

PREVALENCE OF OBESITY AND ASSOCIATION WITH OTHER CARDIOVASCULAR RISK FACTORS IN A GROUP OF YOUNG MEDICINE STUDENTS

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Abstract

Background&Aims: Obesity, especially abdominal type, is one of the modifiable cardiovascular risk factors which present an increasing prevalence in children and adolescents. The purpose of this study is to assess the prevalence of overweight and obesity in young students from the Faculty of Medicine of Timisoara, in the first and second year of study, and to determine if there is a relationship between obesity and cardiovascular risk factors (family history, smoking, physical inactivity and hypertension). **Methods:** The studied group was represented by 518 students (375 girls and 143 boys) aged 20 ± 2 years. Were used clinical, biochemical and imaging parameters. **Results:** $4.26 \pm 1.23\%$ of girls and $15.38 \pm 2.33\%$ of the boys had a BMI between 25 and 29.9 kg/m^2 and $0.55\% \pm 0.1\%$ of girls and $4.19 \pm 1.13\%$ of the boys had a BMI between 30 and 39.9 kg/m^2 . $67.3 \pm 15\%$ had an unhealthy diet (increased consumption of fats and refined carbohydrates) associated with physical inactivity in proportion of $28.8 \pm 8.66\%$ and stress in proportion of $53 \pm 17\%$. $82 \pm 25\%$ of subjects showed besides obesity, at least two associated cardiovascular risk factors. We note also the decrease of HDL - cholesterol $< 50 \text{ mg\%}$ at $5 \pm 1.23\%$ of girls and $< 40 \text{ mg\%}$ at $25 \pm 9.6\%$ of boys. **Conclusions:** Obesity and overweight was predominant at boys; there was an increased incidence of cardiovascular risk factors related to lifestyle, which requires a series of cardiovascular prevention measures since young age.

Keywords: Prevalence, obesity, cardiovascular risk factors, students

Introduction

Obesity, especially abdominal type, is one of the modifiable cardiovascular risk factors. Existing data in the literature suggests that the

nationally prevalence of obesity is 30% of the population, higher in young children, at puberty and menopause [Şerban V et al, 1999].

Worldwide, it is estimated that children are becoming overweight at younger ages [Rössner S, 2002]. Thus, in the U.S., it is estimated that approximately 19% of children aged between 6 and 11 years are overweight. (according to BMI which must be above the 95th percentile) [Must A et al, 1999]. This epidemic of obesity in children raises particular problems because, in addition to specific complications of obesity, causes cardiovascular disease in adults [Weiss R et al, 2004].

The risk factors for cardiovascular disease such as hypertension, dyslipidemia, impaired glucose tolerance, endothelial dysfunction, are already present in overweight children [Abraham S et al, 1971, Berenson GS et al, 1998, Sinha R et al, 2002, Tounian P et al, 2001, Viner RM et al, 2005].

The prevalence of obesity is increasing; in the last 25 years the number of obese children has tripled [Hedley AA et al, 2004, Ogden CL et al, 1999-2000]. According to BMI (above the 95th percentile for age and gender), about 15% of children aged 6 to 19 are obese [Krebs NF et al, 2003]. The longitudinal studies have shown that 60% of children who are overweight at preschool age are overweight also after age 12 [Nader PR et al, 2006]. Moreover, the existing data in the literature show those children who are overweight in childhood continues to gain weight and are overweight also in adolescence, becoming a good predictor for obesity in adults [O'Brien SH et al, 2004].

Obesity is a disease which in time leads to the apparition of co morbidities. Thus it decreases life expectancy [Fontaine KR et al, 2003], increases mortality [Allison DB et al, 1999] and the costs of care [Daviglius ML et al, 2004, Must A et al, 1999].

Obesity is part of the metabolic syndrome, which includes besides this, insulin resistance, hypertension and other metabolic disorders; it occurs in about half of obese children. [Berenson GS et al, 1998]. Furthermore, the presence of obesity in children increases the prevalence of type 2 diabetes [Wolf AM et al, 1998], as well as related diseases such as renal failure [Kiess W et al, 2004] and cardiovascular diseases [Tounian P et al, 2001].

Several studies have shown the relationship between adolescent obesity and cardiovascular disease. There are many studies which show the strong association between cardiovascular morbidity and mortality in overweight adults which were overweight in adolescence. Although the transition from childhood risk factors at diabetes mellitus and cardiovascular disease in adults is unclear, there is evidence that lifestyle modification and weight control in childhood and adolescence may reduce the risk of type 2 diabetes and cardiovascular disease in adults [Isomaa B et al, 2001].

Adolescence is a transition phase to adult, representing also an optimal period for intervention.

Information about the prevalence of overweight and obesity in adolescents in our country are incomplete or missing.

Therefore, a special attention should be given to the treatment of obesity. This is to promote the healthy diet, changing lifestyle and increasing physical activity.

Material And Method

The study group consisted of 518 students, 375 girls (72.4 %) and 143 boys (27.6 %), with mean age 20 ± 2 years, from the Faculty of Medicine of Timisoara, in the first and second year of study. In all we measured height, weight, blood pressure and were asked to answer at some questions included in a questionnaire about lifestyle, smoking, nutrition, physical activity and family history.

At all subjects we determined the total cholesterol, HDLc, LDLc, triglycerides, fasting glucose. All the students were informed about the purpose and nature of all the procedures used and they consent to participate at this study.

The criteria used to identify obesity in young people were:

a) Abdominal circumference (above 80 cm in girls and above 94 cm in boys)

b) BMI above 30 kg/m^2 , with the following interpretation: BMI between 30 and 34.9 kg/m^2 - obesity grade I; between 35 and 39.9 kg/m^2 - obesity grade II; over 40 kg/m^2 – obesity grade III; between 25 and 29.9 kg/m^2 – overweight.

Were evaluated:

- a) Lifestyle and stress levels using a questionnaire;
- b) Lipid profile (total cholesterol, triglycerides, HDL cholesterol, LDL cholesterol);
- c) Systolic and diastolic blood pressure;
- d) Fasting glucose;
- e) Abdominal circumference and body mass index (BMI).

Methods

Questionnaire Method

The questionnaire consisted of 45 questions in order to identify:

- a) family history of cardiovascular disease
- b) associated risk factors with cardiovascular disease such as smoking, sedentary lifestyle, unhealthy diet, psychosocial stress.

To assess the level of stress was used Perceived Stress Questionnaire.

Determination of blood pressure (BP)

Blood pressure was measured using conventional sphygmomanometers (Didytest, Germany), respecting following conditions: "fasting", subject seated with left arm raised to the heart, physical rest for at least 5-10 min without the subjects smoke or drink coffee before the determination [De Backer G, 2003]. The studied values were arithmetic mean of BP values obtained by three successive determinations.

Metabolic evaluation

The "fasting" lipid profile in the peripheral blood was appreciated by determining the total cholesterol (TC), triglyceride (TG), HDL-cholesterol (HDL-C), LDL-cholesterol (LDL-C) and the ratio TC / HDL-C. We used laboratory methods based on the enzyme principle, both for TC (Dimension AR, Dade Behring Inc., USA) and TG and HDL-C (REflectron IV, Roche, Switzerland). The level of LDL-C was calculated according to the Friedwald's formula: $LDL = TC - (HDL + TG / 5)$. Were considered normal: TC < 190 mg%, TG < 150 mg%, HDL-C > 45 mg%, LDL-C < 115 mg%, TC / HDL-C between 2-3.5 [De Backer G, 2003, Grundy MS et al, 2004].

Determination of body mass index (BMI) and waist circumference (AC)

We determined the subjects body weight (kg) and waist (m) and we calculate BMI according to the formula: $BMI (kg/m^2) = \text{body weight}/\text{waist}^2$. The results were interpreted as follows: normal (18.5 to 24.9 kg/m^2), overweight (25 to 29.9 kg/m^2), obesity grade I (30 to 34.9 kg/m^2), obesity grade II (35 to 39.9 kg/m^2), obesity grade III (> 40 kg/m^2), underweight (<18.5 kg/m^2) [De Backer G, 2003, MacLean D, 2000].

Waist circumference was determined with a centimeter by measuring the waist at the half distance between the umbilicus and xiphoid appendix [Şerban V et al, 1999].

Evaluation of nutrition

The subjects completed a questionnaire (Table 1) that included data on weekly frequency of breakfast, daily consumption of bread / cereals, fruits / vegetables, weekly consumption of foods with high fat, cholesterol and refined carbohydrates.

Table 1. Questionnaire to assess the nutrition [De Backer G, 2003, MacLean D, 2000]

1. Breakfast: How many times a week serving a hearty breakfast (more than just a coffee with a frugal meal)?
2. Bread / Grain: How many portions of whole grain bread and whole grains you eat daily? (One portion = 1 piece of bread, 2/3 cup with dry cereal, ½ cup with cooking cereals etc.)
3. Fruits / vegetables: how many portions of fruits and vegetables consumed daily? (One portion = 1 medium fruit, 2/3 cup with juice fruits / vegetables, 1 cup with fruit / raw vegetables, ½ cup with cooked fruit and vegetables, etc..)
4. Foods with high fat and cholesterol: how many times a week consume grilled steak, hamburger, hot dogs, sausages, forcemeat balls, bacon, cream cheese, fries, fried chicken, butter, cream, fat cheese, ice-cream, greasy creams etc.
5. Foods containing increased refined carbohydrates: how many times a week consume soft drinks (Coke, Fanta etc.) fast food, refined grains (white bread, husked rice), bakery products, candy, etc..

Flow-mediated vasodilatation (FMD %)

To assess the vasodilator response of the brachial artery was applied a compression on arm with the cuff tensiometer for 5 minutes, at a pressure higher than 50 mmHg than SBP. Vascular diameter determined before compression (IVD) and at 1 min after compression (FVD) was determined using an ALOKA ProSound SSD 4000 ultrasound with 10 MHz linear probe in the endowment of University Hospital CF Timișoara. Vasodilator response (% FMD) was determined in the following terms: "fasting", physical rest, thermic comforts without the subjects smoke or drinks coffee, and was expressed as percentage of the standard formula: $FMD\% = [(FVD - IVD) \times 100 / IVD]$ [Correti M, 2002].

Statistical Analysis

For statistical analysis we used Microsoft Excel and POP Tools from Microsoft Office 2003 and EPI 2000 program. To measure the quantitative variables were determined media (M) and standard deviation (SD), and to assess the gender differences we used the unpaired t test and ANOVA test, considering statistically significant a $p < 0.05$.

Results and Discussion

From a group of 518 students investigated (375 girls and 143 boys), without personal and family history of cardiovascular disease, $4.26 \pm 1.23\%$ of girls and $15.38 \pm 2.33\%$ of the boys had a BMI between 25 and 29.9 kg/m^2 ($p < 0.001$, $X^2 = 18.82$) and $0.55\% \pm 0.1\%$ of girls and $4.19 \pm 1.13\%$ of the boys had a BMI between 30 and 39.9 kg/m^2 ($p = 0.002$, $X^2 = 9.13$). We note that $26.6 \pm 9.66\%$ of the girls had a BMI $<18.5 \text{ kg/m}^2$ (Fig.1).

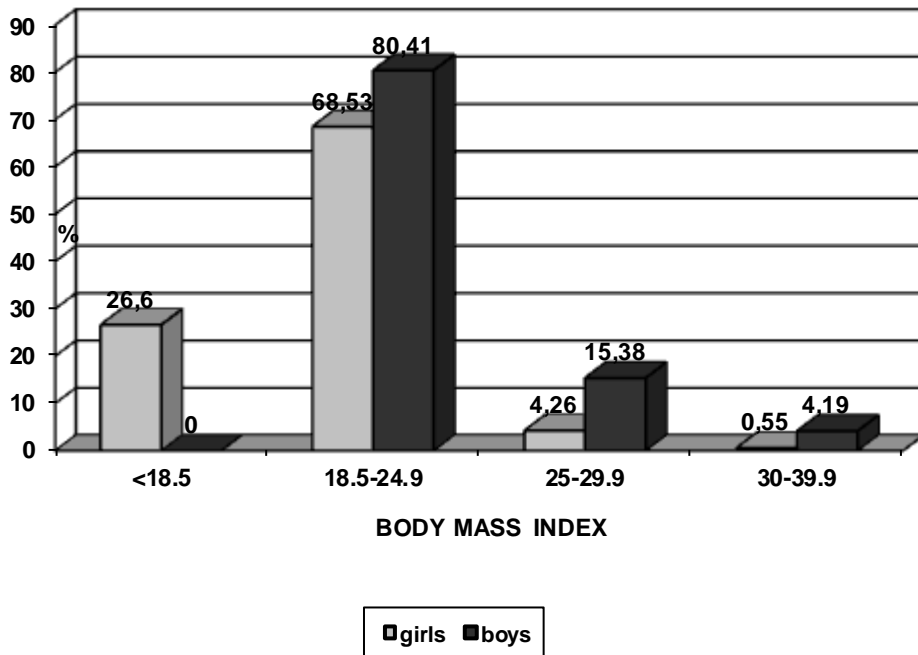


Fig. 1. Prevalence of overweight and obesity at youth

By gender, the prevalence of obesity was higher in boys than in girls, because they were probably more concerned with how they look.

Regarding the relationship with other cardiovascular risk factors, overweight and obesity in adolescents was more common in the sedentary and those whose parents were obese.

Obese adolescents had elevated blood pressure (26.82% versus 0% at normal weight, $p < 0.001$, $X^2 = 980$) (Table 2).

Table 2. The values of BP at overweight and obese youth

BP	Girls (%)	Boys (%)
90-99	1.92	1.92
100-109	1.92	1.92
110-119	11.53	5.76
120-129	13.4	17.3
130-139	0	17.3
140-149	3.84	5.76
> 150	1.92	15.3

Smoking is common in adolescents. Obese girl was smoked in a proportion higher than those with normal body weight (66.66% compared 33.33%, $p = 0.045$, $X^2 = 4$). The proportion of boys was: 46.42% smoking versus 53.57% no smoking ($p = 0.59$, $X^2 = 0.59$) (Table 3).

Overweight and obesity was more frequent in subjects with obese parents – when the parents were normal weight the obesity prevalence was 4.34% to 17.39 % when both parents were obese ($p = 0.044$, $X^2 = 4.04$).

Table 3. The prevalence of smoking in adolescents with normal weight, overweight and obese.

	Smokers	Non-smokers	p
	Girls		
Normal weight	25.98%	74.02%	$p < 0.001$, $X^2 = 163.82$
Overweight and obese	66.66%	33.33%	$p = 0.045$, $X^2 = 4$
	Boys		
Normal weight	34.79%	65.21%	$p < 0.001$, $X^2 = 21.3$
Overweight and obese	53.57%	46.42%	$p = 0.59$, $X^2 = 0.29$

The prevalence of hypertension was 2-3 times higher in obese and overweight adolescents than in those with normal weight. The obese were more sedentary than those with normal weight.

Discussions

Our results on overweight and obesity are comparable to those in Canada and France [Abraham S et al, 1971, Berenson GS et al, 1998]. In these screenings, the boys are more frequently obese than girls.

Obesity occurs due to the interaction of psychological, metabolic, behavioral and social factors. Obese children often have obese parents, the risk is genetic; our results also show this.

Physical inactivity contributes significantly to obesity. Almost half of Americans aged 12 to 21 years did not perform intense physical activity and 14% not performed any physical activity. Our results show that obese teenagers are sedentary, the prevalence of obesity increases with the time

spent watching TV. Watching TV is a significant factor for inactivity [Mossberg HO, 1989].

Obesity and hypertension are significantly associated. Data from the U.S. shows that regardless of race, gender or age, the blood pressure is increased in those with higher body mass index [DiPietro L et al, 1994]. Sorof reported a 3-fold higher prevalence of hypertension in obese adolescents compared to non-obese.

It is noted that at girls the obesity was first degree only, while in boys was the grade I (2.79% of patients) and grade II (1.39% of cases).

Two studies conducted one in the U.S. [Abraham S et al, 1971] and the other one in Sweden [Mossberg HO, 1989, DiPietro L et al, 1994] have also shown that overweight children are an increased risk of cardiovascular disease.

Studies conducted in the U.S. [Must A et al, 1999] and Denmark [Pearson S et al, 2005] shows a further increase in overweight and obesity in children.

A study in Australia showed an increase in overweight and obesity over a period of 10 years from 9.3% in boys and 10.6% for girls and from 1.7% at boys and 1.6% at girls at 15.0% at boys (ranging with age from 10.4% to 20.0%) and 15.8% at girls (ranging with age from 14.5% to 17.2%) and at 4.5% at boys (2.4% -6.8%) and 5.3% at girls (4.2% - 6.3%) [Magarey AM et al, 1998].

67.3 ± 15% had an unhealthy diet (increased consumption of fats and refined carbohydrates) associated with physical inactivity in proportion of 28.8 ± 8.66% and stress in proportion of 53 ± 17% (Fig. 2). We followed the correlation of systolic blood pressure with obesity, lipid profile modification and the number of associated cardiovascular risk factors. Thus 82 ± 25% of subjects showed besides obesity, at least two associated cardiovascular risk factors. We note also the decrease of HDL - cholesterol < 50 mg% at 5 ± 1.23% of girls and < 40 mg% at 25 ± 9.6% of boys (Fig.3).

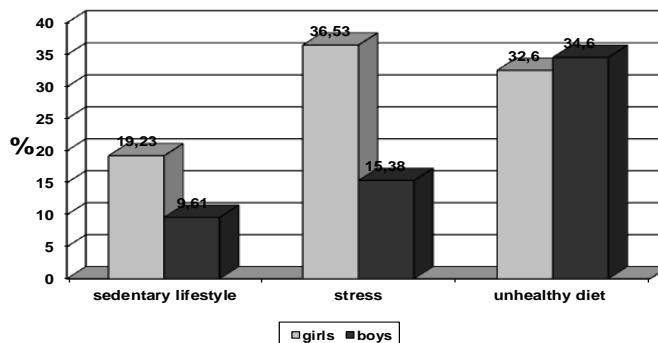


Fig. 2. Association between obesity and sedentary lifestyle, stress and unhealthy diet

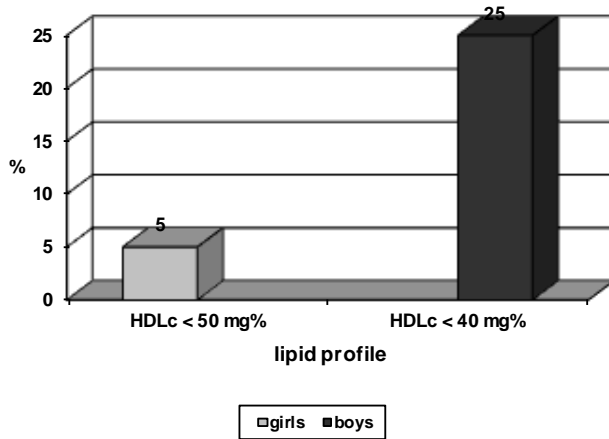


Fig. 3. Association between obesity and lipid profile modification

Between BMI and fasting blood glucose, concentration of triglycerides, total cholesterol, HDLc, respectively SBP average the correlations were weak ($r < 0.05$ or $r < - 0.05$).

Metabolic syndrome defined in accordance with the FID by the following criteria: central adiposity (waist circumference above 90th percentile), and at least two from the following criteria: 1) the concentration of triglycerides above 150 mg% (1.7 mmol / l), 2) HDL cholesterol less than 40 mg% (1.03 mmol / l), 3) SBP above 130 mmHg or DBP above 85 mmHg, 4) fasting glucose above 100 mg% (5.6 mmol / l) or previous diagnosis of diabetes type 2 was found in our study in overweight and obese subjects in 30.43% cases (Fig. 4).

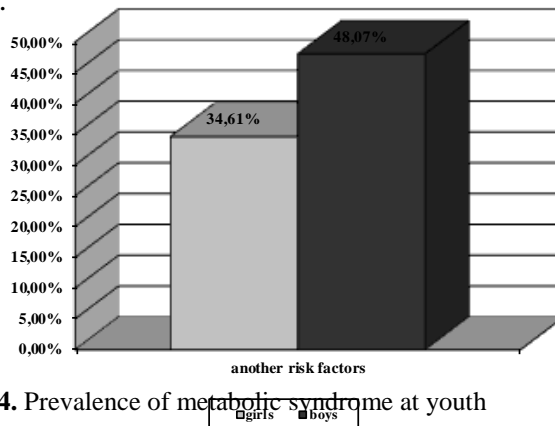


Fig. 4. Prevalence of metabolic syndrome at youth

Conclusion

In our study group overweight and obesity were more prevalent in boys than in girls. Also, overweight and obesity were associated with other

cardiovascular risk factors such as hypertension, family history or unhealthy lifestyle characterized by physical inactivity, unhealthy diet or smoking.

Although there are numerous studies on obesity in the literature, the study of obesity in children and adolescents is just at beginning. Overweight and obesity are highly prevalent in adolescents: our results are comparable with the literature.

Because the prevalence of obesity in young people known epidemic proportion, it is necessary to take measures to avoid it.

Because the relationship between overweight and obesity and cardiovascular risk factors is significant and powerful, overweight and obesity in adolescents require special attention from their family and doctor requiring increasing physical activity and changing dietary habits and lifestyle

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