# Nutrición Hospitalaria

## Original

# A two-phase population study: relationships between overweight, body composition and risk of eating disorders

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## Abstract

*Background:* Overweight and eating disorder (ED) are major public health problems in adolescents.

*Aims:* To assess the association of overweight, body composition and anthropometric characteristics with the probability being at risk of ED.

*Methods:* A two-phase study was used. 329 girls and 96 boys (aged 12-18 years) from an initial sample of 2967 adolescents were studied. The BMI, percentage of fat mass estimated by bioimpedance ($FM_{(BIA)}$), waist circumference, waist-to-height ratio, and waist-to-hip ratio (WHipr) were calculated. The Eating Attitudes Test, Youth´s Inventory-4 and a questionnaire to evaluate social influences were administered.

*Results:* A total of 34.7% of girls and 53.6% of boys at risk of ED were overweight (including obesity). For girls, overweight frequency was significantly higher in risk ED group than in control group. Increases of one point in the BMI or $FM_{(BIA)}$ increased the probability of being at risk of ED by 12% (3.0-19.0) and 4% (0.0-8.0), respectively. An increase in Whipr was negatively associated with ED risk. Smoking and symptoms of dysthymia and the genralized anxiety disorder also increase the probability of being at risk of ED in adolescent girls. In adolescent boys, these relations were not observed.

*Conclusions:* The higher BMI and the percentage of $FM_{(BIA)}$ are associated with greater risk of ED in adolescent girls, when psychological factors are present. Increases in the WHipr, characteristic of childhood body is negatively associated with that risk.

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Key words: *Eating disorders. Overweight. Body Mass Index. Body composition. Anthropometry.*

## ESTUDIO A DOBLE FASE: RELACIÓN ENTRE EL SOBREPESO, LA COMPOSICIÓN CORPORAL Y EL RIESGO DE TRASTORNO DE LA CONDUCTA ALIMENTARIA

### Resumen

*Introducción:* El sobrepeso y los Trastornos de la Conducta Alimentaria (TCA) son problemas importantes de salud pública entre los adolescentes.

*Objetivos:* Valorar la asociación del sobrepeso, la composición corporal y otras características antropométricas con la probabilidad de estar en riesgo de desarrollar un TCA.

*Métodos:* Se realizó un estudio con un diseño en doble fase. Se estudiaron 329 chicas y 96 chicos (de 12-18 años) procedentes de una muestra inicial de 2967 adolescentes. Se calcularon el índice de masa corporal (IMC), el porcentaje de masa grasa (% $MG_{(BIA)}$), la circunferencia de la cintura, los cocientes cintura-talla y cintura-cadera. Se administraron el *Eating Attitudes Test*, el *Youth's Inventory-4* y un cuestionario para evaluar influencia sociocultural.

*Resultados:* El 34,7% de las chicas y el 53,6% de los chicos con riesgo de TCA presentan sobrepeso (incluyendo obesidad). La frecuencia de sobrepeso es significativamente más alta en las chicas del grupo de riesgo de TCA que las del grupo control. En las adolescentes, el aumento de un punto en el IMC o en el % $MG_{(BIA)}$ incrementa el riesgo de estar en riesgo de TCA en 12% (3,0-19,0) y 4% (0,0-8,0), respectivamente; un incremento en el cociente cintura-cadera se asocia negativamente con el riesgo de TCA. Fumar, presentar síntomas de distimia y de trastornos de ansiedad generalizada también se asociaron con la probabilidad de estar en riesgo de TCA, en las adolescentes. En los varones, no se han observado esas relaciones.

*Conclusiones:* El mayor IMC y de % $MG_{(BIA)}$ se asocian con mayor riesgo de TCA en las adolescentes cuando los factores psicológicos están presentes. Un aumento en el cociente cintura-cadera, característico de un cuerpo infantil, se asocia negativamente con el riesgo de TCA.

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Palabras clave: *Trastornos alimentarios. Sobrepeso. Índice de masa corporal. Composición corporal. Antropometría.*

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## Introduction

In 1998 the World Health Organization[1] defined obesity as a global epidemic that affects people of all ages from urban to rural areas. In the last 20 years, prevalence of childhood and adolescent obesity has increased all over the world, including developing countries.[2] In Europe, the highest prevalence (20-40%) is observed in the south-east Mediterranean countries.[3] In Spain, the EnKid study[4] evaluated 3,534 young people between the ages of 2 and 24 and found that the prevalence of childhood and adolescent obesity and overweight was 26.3%. Likewise, data from the AVENA (Food and Assessment of the Nutritional Status of Adolescents) multicentre study indicated a prevalence of overweight and obesity of 25.7% for boys and 19.1% for girls.[5]

Approximately 30% of obese children will remain obese during adulthood[6] and will therefore suffer the associated chronic morbidities. Several studies have also found that overweight adolescents present a higher risk of eating disorders (ED).[7-11] Swenne (2001)[11] observed that adolescents' growth curves of who develop ED showed greater weight than those of adolescents without ED. Other studies found that overweight girls are more likely to present restrictive eating behaviours, worry about their weight and be less satisfied with their appearance.[12] This could have lasting effects on their self esteem and body image and increase the risk of ED.

Childhood obesity seems to predispose especially to bulimia.[13] Self-imposed dietary restrictions (i.e. restrictions without medical prescription or supervision) can lead to binge eating disorder,[14] other EDs and, paradoxically, increased weight gain.[15]

Anthropometric obesity indicators have been related to heart disease risk.[16] Suárez-González et al.[9] observed that 30% of the population studied was at risk for having ED. Furthermore, subjects without eating-related disorders had a lower body mass index (BMI) than sub-clinical subjects.[7-9] Obesity is a well-known risk factor for ED but previous studies did not analysed whether body composition and anthropometric characteristics are associated with the probability of being at risk of ED.

Given the increased prevalence of childhood and adolescent obesity and the importance of high BMI in the aetiopathogeny of ED, our objective was to assess the association of overweight, body composition and anthropometric characteristics with the probability being at risk of ED in a non-clinical population.

## Methods

### Participants

A cross-sectional, multidisciplinary study of ED was carried out in two phases. In the first phase, the whole adolescent school population (mean age = 14.3 ± 1.51) of both sexes was screened. Participation was 87.4% (N = 2,967). They were from the city of Tarragona (Spain) and a sample of rural municipalities of fewer than 5,000 inhabitants from the province of Tarragona. Tarragona is a Mediterranean city of 150,000 inhabitants with middle-high socioeconomic status in relation to the rest country. In the 2nd phase two groups were selected according to the risk of ED. 224 subjects were identified as at risk subjects and the same number was collected for the control group. The participation was 94.9%; thus the sample of the 2nd phase was: A) 161 girls and 56 boys at risk of ED and B) 168 girls and 40 boys as control group.

### Procedure

Prior starting the study we obtained permission to enter the selected schools by the Department of Education of the Catalan Government and the schools themselves. The screening (from October 2000 to June 2001) in the first phase of the study took place in the classroom. In the second phase (from October 2001 to June 2002), we were given parental permission to interview the children and obtain the rest of the variables.

We have defined at risk subjects on the basis of EAT (Eating Attitudes Test) score ≥ 25[17] or the Youth's Inventory[18] cut-off score for symptoms of ED. Some authors have observed that the joint selection of risk subjects by EAT or Youth's Inventory increase the number of subjects at risk of ED. They were subsequently identified as subjects with Eating Disorders Not Otherwised Specificied[19].

Subjects of the control group from the same class, matched by age and sex as the individuals at risk of ED, were selected at random from those who had EAT score < 10.

### Eating Disorder Questionnaires for Screening

*Eating Attitudes Test (EAT):*[20] this is a self-administered questionnaire used as a screening tool for ED. It assesses the risk that a subject will develop ED. The questionnaire was validated for Spain by Castro et al. (1991).[21] The cut-off score in the original version of this questionnaire is 30, above which individuals are at risk of ED. In this study, we used a cut-off score of 25 because it provided better sensitivity and more specific data for the young people in our population.[17]

*Youth's Inventory-4:*[18] this is a self-report rating scale that evaluates DSM-IV emotional and behavioural disorders in youths aged between 12 and 18 years old. The Youth's Inventory-4 contains 120 items for the symptoms of 18 disorders. However, for this study we used only those items for dysthymia, generalized anxiety disorder and major depression. We used an experimental Spanish version translated for this study. Internal consistency was adequate (a = 0.75). In

the first phase, we used the items for bulimia (4 items) and anorexia nervosa (3 items) for screening.

## Personal Data

### Anthropometric and Body Composition Measurements

*Body Mass Index* (BMI, kg/m$^2$): childhood overweight was assessed using the standard definition and the recommended cut-off criteria of the International Obesity Task Force for overweight (which includes obesity). BMI cut-offs were derived from sex-specific BMI age curves that pass through a BMI of 25 and 30 (the cut-off points used in adults to define overweight and obesity, respectively) at 18 years of age, respectively.[22]

*Waist circumference:* was measured midway between the lowest rib and the top of the iliac crest at the end of gentle expiration.

*Waist-height ratio:* was calculated by dividing waist circumference (in cm) by height (in cm). We used a waist-height ratio cut-off score of 0.5. Although this is the cut-off score for adults, McCarthy & Ashwell (2006)[23] suggested that it could be used in a public health context for assessing increased health risk in children associated with an excessive accumulation of body fat in the upper body or even internally.

*Waist-hip ratio:* hip circumference (in cm) was measured over the great trochanters, which is not necessarily the widest circumference. The waist-hip ratio was calculated as the ratio of the waist to the hip.

*Fat Mass Percentage:* it was estimated using bioelectric impedance analyser (BIA) Tanita® (Tanita-305; Tanita Cirp, Tokio, Japan)

*Smoking:* "Smoker" was used as a dichotomic variable (Yes, I smoke; No, I don't smoke).

## Family questionnaires

*Family structure questionnaire*: "divorce" (or "separation") of parents was used as a dichotomic variable.

*Socioeconomic level*: this was evaluated by the Hollingshead Index of Social Position,[24] which contains seven categories of professions and parental educational level. The occupational scale ranges from unskilled employees to top executives. The subjects that were unemployed were categorized as unskilled employees because of their low income. The educational scale ranges from less than seven years schooling to the category of professional. These two factors can be combined to define social class. The Hollingshead Index of Social Position divides social class into five categories: upper, upper-middle, middle, lower-middle and lower. We recoded them into the following three categories: low socioeconomic level (lower), middle socioeconomic level (lower-middle and middle), and high socioeconomic level (upper-middle and upper).

*Sociocultural influence on the thinness model:* We formulated several questions to evaluate the social influences on the "model of thinness":

- Do you talk about dietary product advertisements with your friends? ("advertisements").
- Do you consider thin females to be nicer and more attractive? (thin females = nicer).
- Do you categorise actors' bodies as being thin or fat? ("actors' bodies).
- Are all clothes sizes too small for you when you go shopping? ("clothes size too small").
- The possible answers to these questions were "no" (never) and "yes" (always or sometimes).

## Data Analysis

The data were analysed using the SPSS statistical software for Windows (version 13.0). The chi-squared test was used to compare categorical variables. Analysis of variance was used to compare averages. Pearson's correlation was applied to explore the colinearity between body composition and anthropometric variables and EAT score. We conducted several models multiple logistic regressions (the enter method) in boys and girls to analyse the contribution of one group of variables to the dependent variable we wished to explain: that is to say, whether a subject was at risk of ED (EAT ≥ 25) or not (EAT < 10). Each of those models contained a different indicator of body composition as an independent variable due to the colinearity between the anthropometry variables and body composition. All these regressions were adjusted for age (years), associated psychopathology [dysthymia, generalized anxiety disorder, major depression (yes/no), smoking (yes/no)], family variables [parents' divorce (yes/no), socioeconomic level (score)] and a series of questions to evaluate the social influences on the "thinness model" (yes/no).

We ensured that the conditions for the application of all statistical tests were respected. The level of significance for all statistical tests was α < 0.05 for bilateral contrasts.

The anthropometric and body composition measurements were made double-blind, neither the adolescents nor the dieticians knew what the risk of ED situations were and self-reported bias was thus avoided.

## Results

### Frequency of overweight and general characteristics

Figure 1 shows that the frequency of overweight (including obesity) is significantly higher (34.7%) for
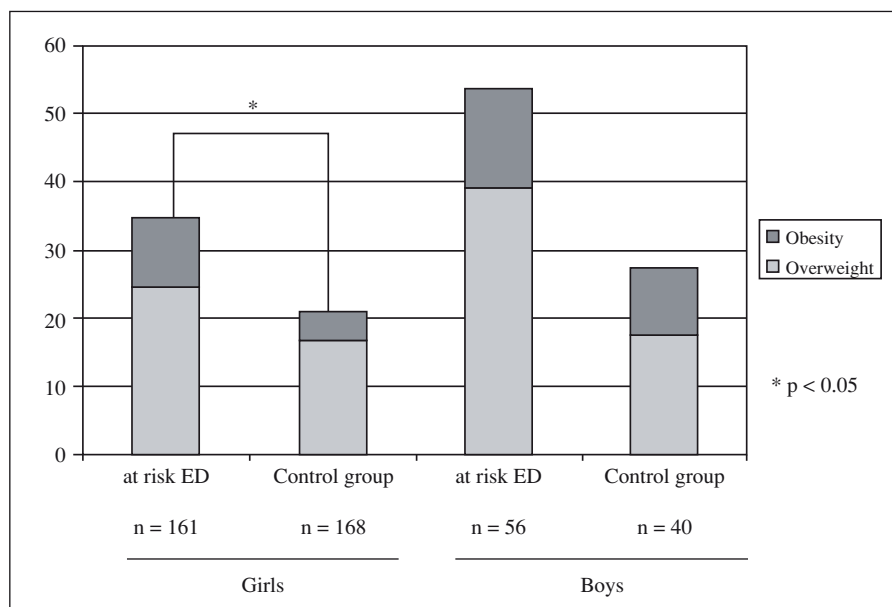
*Fig. 1.—Frequency of overweight in subjects at risk of Eating Disorders (ED) and those without risk (control group).*

adolescent girls at risk of ED than for the adolescent girls of the control group (20.9%). The trend is similar for boys (53.6% *versus* 27.5%), though the difference is not significant. The frequency of overweight boys was significantly higher ($\chi^2_1$; 6.13; $p < 0.05$) than overweight girls.

Table I shows the general characteristics for subjects with overweight. To exception of BMI, the other

**Table I**
*General characteristics of overweight subjects (girls and boys) at risk of Eating Disorders (ED) and those without risk (control group)*

|  | | Girls | | | Boys | | |
|---|---|---|---|---|---|---|---|
|  |  | At risk ED (n = 56) | Control group (n = 35) | p | At risk ED (n = 30) | Control group (n = 11) | p |
| Age (years); mean (standard deviation) | | 14.2 (1.2) | 14.3 (1.0) | NS | 13.8 (1.2) | 14.1 (1.1) | NS |
| Weight (kg); mean (standard deviation) | | 71.3 (11.6) | 70.2 (9.6) | NS | 71.9 (12.4) | 74.0 (19.0) | NS |
| Height (cm); mean (standard deviation) | | 161.0 (5.3) | 161.5 (6.5) | NS | 166.2 (9.5) | 167.4 (12.4) | NS |
| Smokers (%) | | 39.3 | 22.9 | NS | 16.7 | 27.3 | NS |
| Physical activity level (score) | | 2.6 (0.5) | 2.5 (0.5) | NS | 3.1 (0.6) | 2.8 (0.5) | NS |
| Parents' divorce (%) | | 14.3 | 21.4 | NS | 8.9 | 9.3 | NS |
| Body mass index (kg/m²); mean (standard deviation) | | 27.4 (3.9) | 26.9 (3.0) | *** | 26.1 (3.9) | 26.0 (3.5) | NS |
| Waist circumference (cm); mean (standard deviation) | | 80.8 (9.2) | 80.3 (6.2) | NS | 83.8 (9.4) | 84.9 (9.9) | NS |
| Waist-hip ratio | | 0.7 (0.5) | 0.77 (0.57) | NS | 0.8 (0.7) | 0.82 (0.77) | NS |
| Waist-height ratio | | 0.5 (0.7) | 0.49 (0.05) | NS | 0.5 (0.1) | 0.51 (0.04) | NS |
| Waist-height ratio > 0.5 (%) | | 42.2 | 33.3 | NS | 34.8 | 45.5 | NS |
| Percentage Fat Mass$_{(BIA)}$; mean (standard deviation) | | 36.8 (5.3) | 35.9 (4.7) | NS | 22.8 (7.2) | 22.4 (5.0) | NS |
| Dysthymia (%) | | 30.4 | 14.3 | NS | 13.3 | 18.2 | NS |
| Generalized Anxiety Disorders (%) | | 25.0 | 8.6 | * | 18.2 | 13.3 | NS |
| Major depression (%) | | 8.9 | 11.4 | NS | 0.0 | 9.1 | NS |
| Socioeconomic level (%) | Low | 32.3 | 28.6 | | 0.0 | 41.4 | |
|  | Middle | 45.2 | 53.6 | NS | 80.0 | 31.0 | NS |
|  | High | 22.6 | 17.6 | | 20.0 | 27.6 | |
| Socio-cultural influence (%) | Advertisements[1] | 43.6 | 31.4 | NS | 37.0 | 27.3 | NS |
|  | Thin women = nicer[2] | 32.7 | 20.0 | NS | 41.4 | 36.4 | NS |
|  | Actor's bodies[3] | 74.5 | 82.9 | NS | 62.1 | 45.5 | NS |
|  | Clothes size too small[4] | 83.3 | 88.6 | NS | 65.5 | 45.5 | NS |

NS = Not significant; * $p < 0.05$; *** $p < 0.001$.
[1]Do you talk about dietary product advertisements with your friends?; [2]Do you consider thin women to be nicer and more attractive?; [3]Do you categorise actors' bodies as being thin or fat?; [4]Are all clothes sizes too small for you when you go shopping?

anthropometric measurements and body composition of the adolescent girls were not significantly different between overweight and at risk of ED girls (n = 56) and those with overweigh of the control group (n = 35). For boys, there were not significant differences in these variables between subjects at risk and the control group. In all overweight groups, the average waist circumference was above 80 cm.

### Correlation between variables

As expected, there were high correlations between BMI and the various body composition parameters for both boys and girls, which suggest colinearity between these variables. For girls, there were low but significant correlations between the BMI (r = 0.28; p < 0.001); waist circumference (r = 0.21; p < 0.001); waist-height ratio (r = 0.21; p < 0.001); fat mass$_{(BIA)}$ (r = 0.22; p < 0.001) and the EAT scores. For boys, there were not significant correlations between anthropometric or body composition variables and EAT score.

### Relationships between anthropometric and body composition measurements

*BMI:* For girls, we observed an increase of 12% in the probability of being at risk of ED when BMI as the independent variable increased by one point (see table II). Other variables that increased the probability of being at risk of ED were generalized anxiety disorder, dysthymia, smoking and talking about dietary product advertisements with your friends. For boys, when the BMI was the independent variable, the multiple logistic regression model was not significant ($\chi^2_{12}$; 20.72; p = 0.055). However, the results for the explanatory variables showed a similar trend to that of the girls (data not shown).

*Fat Mass$_{(BIA)}$ and Waist-Hip ratio:* When fat mass$_{(BIA)}$ (table III) and waist-hip ratio (table IV) were included

**Table II**

*Association of body mass index on risk of eating disorders in adolescent girls*

| | Odds Ratio | C.I[1]. at 95% | p-value |
|---|---|---|---|
| Body mass index (kg/m³) | 1.12 | 1.03-1.19 | 0.001 |
| Generalized anxiety disorder (no, yes) | 2.99 | 1.15-7.76 | 0.024 |
| Dysthymia (no, yes) | 5.04 | 1.78-14.32 | 0.002 |
| Smoker (no, yes) | 1.92 | 1.10-3.35 | 0.023 |
| Advertisements[2] (no, yes) | 1.76 | 1.05-2.92 | 0.030 |
| $\chi^2_{12}$; (p) | | 58.47; (< 0.001) | |

[1]Confidence interval; [2]"Do you talk about dietary product advertisements with your friends?"
Adjusted also for: age (years); parents' divorce (no = 0; yes = 1); major depression (no = 0; yes = 1); socioeconomic level (score); socio-cultural influence on the model of thinness: "Do you consider thin women to be nicer and more attractive?" (no = 0; yes = 1); "Do you categorise actors' bodies as being thin or fat?" (no = 0; yes = 1); "Are all clothes sizes too small for you when you go shopping?" (no = 0; yes = 1).

**Table III**

*Association of Percentage Fat Mass$_{(BIA)}$ on the risk of eating disorders in adolescent girls*

| | Odds Ratio | C.I[1]. at 95% | p-value |
|---|---|---|---|
| Percentage Fat Mass$_{(BIA)}$ | 1.04 | 1.00-1.08 | 0.028 |
| Generalized anxiety disorder (no, yes) | 2.77 | 1.06-7.25 | 0.037 |
| Dysthymia (no, yes) | 5.03 | 1.77-14.28 | 0.002 |
| Smoker (no, yes) | 2.00 | 1.14-3.35 | 0.016 |
| Advertisements[2] (no, yes) | 1.70 | 1.02-2.38 | 0.043 |
| Thin women = nicer[3] (no, yes) | 1.86 | 1.02-3.38 | 0.043 |
| $\chi^2_{12}$; (p) | | 53.54; (< 0.001) | |

[1]Confidence interval; 2 Do you talk about dietary product advertisements with your friends?; 3 Do you consider thin women to be nicer and more attractive?
Adjusted also for: age (years); parents' divorce (no = 0; yes = 1); major depression (no = 0; yes = 1); generalized anxiety disorder (no = 0; yes = 1); socioeconomic level (score); socio-cultural influence on the model of thinness: "Do you categorise actors' bodies as being thin or fat?" (no = 0; yes = 1); "Are all clothes sizes too small for you when you go shopping?" (no = 0; yes = 1).

as independent variables, the multiple logistic regression models were significant ($\chi^2_{12}$; 53.54; p = < 0.001 and $\chi^2_{12}$; 47.09; p = < 0.001 respectively). The effects of these variables were also significant. An increase of one in the fat mass$_{(BIA)}$ led to an increase of 4% in the probability of being at risk of ED. We observed a protection of 50.4% for each tenth of a point that the waist-hip ratio increased (i.e. when the difference between waist and hip is smaller). In the model that included fat mass$_{(BIA)}$, generalized anxiety disorder, dysthymia, smoking, talking about dietary product advertisements with your friends and considering thin females nicer and more attractive the probability of being at risk of ED increased.

As with the other multiple logistic regression models, in the model that included waist-hip ratio, dysthymia and smoking the probability of being at risk of ED increased but generalized anxiety disorder was not significant (OR 2.58 p = 0.064). For boys, these relationships were not observed.

**Table IV**

*Association of waist-hip ratio on the risk of eating disorders in adolescent girls*

| | Odds Ratio | C.I[1]. at 95% | p-value |
|---|---|---|---|
| Waist-hip ratio (cm/cm)*10 | 0.50 | 0.28-0.91 | 0.022 |
| Dysthymia (no, yes) | 5.46 | 1.91-15.65 | 0.002 |
| Smoker (no, yes) | 2.08 | 1.15-3.74 | 0.015 |
| $\chi^2_{12}$; (p) | | 47.09; (< 0.001) | |

[1]Confidence interval;
Adjusted also for: age (years); parents' divorce (no = 0; yes = 1); major depression (no = 0; yes = 1); socioeconomic level (score); socio-cultural influence on the model of thinness: "Do you consider thin women to be nicer and more attractive?" (no = 0; yes = 1); "Do you categorise actors' bodies as being thin or fat?" (no = 0; yes = 1); "Are all clothes sizes too small for you when you go shopping?" (no = 0; yes = 1).

*Waist-height ratio and Waist Circumference:* For girls, the multiple logistic regression models that included waist-height ratio and waist circumference (table no shown) as independent variables were significant ($\chi^2_{12}$; 43.44; p = < 0.001; $\chi^2_{12}$; 42.48; p = < 0.001, respectively). However, these variables (waist-height ratio and waist circumference) were not statistically significant (OR 20.07; p = 0.260; and OR 1.01; p = 0.402, respectively). In both multiple logistic regression models, dysthymia (OR 5.46; p = 0.002 and OR 4.97; p = 0.003, respectively) and smoking (OR 2.18; p = 0.009 and OR 2.17 p = 0.009, respectively) were significant. For boys, these relationships were not observed.

## Discussion

Our sample included non-clinical subjects from a two-phase study and the participation in both phases was high.

To the best our knowledge, any studies have analyzed the relationship between body composition and anthropometric characteristics with the probability of being at risk of ED in general population. In our sample, an increase in BMI or fat mass$_{(BIA)}$ increases the probability of being at risk of ED, while a high waist-hip ratio protects against that risk in the presence of dysthymia, generalized anxiety disorder and, especially, smoking in female populations. Thus, every tenth of a point increase in the waist-hip ratio was negatively associated with the probability of being at risk of ED by 50.0%. The waist-hip ratio decreases with age until puberty, especially in girls. This is due to an increase in pelvis diameter and predominant fat deposition in the gluteal area.[25] A high waist-hip ratio indicates a smaller difference between waist and hip (i.e. characteristic of childhood). Therefore, our data suggest that present childhood characteristics is a protective factor and that changes in body shape towards more prominent curves in the hip and waist increase the probability of adolescent girls being at risk of ED.

Strong association between obesity and ED risk is well-known.[7,8,11,26] We found that overweight was indeed significantly more frequent for girls at risk of ED. Likewise overweight was 26.1% more frequent for boys at risk of ED than for controls. However, we did not observe significant differences among the boys from the groups at risk and the control group, probably due to the low number of subjects studied. On the other hand, in the control group, the frequency of overweight was 20.9% for girls and 27.5% for boys. These figures are similar to those of the latest Spanish studies.[4,5]

The results of the multiple logistic regressions for girls, when adjusted for age, smoking, and psychological and family variables, support the relationship between high BMI or high fat mass$_{(BIA)}$ and the risk of ED observed in previous studies.[8-11] Rolland et al. (1998)[27] observed that children with overweight tended to have the highest ChEAT (Children Eating Attitudes

Test) scores. Neumark-Sztainer et al. (1997)[28] suggested that children with overweight may be at greater risk of developing the full manifestations of ED than children with normal weight. The same authors also observed that unhealthy weight control behaviour patterns predicted obesity and ED five years later.[29]

Psychological factors, dysthymia and generalized anxiety disorder, are statistically significant explanatory variables in all multiple logistic regressions used. This seems to indicate that body shape evaluated by body composition characteristics only affects the probability of being at risk of ED when psychological factors are present. Zaider et al. (2000)[30] observed that dysthymia can predict ED on its own. Kaye et al. (2004)[31] observed that anxiety disorders that begin in childhood before the onset of ED are a factor in the possible development of anorexia or bulimia nervosa. The coexistence of these psychopathological disorders therefore has important implications for the possible risk of developing ED in adolescence.[30] There is also evidence, particularly among adolescent girls, that concerns about weight are related to the use of tobacco[32] and some authors (e.g. Croll et al. 2002)[33] consider smoking to be a risk factor for ED.

One limitation of our study is that the fact to detect the maximum of risk subjects in non-clinical population assumes to increase the number of false positives. Secondly, other limitation is that at risk's subjects were not confirmed by diagnostic interviews. Prospective study would enable to know whether the risk subjects are prone to develop a particular type of ED (anorexia, bulimia, binge eating disorders or other eating disorders no otherwised specificied).

## Conclusion

Overweight is more frequent among adolescent at risk of ED. An increase in BMI or fat mass$_{(BIA)}$ increases the probability of being at risk of ED, while a high waist-hip ratio protects against the probability of being at risk of ED in the presence of dysthymia, generalized anxiety disorder and, especially, smoking in adolescent girls.

The high prevalence of childhood and adolescence obesity and the increasing prevalence of ED make it necessary to develop strategies for identifying and controlling these health problems from the community perspective. Furthermore, the high prevalence of childhood and adolescence obesity and the risk of developing ED and other possible chronic pathologies in adulthood support the need for such strategies.

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