

# The association between obesity and the risk for development of eating disorders – A large-scale epidemiological study

E. TSEKOURA<sup>1</sup>, E. KOSTOPOULOU<sup>1</sup>, S. FOUZAS<sup>1</sup>, E. SOURIS<sup>2</sup>, D. GKENTZI<sup>1</sup>, E. JELASTOPULU<sup>2</sup>, A. VARVARIGOU<sup>1</sup>

<sup>1</sup>Department of Pediatrics, University General Hospital of Patras, Patras, Greece

<sup>2</sup>Department of Public Health, School of Medicine, University of Patras, Patras, Greece

*Efstathia Tsekoura and Eirini Kostopoulou contributed equally to this work*

**Abstract.** – **OBJECTIVE:** Eating disorders and obesity are serious, multifactorial diseases with increasing prevalence worldwide, often manifesting during childhood and adolescence. The aim of this study was to investigate the risk for developing eating disorders in children and adolescents of Primary and Secondary Education, with normal or excessive body weight.

**MATERIALS AND METHODS:** A representative sample (N=3504) of students from schools of Western Greece, 50.2% boys, aged 10-16 years old, participated in the present cross-sectional epidemiological study. The students' dietary habits were assessed through multiple-choice questions and the risk for the development of eating disorders was evaluated using the Eating Attitudes Scale (EAT-13) validated questionnaire. Anthropometric measurements were obtained and the BMI, BMI% and BMI z-score were calculated.

**RESULTS:** Nearly 20% of the participants, particularly those with overweight or obesity, were at increased risk for developing eating disorders (25% of normal weight-, 28.2% of overweight- and 33% of participants with obesity). Boys were more likely to develop eating disorders than girls, but not statistically significantly. A positive correlation of: (1) the overall EAT-13 score, (2) food pre-occupation score and (3) dieting score, with BMI z-score and obesity was found, as opposed to a negative correlation of Important Others score with BMI z-score and obesity.

**CONCLUSIONS:** Increased awareness regarding the risk for developing eating disorders or disordered eating in children and adolescents with overweight and obesity is recommended to avoid underdiagnosis of this condition. Prompt identification of children at risk contributes to the implementation of targeted and effective prevention and treatment interventions.

*Key Words:*

Eating disorders, Pediatric obesity, Eating attitudes scale (EAT-13), Children, Adolescents, Body mass index.

## Introduction

Pediatric obesity represents a challenging health hazard that has already reached epidemic proportions worldwide<sup>1</sup>. Obesity during childhood has been directly linked to increased cardiovascular diseases and metabolic disorders, including dyslipidemia, hypertension, insulin resistance, type 2 diabetes mellitus and non-alcoholic fatty liver disease<sup>2-4</sup>. Knowing that pediatric obesity composes a fairly good predictor of future morbidity and mortality, the increase in the prevalence of the disease is alarming.

In addition to the aforementioned obesity-associated comorbidities, the psychological aspects of pediatric obesity are not to be ignored. It is well known that children with obesity are frequently ridiculed and victimized at school and at home, which impacts on their self-esteem<sup>5</sup>. Body shape discontent, increased levels of anxiety and guilt regarding food consumption have also been noted in children suffering from obesity<sup>6,7</sup>, increasing the likelihood of depression<sup>8</sup>.

Among the psychological consequences of pediatric obesity, eating disorders have also gained attention. Eating disorders represent another complex health condition of rising prevalence that often presents during childhood or adolescence. The most prevalent diagnoses of eating

disorders include anorexia nervosa, bulimia nervosa, binge eating disorder and other specified feeding or eating disorders<sup>9</sup>.

The aim of the present study was to identify the risk for developing eating disorders in children and adolescents with normal and excessive body weight.

## Materials and Methods

This is a large-scale school-based epidemiological study of 3504 students from Western Greece, aged 10-16 years old (mean  $\pm$  SD: 12.8  $\pm$  1.4). The two sexes were equally represented (males: 50.2%, females: 49.8%). Children of primary (5<sup>th</sup> and 6<sup>th</sup> graders) and secondary education were included in the study.

A thorough dietary history was obtained using a validated questionnaire which included multiple choice answers regarding: i) the number of daily meals, ii) the frequency of breakfast skipping, iii) the frequency of consumption of school snacks between breakfast and lunch, and iv) the frequency of consumption of fast food and sweets. The questionnaire was developed following literature search and was validated during a pilot study that was executed in a sample of 50 students prior to the implementation of the final study. Eating attitudes and the risk for developing eating disorders was also evaluated using a validated 13-item Eating Attitude Test (EAT-13). EAT-13 included three subscales (Food pre-occupation, Dieting and Important Others)<sup>10</sup>. The responses were provided in a 4-point Likert scale and the total score ranged from 0 to 39. Subjects who scored at or higher of the cut-off score 12, were considered to be high risk for developing an eating disorder<sup>10,11</sup>.

Anthropometric measurements were obtained and the BMI, BMI% and BMI z-score were calculated. The study was approved by the Research Ethics Committee of the University of Patras and the Greek Ministry of Education and Religious Affairs and was in accordance with the ethical standards described in the 1964 Declaration of Helsinki (IRB numbers:  $\Phi$ 15/25937/28741/ $\Delta$ 1, 33157/ $\Delta$ 2,  $\Phi$ 15/100824/113700/ $\Delta$ 1, 66000/ $\Delta$ 2). Written informed consent was obtained from the parents of each student included in the study and verbal assent from all the participants.

### Statistical Analysis

Categorical variables are expressed as absolute and relative frequencies, while continuous vari-

ables as means  $\pm$  standard deviations. Univariable linear regression analysis was applied to explore the relationship between EAT-13 (overall score or subscales) and BMI z-score. Statistics were performed using the SPSS v.25 software (IBM Corp, Armonk, NY, USA). The level of significance was set to 0.05 for all analyses.

## Results

The demographic, somatometric characteristics and dietary habits of the participants are shown in Table I.

EAT-13 scores in males and females are shown in Table II. No statistically significant difference was observed in EAT-13 scores between the two sexes. Also, no statistically significant difference was observed in the proportion of boys with pathological EAT-13 score (above 12), when compared to the girls (Figure 1).

EAT-13 score (mean  $\pm$  SD) was higher in participants with obesity compared to those with overweight or normal weight (9.54  $\pm$  5.89 vs. 8.51  $\pm$  5.72 vs. 8.11  $\pm$  5.95, respectively). Statistical significance was found when EAT-13 of children with obesity was compared to that of the other two BMI% groups ( $p < 0.05$ ), (Table II). EAT-13 score was pathological (above 12) in 33% of children with obesity, 28.2% of overweight children and 25% of normal weight children (Figure 2).

A positive correlation was found using linear regression analysis between the overall EAT-13 score and the BMI z-score (Table III). There was also a strong positive correlation between Food preoccupation score and the BMI and between Dieting score and the BMI. A strong negative correlation was identified between Important Other scores and the BMI (Table III). A positive correlation was also found between the overall EAT-13 score and obesity, Food preoccupation score and obesity and Dieting score and obesity. A negative correlation was found between Important Others score and obesity (Table III).

## Discussion

Childhood obesity has been associated with an increased risk of developing eating disorders during adolescence<sup>12-14</sup>. Also, adolescents who present with both an eating disorder and obesity are at increased risk for future development of full threshold eating disorders and additional

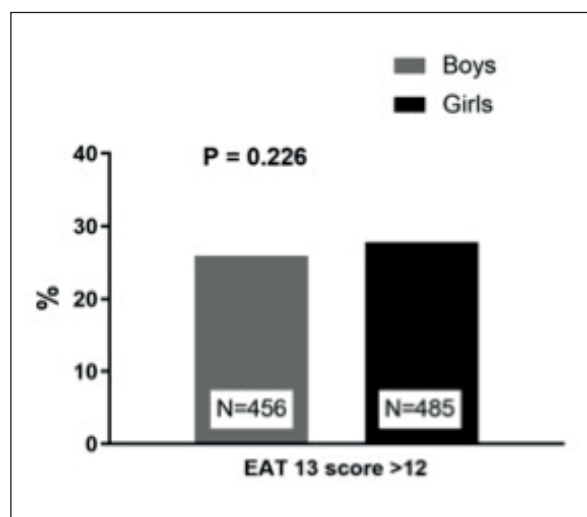
**Table I.** Demographic data, anthropometric measurements and dietary habits.

Number of participants	3504
Boys / Girls (n, %)	1759 (50.2) / 1745 (49.8)
Age, years (mean ± SD, min, max)	12.8 ± 1.4 (10-16)
Weight, kg	52.4 ± 13.6
Height, cm	158.2 ± 10.4
BMI, kg/m <sup>2</sup>	20.7 ± 3.9
BMI z-score	0.43 ± 1.02
BMI percentile	62.7 ± 28.7
Obese (BMI ≥ 95 <sup>th</sup> percentile)	424 (12.1)
Overweight (BMI 85 <sup>th</sup> -95 <sup>th</sup> percentile)	673 (19.2)
Underweight (BMI < 3 <sup>rd</sup> percentile)	51 (1.5)
Daily meals	4 (3-5)
Breakfast consumption	2694 (76.9)
Breakfast at school	324 (9.2)
Meal between breakfast and lunch	1858 (53)
Fast food (lunch)	106 (3)
Poor-quality school food	2876 (82.1)
Never	628 (17.9)
1-2 times/week	744 (21.2)
3-4 times/week	1260 (36)
Everyday	872 (24.9)
Sweet consumption	
Never	99 (2.8)
1-2 times/week	1906 (54.4)
3-4 times/week	978 (27.9)
Everyday	521 (14.9)

Data are mean ± SD or number of cases (%).

weight gain<sup>15</sup>. The overall estimated prevalence rates of eating disorders among adolescents range from 1.2-2.9% for boys and 5.7-15.2% for girls<sup>16,17</sup>. These rates are probably higher in adolescents with increased weight. Data from a Canadian study demonstrated that 3.7% of

male adolescents and 10.3% of female adolescents with overweight, and 9.3% of males and 20.2% of females with obesity, met the criteria for an eating disorder. Among both male and female adolescents with overweight and obesity, bulimia nervosa was the most common eating disorder<sup>18</sup>. Similarly, according to another study, 8% of youth seeking treatment for overweight or obesity met the criteria for an eating disorder upon presentation<sup>19</sup>. Conversely, youth seeking treatment for a restrictive eating disorder were reported as previously meeting the criteria for overweight or obesity<sup>20</sup>.

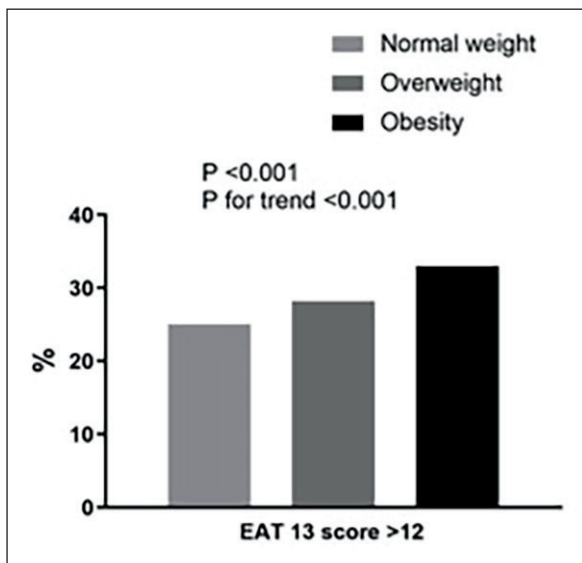


**Figure 1.** Percentage of boys and girls with EAT-13 score above 12. No statistical significance was found between the two sexes ( $p=0.226$ ).

**Table II.** EAT 13 score in relation to sex and BMI group. Data are mean ± SD.

	EAT 13 score
Boys (N = 1759)	8.32 ± 5.79
Girls (N = 1745)	8.35 ± 6.04
Normal weight (N = 2356)	8.11 ± 5.95
Overweight (N = 673)	8.51 ± 5.72
Obesity (N = 424)	9.54 ± 5.89*

No significant difference between boys and girls. \*Significant difference ( $p < 0.05$ ) when obesity is compared to the other BMI groups (one-way ANOVA with Bonferroni correction).



**Figure 2.** Percentage of children and adolescents with normal weight, overweight or obesity with EAT-13 score above 12. The EAT-13 score was significantly higher in children and adolescents with obesity ( $p < 0.001$ ).

Adolescents with excess weight may also exhibit milder disordered eating behaviors, such as chronic dieting, binge eating, bulimic behaviors and higher levels of body dissatisfaction compared to their normal-weight counterparts<sup>21,22</sup>.

The present study showed a positive relationship between the BMI and the probability of developing disordered eating. The EAT-13 score

was significantly higher in children and adolescents with obesity compared to the other two BMI categories (overweight and normal weight). Also, a higher percentage of participants with obesity had a pathological EAT-13 score, suggestive of an increased risk for disordered eating. Interestingly, in the present study the boys were more likely to score high (above the high normal value of 12) on the EAT-13 scale compared to the girls, however with no statistical significance. Hence, our results did not confirm a higher risk for developing eating disorders in females as reported in the literature<sup>18</sup>. When individual parameters of disordered eating were evaluated, the findings demonstrated a positive relationship between the BMI and weight-associated guilt, food restriction intention and weight and shape concern (Food preoccupation subscale). Also, bigger BMIs were positively associated with a bigger effort of the children to eat healthily, as well as the perception that they ate healthily (Dieting subscale). Furthermore, higher BMIs were associated with a smaller environmental (parental) pressure to overeat (Important Others subscale). The above findings suggest that children with overweight or obesity are likely to present body dissatisfaction, are conscious of their excess weight, are willing to improve their weight status and also susceptible to psychological distress after eating calorie-rich foods. Interestingly, children with excess weight are convinced that they eat healthily, despite the

**Table III.** Total and subscale scores of EAT-13 and their correlations with BMI z-score and obesity.

Overall score, mean ± SD	8.3 ± 5.9
Risk for eating disorders (score ≥ 12), No. (%)	941 (26.9)
Subscales	
Food pre-occupation, mean ± SD	4 ± 3.8
Dieting, mean ± SD	3.1 ± 2.9
Important Others, mean ± SD	1.3 ± 2.1
Correlation between BMI z-score and Eating Attitudes Test (EAT-13) score	
Overall EAT-13 score	0.073 (< 0.001)
Subscales	
Food pre-occupation	0.237 (< 0.001)
Dieting	0.067 (< 0.001)
Important Others	-0.299 (< 0.001)
Correlation between Obesity and Eating Attitude Test (EAT-13) score	
Overall EAT-13 score	0.076 (< 0.001)
Subscales	
Food pre-occupation	0.151 (< 0.001)
Dieting	0.060 (< 0.001)
Important Others	- 0.129 (< 0.001)

Data are mean ± SD or number of cases (%). Variables of linear regression analysis and p-values (parentheses) are presented. Statistically significant correlations are presented in bold.

fact that they over-consume fast food, sweets and school snacks of poor quality. This may infer poor nutritional education and offers a field for preventive intervention.

This is large-scale epidemiological study of a homogeneous school-population sample, conducted in a wide age-range group. Since Western Greece represents the fourth in population size Greek administrative region, we assume that the results provide a good nationwide estimate. Furthermore, the results are based on self-reported data that could be subject to recall or socially accepted reporting bias. However, the fact that children's responses were anonymous reduces the likelihood of misreport.

### Conclusions

We demonstrated that eating disorder pathology is high among children with excess weight, particularly those with obesity. Therefore, it is important that this psychological aspect is not neglected but looked for by physicians. To the best of our knowledge, this study is the first to investigate the prevalence of eating disorder traits in such a large sample of children and adolescents and to compare the corresponding rates between children and adolescents with normal and increased body weight. Since the current treatment approaches of obesity assume rational behavior, identifying eating disorder traits should encourage the adaptation of different, integrated diagnostic and treatment strategies that may require psychiatry or psychology involvement.

#### Conflict of Interest

The Authors declare that they have no conflict of interests.

#### ORCID ID

Eirini Kostopoulou ORCID: 0000-0002-7051-7537.

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