



## BODY MASS INDEX AND WAIST CIRCUMFERENCE IN GREEK ADULTS

Mavrovounioti, Chr.<sup>1</sup>, Patsika, Gl.<sup>2</sup>, Mavrovouniotis, F.<sup>2</sup>, Argiriadou, Eir.<sup>2</sup>, Zaggelidis, G.<sup>2</sup>

<sup>1</sup>*Department of Home Economics and Ecology, Charokopio University of Athens*

<sup>2</sup>*Department of Physical Education and Sport Sciences, Aristotle University of Thessaloniki*

The aim of the present study was to investigate overweight and obesity, in Greek adults. In the present study, 110 men and women, 19- to 60 years old, took part. Measurements of subject's height, body weight, and waist circumference (WC) were performed. BMI was used for the evaluation of the degree of overweight and obesity and WC for the evaluation of the degree of central obesity, according to the values for adults set by World Health Organisation (WHO). For the statistical analysis the statistic packet SPSS/PC version 12.0 for windows was used. From data statistical analysis, it was found out that men had BMI  $24.94 \pm 3.22$  kg/m<sup>2</sup> and WC  $90.78 \pm 13.24$ cm, while women had BMI  $22.99 \pm 4.75$  kg/m<sup>2</sup> and WC  $80.64 \pm 11.19$ cm. T-tests showed that the observed differences between men and women in both BMI and WC were significant ( $t=2.51$ ,  $p<0.05$  and  $t=4.34$ ,  $p<0.001$ , respectively). Additionally, it was found out that more than half of the men were overweight and/or obese (51.9%), while approximately the 1/5<sup>th</sup> of women were overweight and/or obese (21.5%). Chi-square test showed that sex affects significantly the degree of overweight and obesity ( $\chi^2=18.14$ ,  $p<0.001$ ). Moreover, men presented central obesity to a percentage of 11.1%, while women presented central obesity to a smaller percentage (3.60%). Consequently, in the present study, there were observed high percentages of overweight and obesity, as well as of central obesity, especially on men. Thus, a combination of an exercise program with a balanced diet is suggested in order to lead to a normal body weight and normal abdominal fat quantity for an enhanced quality of life without health disorders due to obesity.

**Key-Words:** overweight, obesity, android or visceral obesity, diseases, prevention

### Introduction

Overweight and obesity are part of the U.S. Department of Health and Human Services' health agenda that have steadily moved away from their established targets for improvement. Today, public health leaders recognize obesity as a "neglected public health problem" (CDC, 2002). Obesity is a complex, multi-factorial chronic disease involving environmental (social and cultural), genetic, physiologic, metabolic, behavioural and psychological components (Flegal et al., 2002). The progressive weight gain often observed between the third and sixth decade of life may be partly explained by age-related changes: although energy intake tends to decline after the second decade of life, this decrease is insufficient to offset the greater decline in the amount of energy that most people expend throughout their adult years (Bray, 1983; Federation of American Societies for Experimental Biology, 1995). In addition to these age trends, population surveys indicate that the age-adjusted prevalence of overweight among adults in the United States has increased from about 25% in the 1970s to 33% in 1988–1991. The increase is evident for all race and sex groups (Kuczmarski et al., 1994). This phenomenon is believed to be due to high rates of inactivity combined with easy access to energy-dense food (Blackburn, & Prineas, 1983). Therefore, obesity, is one of the most dangerous civilisation-related diseases and statistics shows that 1/5 to 1/3 of the total adult population have excessive reserves of adipose tissue (Cieslinska et al., 2002) and is the second leading cause of preventable death in the U.S.A. (Flegal et al., 2002). Obesity is a disease which may contribute to the development of myocardial infarction, coronary artery diseases, neoplasm, diabetes and locomotor system dysfunctions. Moreover, costs of treatment of obesity-related diseases are very high (5.5% of total medical costs in USA) (Cieslinska et al., 2002).

Moreover, body weight control, that theoretically appears to be an easy affair, as the statistics show, has

become today for a lot of individuals a very difficult one. Given the facts that the most trials for weight loss during adulthood are, usually, unsuccessful, as well as that the corresponding implications on health and on health care costs in the future will be huge, obesity prevention seems to be the more useful strategy for obesity control (NIH, 1993). For these reasons the purpose of the present study was the examination of overweight and obesity, in Greek adults.

**Method**

**Sample:** In the present study 110 men and women from Greece, took part. Men were 31.67±12.81 years old and women were 34.61±11.86 years old.

**Measurements.** Measurements of subject's height, body weight and waist circumference were performed. Height was measured using a portable stadiometer, to the nearest 0.1 cm. All the women removed their shoes. Body weight was measured using an accurate scale (Sega, Germany), to the nearest 100 g, while wearing only light indoor clothing. WC was measured to the nearest 0.1 cm, with the help of a plastic tape measure, at a level midway between the lower rib margin and iliac crest with the tape all around the body in horizontal position, while there was no clothing in the point of measurement. The stadiometer, the scale and the tape measure were checked for the precision of their measurements and were calibrated. Data collection was done by properly trained teachers of physical education with extensive experience. Finally, body mass index (BMI) was calculated.

**Total obesity and Central obesity evaluation.** The Body Mass Index (BMI) was used for the evaluation of the degree of overweight and obesity, according to the values for adults set by World Health Organisation (WHO). BMI is objective, highly reliable, and has a high correlation (r=0.7-0.8) with the body fat content in adults (Albert, & DiGuseppi, www.vnh.org/ GCPS2/31.html; Corbin et al., 2001). Waist circumference (WC) was used for the evaluation of the degree of central obesity, accordingly to the values for adults set by WHO. WC measurement is a simple but extremely useful index (evaluation method) of fat distribution, in every day clinical practice (Hellenic Medicine Association of Obesity, 2007). WC provides a central obesity measurement that is related particularly with cardiovascular risk factors. In comparison with BMI, WC is related a little more with cardiovascular risk factors and more strongly with insulin and systolic blood pressure (Sung et al., 2006).

**Statistical Analysis.** The statistic packet SPSS/PC Version 12.0 for windows was used. The *non-parametric test Kolmogorov-Smirnov* was used to evaluate samples' normal distribution. To evaluate significant differences between the men and women *student t-test* was used. Moreover, descriptive analysis, crosstabulations, as well as  $\chi^2$  tests were used. The level of significance was set to  $p<0.05$ .

**Results**

In Table 1 the mean (M) and standard deviation (SD) of men and women anthropomorphological characteristics are presented. As it is shown, there is no significant difference between men and women, as for age. However, significant differences for height and weight were observed (Table 1).

**Table 1.** Anthropomorphological characteristics

Variables	Men (M±SD)	Women (M±SD)	t & p
Age (years)	31.67±12.81	34.61±11.86	NS
Height (m)	1.79±0.06	1.67±0.06	t=9.98 & p<0.001
Weight (kg)	79.80±9.64	64.05±13.98	t=6.85 & p<0.001

In Table 2, the means of BMI and WC for men and women are presented. As it is shown, men have significantly increased values in comparison to women (Table 2).

**Table 2.** BMI and WC and the differences between men and women

Variables	Sex	Mean	St. Dev.	t & p
BMI (kg/m <sup>2</sup> )	♂	24.94	3.22	t=2.51 & p<0.05
	♀	22.99	4.75	
WC (cm)	♂	90.78	13.24	t=4.34 & p<0.001
	♀	80.64	11.19	

In Figure 1 and Figure 2 men and women percentages in regard to BMI are presented. The BMI evaluation showed high percentages of overweight and obesity, in both men and women. However, the percentages are significantly more increased in men in comparison to the women.

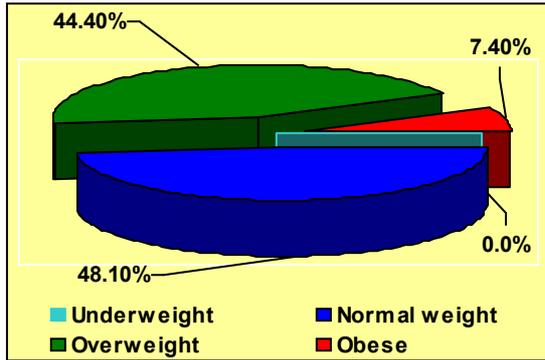


Figure 1. Men distribution in regard to BMI

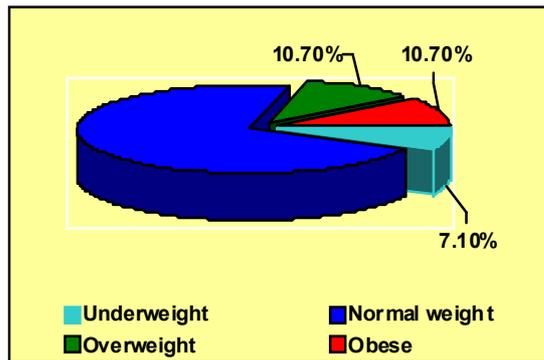


Figure 2. Women distribution in regard to BMI

In addition, chi-square test showed that sex affects significantly the degree of overweight and obesity ( $\chi^2=18.14$ ,  $p<0.001$ ). It is worth to be mentioned that 7.10% of women are underweight, while no man is underweight (Figure 1 & 2). Furthermore, in Figure 3 and 4 men and women percentages in regard to fat distribution are presented. The WC measurement showed high percentages of central obesity. The percentages of central obesity are presented more increased on men in relation to women.

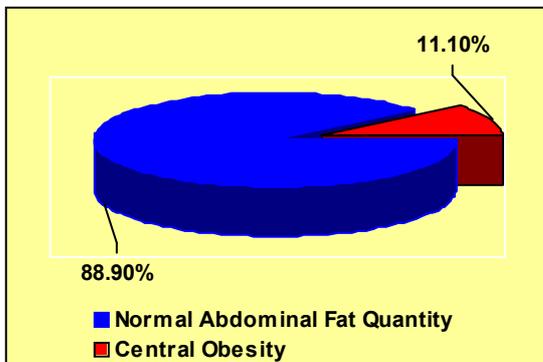


Figure 3. Men distribution in regard to WC

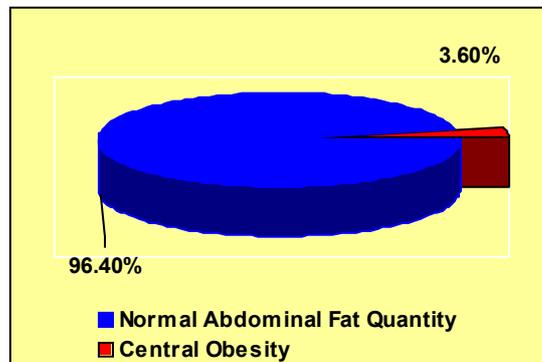


Figure 4. Women distribution in regard to WC

However chi-square test showed that the differences aren't significant indicating that sex didn't affect the degree of central obesity (Figure 3 & 4).

### Discussion

The last years, all over the world, a tremendous increase in obesity is observed. A characteristic example is USA. In 1990, among states participating in the Behavioral Risk Factor Surveillance System, 10 states had a prevalence of obesity less than 10% and no states had prevalence equal to or greater than 15%. By 1998, no state had prevalence less than 10%, seven states had a prevalence of obesity between 20-24%, and no state had prevalence equal to or greater than 25%. In 2006, only four states had a prevalence of obesity less than 20%. Twenty-two states had a prevalence equal or greater than 25%. Two of these states (Mississippi and West Virginia) had a prevalence of obesity equal to or greater than 30% (CDC, 2006). Thus, over the last decade the increase in overweight, obesity and severe obesity prevalence is evident in adults (aged 20 to 74) of both genders (CDC, 2002).

In agreement, the results of the present study, overall, indicated high percentages of total and central obesity. Men had significantly more increased BMI and WC in comparison to the women. More specifically, it was found out that more than half of the men were overweight and/or obese (51.9%), while approximately the 1/5<sup>th</sup> of women were overweight and/or obese (21.5%). Thus, sex affects significantly the degree of overweight and obesity. Additionally, men presented central obesity to a percentage of 11.1%, while women presented central obesity to a smaller percentage (3.60%).

CDC declares that the prevalence of overweight is higher for men (67%) than women (62%), while the prevalence of obesity is higher for women (34%) than men (27.7%) (CDC, 2002). In agreement in the present study bigger percentages of overweight were presented in men (44.4%) than in women (10.7%). However, bigger percentages of obesity were presented in women (10.7%) in comparison to men (7.4%).

The localisation of the excessive adipose tissue is very important. Excessive adipose tissue in the area of

the stomach, thorax and neck is so-called android or visceral obesity. This type of excessive adipose tissue localisation is the most dangerous due to possible obesity-related disorders (Cieslinska et al., 2002). WC (central obesity) is a factor for metabolic syndrome determination in adults (Kafatos, 2004), while WC and BMI are related with cardiovascular risk factors and with insulin, as well as with systolic blood pressure (Sung et al., 2006). Moreover, BMI has shown a monotonic association mortality in several recent cohort studies (Lee et al., 1993; Manson et al., 1995). According to WC measurement, the percentages of central obesity that observed in the present study are quite big, especially for the men, indicating that they are in a high risk factor.

Obesity is a major public health problem that increases the risk of illness from about 30 serious medical conditions. Obesity plays a central role in the development of diabetes mellitus and confers an increased risk for CHD, high blood pressure, osteoarthritis, dyslipoproteinemia, various cancers, and all-cause mortality. Moreover, individuals with obesity are at higher risk for impaired mobility, while overweight or obese individuals experience social stigmatization and discrimination in employment and academic situations (Albanes, 1987; Bray, 1985; Flegal et al., 2002; Hubert et al., 1983; Lee et al., 1993; Manson et al., 1995). Total percentages as the 58% of the cases of diabetes mellitus type II, the 21% of cardiovascular diseases and between 8% and 42% of certain type of cancer are due to overweight and obesity (Department of Health, 2002). Thus, a loss of body weight even of 5-10% can decrease the risk factors (Anderson et al., 1987).

However, obesity treatment is mainly symptomatic, and very rarely causal. The objective of the treatment is obese subjects' organism's mobilization in order to use its own energy reserves stored in adipose tissue and as such obtain negative energy balance. This can be obtained either by reduction of energy intake supplied with food or by increase of basal metabolic rate and increase of energy expenditure associated with physical exercise and the organism's growth (Cieslinska et al., 2002).

Physical activity is important for weight control. By using energy and maintaining muscle mass, physical activity is a useful and effective adjunct to dietary management for avoiding weight gain or losing weight. Physical activity appears to favorably affect distribution of body fat. Consequently a combination of an exercise program with a balanced diet is suggested in order to lead to a normal body weight and normal abdominal fat quantity for an enhanced quality of life without health disorders due to obesity.

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