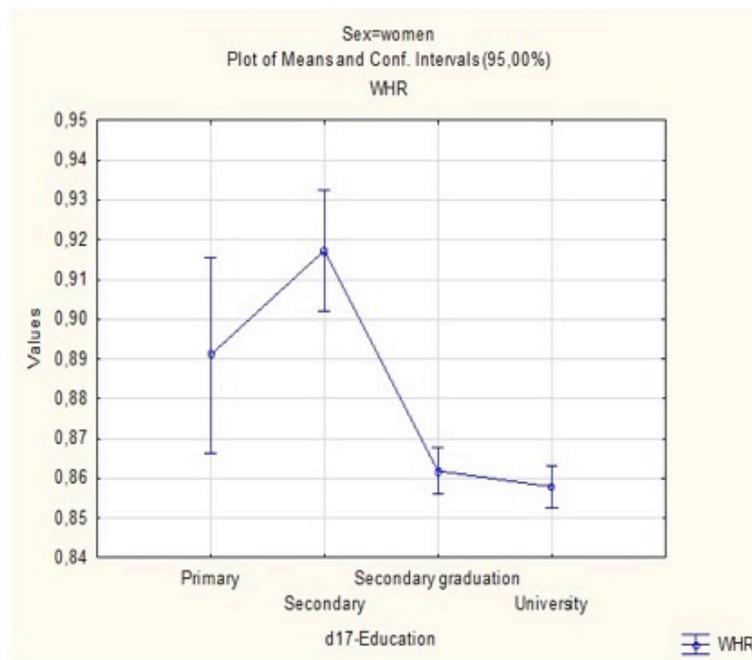


Figure 7. Graphical representation of changes of PBF in dependence on the educational attainment



**Figure 8.** Graphical representation of changes in WHR in dependence on the educational attainment

Figure 3. shows the gradual increase in the percentage of body fat (PBF, %) in different age groups – Group 1 25.76% (SD 7.13); Group 2 30.23% (SD 8.09), Group 3 34.61% (SD 7.74). According to PBF, only Group 1 is in the area of normal body weight, Group 2 is in the area of obesity and the oldest age group (Group 3) falls into the category of extreme obesity. The average value of PBF in all measured women was 28.78%, which is the level of obesity. Statistically significant differences were observed among all age groups, which means that a significant increase in PBF occurs around the age of 40 years and subsequently even around the age of 60.

Figure 4. Even values of the indicator WHR increase with age – Group 1 0.85 (SD 0.05); Group 2 0.88 (SD 0.05), Group 3 0.90 (SD 0.06). According to WHR, only the youngest age group has body weight within the normal range. The other two groups are in the area of obesity. The average of all women was 0.87, which is the value of obesity. Statistically significant differences were found between all age groups. The indicator WHR thus further confirms that a significant accumulation of fat in the abdominal region occurs around the age of 40 years, and subsequently around the age of 60 years.

## 2. Relationship between indicators of obesity and the educational attainment of Czech women

Based on the measured results, we can demonstrate that the values of the basic indicators of obesity vary depending on the level of education (Fig. 5). We can conclude that women with university education have the lowest average values of BMI, WHR, PBF and the highest average values of FS and % skeletal muscle mass. On the other hand, women with secondary education-trained have the highest average values of BMI, WHR, PBF and the lowest average value of FS and % skeletal muscle mass (Tab. 2).

Our results indicate that the average BMI (kg/m<sup>2</sup>) varies in dependence on the level of education (Fig. 6): primary education - 25.87 kg/m<sup>2</sup> (SD 1.03), secondary education-trained - 27.59 kg/m<sup>2</sup> (SD 0.72), secondary education-graduation diploma - 23.86 kg/m<sup>2</sup> (SD 0.31), university education - 23.58 kg/m<sup>2</sup> (SD

0.30). According to BMI, women with secondary education-graduation diploma and university education have normal body weight. Women with primary education and secondary education-trained are in the area of obesity. The lowest average value of BMI was found in women with university education, while the highest average BMI was documented in women with secondary education-trained. Statistically significant differences were observed between groups 2 and 3 (secondary education-trained vs. secondary education-with GCE), and 2 and 4 (secondary education-trained vs. university education), which suggests that women with secondary education-apprenticeship achieve the worst results in terms of potential risks of obesity according to BMI.

Further, even the percentage of body fat (PBF, %) varies in dependence on the educational attainment (Fig. 7): primary education - 31.64% (SD 1.43), secondary education-trained - 36.81% (SD 1.00), secondary education-with GCE - 28.51% (SD 0.43), university education - 27.36 (SD 0.42). The results show that only university educated women have normal PBF levels. Women with primary education and secondary education-with GCE are above the threshold for obesity, and women with secondary education-trained are even in the area of extreme obesity. The lowest average values of PBF were found in university educated women, while the highest were found in women with secondary education-trained. A statistically significant increase in PBF occurred between groups 2 and 3 (secondary education-apprenticeship vs. secondary education-with GCE), and 2 and 4 (secondary education-apprenticeship - university), which indicates that women with secondary education-trained fare worst even according to PBF levels.

The average values of another indicator of obesity - WHR – also vary according to educational attainment (Fig. 8): primary education - 0.89 (SD 0.01), secondary education-trained - 0.92 (SD 0.01), secondary education-with GCE - 0.86 (SD 0.003), university education - 0.86 (SD 0.003). The measured values show that all groups are in the area of obesity. The lowest average values of WHR (just above the level of obesity) can be found in university educated women, while the highest values of WHR were measured in women with secondary education-trained. A statistically significant increase in WHR was documented between groups 2 and 3 (secondary education-trained vs. secondary education-with GCE), and 2 and 4 (secondary education-trained vs. university education). Again, women with secondary education-trained achieved the worst results.

## DISCUSSION

The results of our study show that the selected indicators of obesity (BMI, PBF, WHR) vary in dependence on the age and education of adult Czech women. Baum & Ruhm (2009) reported an increase in the average BMI in women aged 18-40 years, which is consistent with our findings. Similarly, Pol (2009) confirmed that BMI increases with an increasing age in French women. Based on the monitoring of obesity in relation to the level of education in France from 1981 to 2003, the same author (Pol, 2009) showed that people with lower educational attainment have a higher tendency to overweight and obesity. They have a higher mean BMI (a statistically significant difference was found mainly in women), which corresponds with the results of our work. According to these studies, 15% French people with secondary education were obese in 2003, while only 5% people with university education were obese. For example, a woman with secondary education, 163 cm tall, had on average +3.9 kg higher body weight than a woman of the same height and age having a bachelor's degree. Cutler & Lleras-Muney (2010), using data of adults aged over 25 years (an age group, in which most of the educational process is completed) in two countries (UK and U.S.) concluded that people with higher education are less likely to be obese. Similarly, Faeh et al. (2010) demonstrated an inverse relationship between socioeconomic factors and overweight. Interestingly, the highest relationship of this sort was found in women. Fillol et al. (2011) found a strong, inverse relationship

between the level of education (and also other socio-economic factors) and obesity (expressed in BMI) in French women.

These authors thus confirm the results of our study: A lower level of education corresponds with a higher risk of overweight and obesity in adult women.

## 5 CONCLUSIONS

The selected indicators of obesity in Czech women significantly change according to age. We repeatedly found significant differences in mean values of BMI, WHR, PBF, FS and % skeletal muscle mass between different age groups. With an increasing age, there occurs an increase in the values of BMI, WHR and PBF, but in contrast, the average values of FS and % skeletal muscles mass decrease.

In this study, a significant correlation between education and obesity in Czech women was also found. Education, as one of important socio-economic factors, is inversely related to overweight and obesity. Women, who have higher levels of educational attainment (secondary education-with GCE and university education) have lower levels of risk factors of obesity (BMI, WHR, PBF) and higher values of indicators of good physical condition (FS, % muscle) than women with less education. According to our results, Czech women with secondary education-trained achieve the worst results in all indicators of obesity and have the greatest tendency to overweight and obesity.

Based on our results, we believe that preventative steps against increasing levels of overweight and obesity must take into account educational attainment, and should primarily be aimed at groups with a lower education level. Our future studies will explore further socio-economic variables potentially related to obesity, such as the size of the place of residence, marital status and family income.

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