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## **Obesity – a rapidly incoming public health problem Otyłość – gwałtownie narastający problem społeczny**

### **Summary**

Obesity is now widely accepted as a multifactorial, chronic disorder, with an alarming increase in the worldwide prevalence in both adults and children. According to available data in 2013 from the Global Database on Body Mass Index launched on the WHO website, in 2008 more than 1.4 billion adults, 20 and older, were overweight. Of these overweight adults, over 200 million men and nearly 300 million women were obese. Overall, more than 10% of the world's adult population was obese. In 2011, more than 40 million children under the age of five were overweight. More than 30 million overweight children are living in developing countries and 10 million in developed countries. The increasing overweight and/or obese population is disturbing because of the well-established major health risks and chronic conditions associated with obesity, such as hypertension, hyperlipidemia, type II diabetes, coronary heart disease, stroke, obstructive sleep apnea, asthma, orthopedic disorders, and social and mental health problems.

The aims of the study were to summarize the current knowledge about the trends in obesity and to investigate the prevalence of overweight and obesity of patients in Cisna commune (Bieszczady).

According to our results, the prevalence of overweight and obesity in group of females was 36 and 23%, respectively. The prevalence of overweight and obesity in group of males was 37 and 31%, respectively.

In our investigations, the age of patients correlates positively with BMI in group of non-smoking males, non-smoking females and smoking females. In group of smoking males the correlation is also positive but statistically non significant.

In the current study, there is a significant difference between BMIs values in group of males and females. The prevalence of overweight and obesity is higher in males than females.

**Key words:** obesity, overweight, BMI, mortality

### **Streszczenie**

Otyłość jest obecnie powszechnie uznawana za wieloczynnikową, przewlekłą chorobę, której występowanie wzrasta w alarmującym tempie, zarówno w przypadku osób dorosłych, jak i dzieci. Na podstawie danych dostępnych w 2013 roku na stronie WHO (the Global Database on Body Mass Index), w 2008 roku 1,4 miliarda dorosłych, powyżej 20 roku życia, posiadało nadwagę. Spośród tych osób, ponad 200 milionów mężczyzn i prawie 300 milionów kobiet to ludzie otyli. W 2011 roku, ponad 40 milionów dzieci poniżej piątego roku życia posiadało nadwagę. Ponad 30 milionów dzieci z nadwagą mieszka w krajach rozwijających się, a 10 milionów w krajach rozwiniętych. Narastanie populacji osób z nadwagą lub/i otyłych jest niepokojąca ze względu na występowanie poważnych zagrożeń

zdrowotnych i przewlekłych dolegliwości związanych z otyłością, takich jak nadciśnienie, hiperlipidemia, cukrzyca typu 2, choroba niedokrwienna serca, udar, obturacyjny bezdech senny, astma, schorzenia ortopedyczne, oraz społeczny i psychiczne problemy zdrowotne.

Celem badania było zebranie bieżącej wiedzy na temat tendencji zachorowalności na otyłość i określenie częstości występowania nadwagi i otyłości wśród pacjentów gminy Cisna (Bieszczady).

Na podstawie naszych wyników, stwierdzono występowanie nadwagi u 36% kobiet i 37% mężczyzn. Otyłość stwierdzono u 23% kobiet i 31% mężczyzn.

W naszych badaniach, wiek pacjentów wykazywał dodatnią, istotną statystycznie korelację z BMI w grupie niepalących mężczyzn, niepalących i palących kobiet. W grupie palących mężczyzn korelacja była także dodatnia, ale nie istotna statystycznie.

W obecnym badaniu wykazano istotną statystycznie różnicę pomiędzy wartościami BMI w grupach mężczyzn i kobiet. Częstość występowania nadwagi i otyłości jest wyższa w przypadku mężczyzn.

**Słowa kluczowe:** otyłość, nadwaga, BMI, śmiertelność

## Introduction

Obesity is now widely accepted as a multifactorial, chronic disorder, with an alarming increase in the worldwide prevalence in both adults and children (Elangram, 2009). According to the World Health Organization (WHO), overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health ([www.who.int/mediacentre/en/](http://www.who.int/mediacentre/en/)). For practical purposes and among both children and adults, BMI (weight (kg)/height (m)<sup>2</sup>) is now widely used to assess obesity (Wang, Beydoun, 2007). The WHO currently defines overweight and obesity by using BMI cutpoints of 25 and 30 kg/m<sup>2</sup>, respectively ([www.who.int/mediacentre/en/](http://www.who.int/mediacentre/en/)). These cutpoints were recommended by National Heart, Lung, and Blood Institute's and North American Association for the Study of Obesity expert Committee (Wang, Beydoun, 2007). According to Bray (1992), good weight is defined as BMI between 18.5 and 25 kg/m<sup>2</sup> for men and women between 19 and 34 years old and 21-27 kg/m<sup>2</sup> for those over 35 years old. Overweight is a BMI of 25 or 27-30 kg/m<sup>2</sup> and is associated with low risk. A BMI > 30 kg/m<sup>2</sup> is almost always synonymous with obesity, except in body builders and other athletes.

The National Heart, Lung, and Blood Institute/North American Association for the Study of Obese committee also recommends using waist circumference cutpoints of 40 inches (102 cm) for men and 35 inches (88 cm) for woman to define "central obesity". Increasingly, research shows that waist circumference or central obesity is a better predictor of obesity-related diseases than overall obesity assessed by using BMI (Wang, Beydoun, 2007).

According to available data in 2013 from the Global Database on Body Mass Index launched on the WHO website, in 2008 more than 1.4 billion adults, 20 and older, were overweight. Of these overweight adults, over 200 million men and nearly 300 million women were obese. Overall, more than 10% of the world's adult population was obese. In 2011, more than 40 million children under the age of five were overweight. More than 30 million overweight children are living in developing countries and 10 million in developed countries ([www.who.int/mediacentre/en/](http://www.who.int/mediacentre/en/)).

Currently, more than two thirds of US adults and approximately one third of US children and adolescents are overweight or obese. The prevalence of obesity and overweight among US children and adults has more than doubled since the 1970s, and the rate continues to rise. Obesity has become the second leading preventable cause of disease and death in the United States second only to tobacco use (Wang, Beydoun, 2007).

The increasing overweight and/or obese population is disturbing because of the well-established major health risks and chronic conditions associated with obesity, such as hypertension, hyperlipidemia, type II diabetes, coronary heart disease, stroke, obstructive sleep apnea, asthma, orthopedic disorders, and social and mental health problems. The overweight and/or obese contributes to the increase in mortality and morbidity of multiple cancer types: postmenopausal breast cancer and cancers of the colon and/or the rectum, endometrium, kidney, esophagus but not definitely for prostate, gallbladder, ovary, and pancreas (Elangbam, 2009; Low et al. 2009; Li et al. 2006).

Manson et co-workers (1995) examined association between BMI and both overall mortality and mortality from specific causes in a cohort of 115,195 U.S. women were 30 to 55 years of age and free of known cardiovascular disease and cancer in 1976. During 16 years of follow-up, they documented 4726 deaths, of which 881 were from cardiovascular disease, 2586 from cancer, and 1259 from other causes. The increased relative risk of death was 1.3 in those with a BMI 25.0-26.9, 1.6 in those with BMI 27.0-28.9 and was doubled (2.1) for those with a BMI of 29.0-31.0. Among woman with a BMI above 32 who had never smoked, the risk of death from cardiovascular disease was 4.1 and from cancer was 2.1. In terms of attributable risk, some 53% of all deaths in that study among women with a BMI of 29 or greater could be attributed directly to their obesity.

Most non insulin dependent diabetic patients are overweight, about 75% in most studies (Jung, 1997). The excessive free fatty acid released by adipose tissue leads to decrease in insulin sensitivity of muscle, fat and liver, which is followed by raised glucose levels, insulin resistance and type 2 diabetes (Qin et al. 2010).

Until recently it was thought that only severe degrees of excess weight increased the risk of coronary heart disease but some evidence shows a clear association with modest weight gain (Jung, 1997). Willet and co-workers (1995) found that the risk of coronary heart disease was increased 2-fold in women of BMI 25-28.9 and 3.6 for BMI of 29 or more.

Blood pressure is increased by 6 mm systolic and 4 mm diastolic for a 10% gain in body fat with those genetically more susceptible showing the greater effect (Jung, 1997).

The most characteristic lipid disorder in obesity is elevated total cholesterol and triglycerides, high LDL-cholesterol and low HDL-cholesterol. Dattilo and Kris Etherton (1992) summarized, via the review method of meta-analysis, the results of studies that examined the effect of weight reduction by dieting on total cholesterol, triglycerides, LDL-cholesterol and HDL-cholesterol. The results indicated that for every 1 kg of weight lost, there is a corresponding reduction by about 1% in total cholesterol and LDL, a rise by 1% in HDL and reduction by 3% of cholesterol.

### The aim of the study

The aims of the study were to summarize the current knowledge about the trends in obesity and to investigate the prevalence of overweight and obesity of patients in Cisna commune (Bieszczady).

### Materials and methods

The study was performed during a research camp arranged by the Medical University of Lublin in Cisna commune (Bieszczady) in July 2012 on 216 females (146 non-smoking and 70 smoking) and 120 males (69 non-smoking and 51 smoking).

The entire characteristic of the examined group is presented in the Table 1.

Tab. 1. The characteristic of the examined group of patients (n=336)

Patients	Parameter	Mean	SD*	Maximum	Minimum	Median
Non-smoking females	AGE (years)	48.22	17.72	82.0	12.0	50.0
	BMI** (kg/m <sup>2</sup> )	26.33	5.98	45.6	15.6	25.4
	BODY WEIGHT (kg)	68.88	14.35	115.0	40.0	68.0
	FGC*** (mg/dL)	98.19	27.36	328.6	72.5	92.2
Smoking females	AGE (years)	48.53	11.73	76.0	23.0	51.0
	BMI** (kg/m <sup>2</sup> )	26.26	5.37	42.7	16.3	25.8
	BODY WEIGHT (kg)	70.09	13.28	100.0	48.0	67.0
	FGC*** (mg/dL)	92.93	12.04	151.2	72.0	91.3
Non-smoking males	AGE (years)	52.52	17.85	90.0	18.0	52.0
	BMI** (kg/m <sup>2</sup> )	28.04	4.68	41.8	19.1	27.7
	BODY WEIGHT (kg)	85.37	16.24	148.0	62.0	83.0
	FGC*** (mg/dL)	101.92	20.65	171.2	70.7	95.8
Smoking males	AGE (years)	51.56	13.40	79.0	29.0	53.5
	BMI** (kg/m <sup>2</sup> )	29.15	5.03	44.1	19.9	28.1
	BODY WEIGHT (kg)	90.54	15.98	135.0	62.0	90.0
	FGC*** (mg/dL)	105.71	25.06	227.4	78.2	98.1

\*Standard deviation \*\* Body mass index \*\*\* Fasting glucose concentration

The glucose concentrations were measured with the use of standard enzymatic methods.

Body Mass Index (BMI) was calculated using the formula:

$$\text{BMI} = \text{body mass [kg]} / \text{height [m}^2\text{]}$$

The results were analyzed statistically. The values of analyzed parameters were characterized by the means of arithmetical mean (M), standard deviation (SD), the minimal and maximal values, and median. W Shapiro-Wilk test was used to assess the distribution conformity of examined parameters with a normal distribution. To compare the two groups according to the type of distribution and variance homogeneity Mann-Whitney test was used. To assess if there was a correlation between two parameters a correlation coefficient significance Spearman test was used. An accepted conclusion error was 5% and connected with it statistical significance was  $p < 0.05$  which would reveal the existence of statistically significant differences of correlations. The statistical analyses were performed using computer software STATISTICA v.8.0 (StatSoft, Poland).

## Results

The cohort was grouped into approximate quartiles according to age (18-36, 36-53, 54-71, 72+) and BMI (underweight BMI  $<18.5$  kg/m<sup>2</sup>, normal weight BMI 18.5-24.9 kg/m<sup>2</sup>, overweight BMI 25-29.9 kg/m<sup>2</sup>, obesity BMI  $\geq 30.0$  kg/m<sup>2</sup>). Table 2 shows the prevalence of overweight and obesity in the examined group of patients within age groups.

Tab. 2. The prevalence of overweight and obesity in the examined group of patients within age groups (n=336)

age group	males (n=120)			females (n=216)		
	n	% overweight*	% obese**	n	% overweight*	% obese**
18-35	27	37	7	51	16	6
36-53	39	31	31	73	32	22
54-71	38	42	42	76	55	29
72+	16	44	44	16	31	56

\*overweight BMI 25-29.9 kg/m<sup>2</sup> \*\* obesity BMI  $\geq 30.0$  kg/m<sup>2</sup>

The lowest percentages of obese people (for males, 7; for females, 6) were obtained for patients in the youngest group (18-35 years old). The highest percentages of obese people (for males, 44; for females, 56) were calculated for the patients aged 72+ (the group of the oldest patients). See Table 2.

According to our results, the prevalence of overweight and obesity in group of females was 36 and 23%, respectively. The prevalence of overweight and obesity in group of males was 37 and 31%, respectively (data not shown). The prevalence of underweight was found only in the youngest group of females and it was 3% (data not shown).

In our investigations, the age of patients correlates positively with BMI in group of non-smoking males (see the Figure 1), non-smoking females (see the Figure 3) and smoking females (see the Figure 4). In group of smoking males the correlation is also positive but statistically non significant (see the Figure 2).



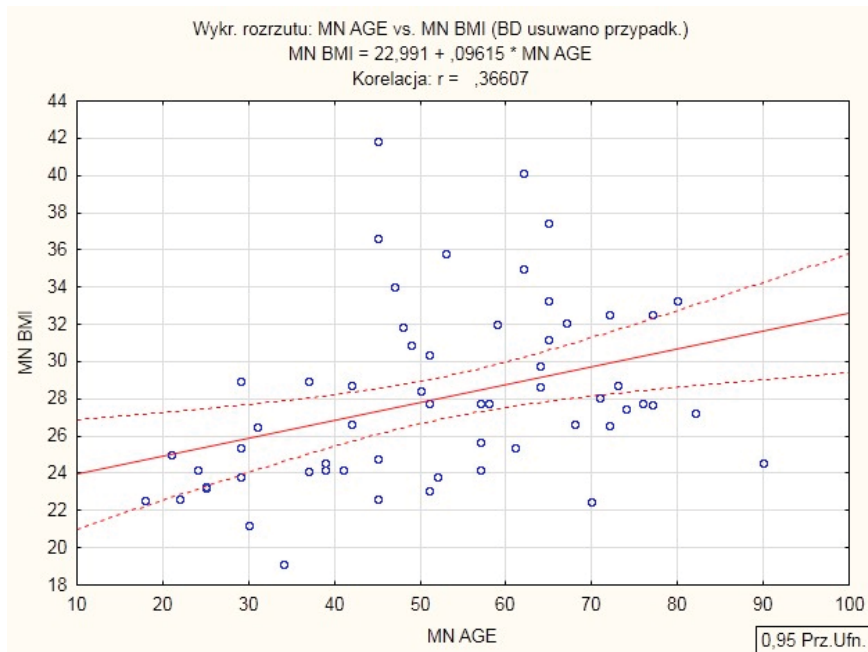


Fig. 1. The age of non-smoking males (MN AGE) correlated positively with BMI (R=0.36; p<0.05)

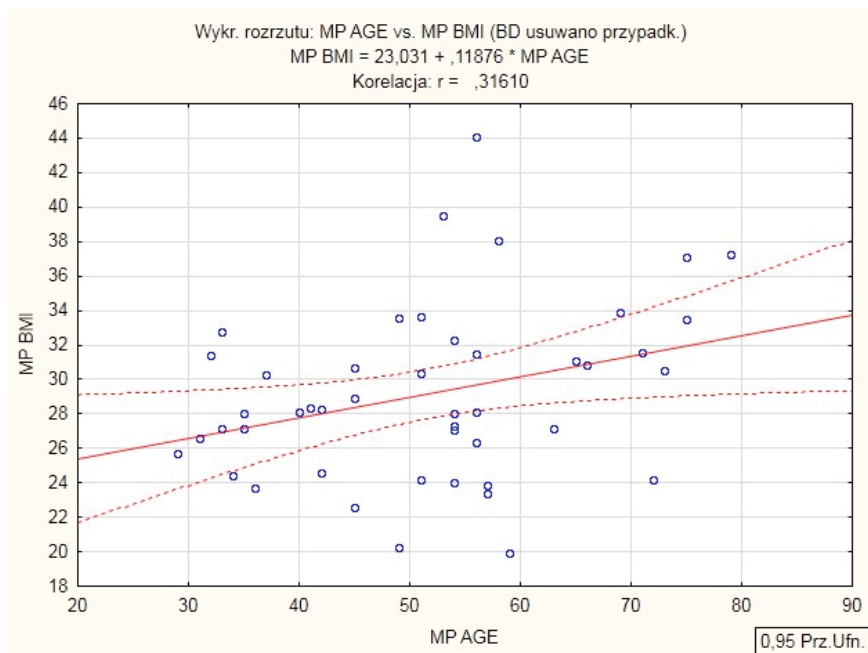


Fig. 2. The age of males (MP AGE) correlated positively with BMI (R=0.32; p>0.05)

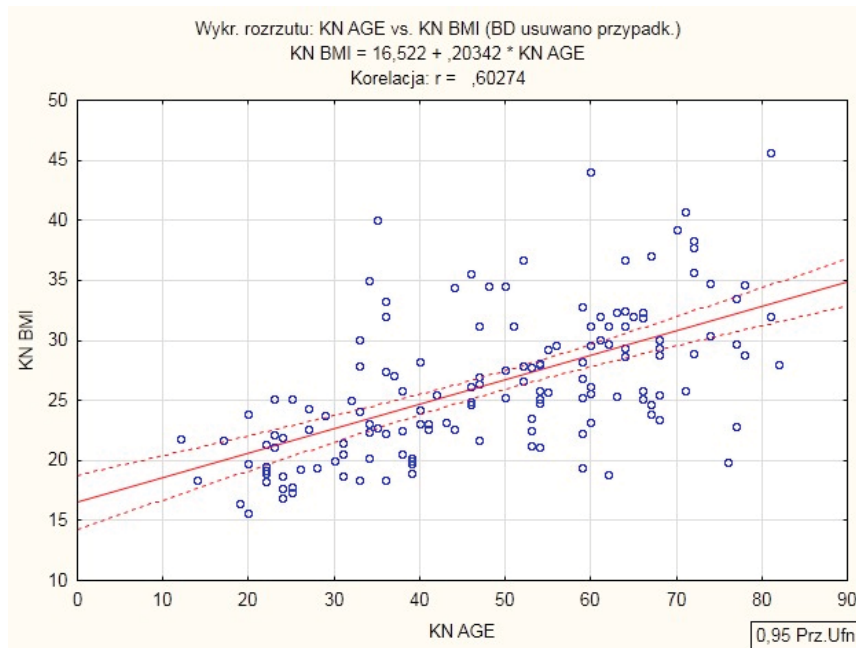


Fig. 3. The age of non-smoking females (KN AGE) correlated positively with BMI (R=0.60; p<0.05)

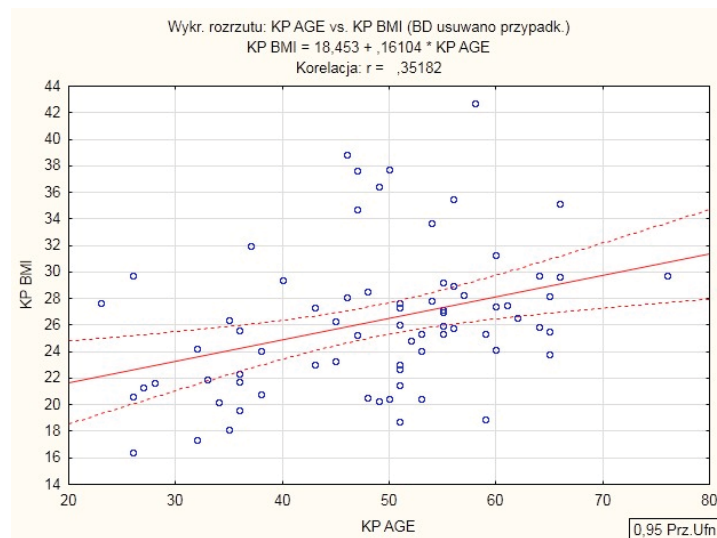


Fig. 4. The age of smoking females (KP AGE) correlated positively with BMI (R=0.36; p<0.05)

In the current study, there is a significant difference between BMIs values in group of males and females (see the Figure 5). The prevalence of overweight and obesity is higher in males than females.

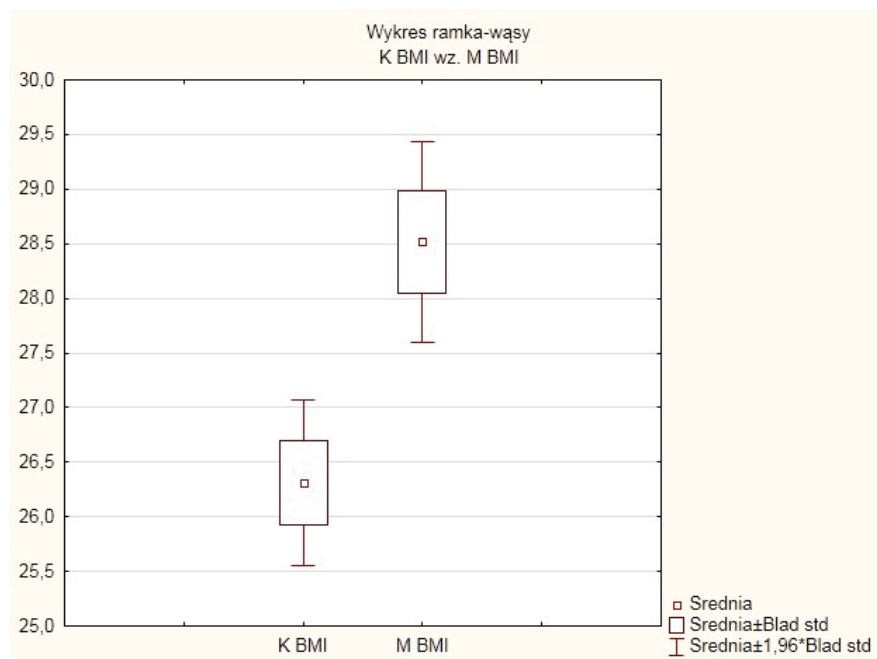


Fig. 5. A significant difference between BMI values between females (K BMI) and males (M BMI)

## Discussion

The literature review of Low and co-workers (2009) shows the prevalence of adults being overweight and obese in developed and developing countries. The prevalence of obesity for males and females ranged from 2.4% in the Republic of Korea to 32.2% in the USA among the developed countries, and from 2.4% in Indonesia to 35.6% in Saudi Arabia among developing countries (no obvious trends were noted). There were no differences between males and females for adult obesity among the developed countries. However, it was noted that the prevalence of obesity was generally higher among females compared to males in the developing countries. According to our results, the prevalence of overweight and obesity in group of females was 36 and 23%, respectively. The prevalence of overweight and obesity in group of males was 37 and 31%, respectively.

Low and co-workers (2009) show the prevalence of obesity by age groups. There was an increasing trend with age. The peak prevalence was reached at around 50 to 60 years old in developed countries and at around 40 to 50 years old in most developing countries. It was observed that most of the rural areas tended to have a lower prevalence of obesity than the urban areas. A gender difference was also noted with females having a higher prevalence of obesity in both rural and urban areas. In our investigations, the age of patients correlates positively with BMI in group of non-smoking males, non-smoking females and smoking females. In group of smoking males the correlation is also positive but statistically non significant. Smoking appreciably elevates mortality (Jung, 1997). Because the presence of two conditions (obesity and cigarette smoking) together probably carries an increased risk to health, statistics on how these conditions overlap could help in the development of an effective policy for prevention and treatment (Sturn, 2002; Heaton et al. 2006). Smokers tend to gain weight when they quit smoking. The



stronger the dependence, the greater the risk of relapse. With a normal BMI, smokers tend to have a greater risk of abdominal fat accumulation compared with nonsmokers. The mechanism is not well elucidated but because smoking has an antiestrogenic effect, it could be related to a hormonal imbalance that could lead to central obesity (Cnop et al. 2003, Willi et al. 2007).

In Europe, the prevalence of obesity in men ranged from 4.0% to 23.3% and in women from 6.5% to 36.5%. The highest prevalences were found in regions of Italy and Spain in both sexes, as well as in Portugal, Poland, the Czech Republic, Romania, and Albania in women. Eastern Europe and the Mediterranean countries showed higher prevalences of obesity than countries in Western and Northern Europe (Berghöfer et al. 2008).

In the UK rates of obese have increased by 30% in woman, 40% in man, and 50% in children within the last decade resulting in 23% of adults being obese in 2007 and prognosis of 50% for 2050 (Zeyda, Stulnig, 2009).

In the current study, there is a significant difference between BMIs values in group of males and females. The prevalence is higher in males than females. This finding is consistent with many studies which come from different countries. In the systematic review by Wang and Beydoun (2007), 66.3% of adults aged 20 years and older were overweight or obese and 34.42% were obese between 2003 and 2004. The prevalence was higher in males than females. The obesity prevalence doubled from 15.1% in 1976 and 1980 to 30.2% in 1999 and 2000 among adults US. The Chinese obesity standard shows an increase from 20.0 to 29.9% between 1992 and 2002. The annual increase rate was highest in men aged 18-44 years and women aged 45-59 years (approximately 1.6 and 1.0% points, respectively). In general, male subjects, urban residents, and high-income groups had a greater increase (Wang et al. 2007).

The lowest percentages of obese people (for males, 7; for females, 6) were obtained for patients in the youngest group (18-35 years old). The highest percentages of obese people (for males, 44; for females, 56) were calculated for the patients aged 72+ (the group of the oldest patients). Our finding does not support the finding of Bender and co-workers (1999) which have investigated the associations among body weight, age, and mortality in 6193 German obese patients with mean BMI of 36.6 and mean age of 40.4. The excess mortality associated with obesity declined with age. Standardized mortality ratios increased with BMI but, within each BMI group, decreased with age.

According to a Kumanyika and co-workers report (2002), obesity is an extremely costly problem. Obesity accounts for 2-6% of total health care costs in several developed countries. The true costs are undoubtedly much greater. In the USA in 1995, the direct healthcare costs of obesity were similar to those for type 2 diabetes, 1.25 times greater than those of heart disease and 2.7 times greater than those of hypertension.

## Conclusions

Obesity is a major public health problem with extensive human suffering and also a massive financial cost to society. According to our results, the prevalence of overweight and obesity in group of females was 36 and 23%, respectively. The prevalence of overweight and obesity in group of males was 37 and 31%, respectively. The lowest percentages of obese people (for males, 7; for females, 6) were obtained for patients

in the youngest group (18-35 years old). The highest percentages of obese people (for males, 44; for females, 56) were calculated for the patients aged 72+ (the group of the oldest patients), so the age of patients correlates positively with BMI in group all groups of patients. In the current study, there is a significant difference between BMIs values in group of males and females. The prevalence is higher in males than females. These data provide evidence that there is a strong requirement for creating new, national strategies and programmes that can address the challenges of growing obesity and chronic disease epidemic.

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