

Determinants of Eating Disorders Symptomatology in Portuguese Adolescents

Conceição Costa, MPH; Elisabete Ramos, PhD; Milton Severo, MSc; Henrique Barros, MD, PhD; Carla Lopes, PhD

Objective: To evaluate the association of psychological, biological, social, and familial characteristics and eating disorders symptomatology in 13-year-old Portuguese adolescents.

Design: Cross-sectional study.

Setting: Schools in Porto, Portugal.

Participants: Adolescents born in 1990 and attending schools in Porto, Portugal (n=2036) completed a questionnaire at school containing the Eating Disorders Inventory (EDI) and Beck Depression Inventory, Second Edition. Anthropometrical measurements were also performed. A questionnaire addressing parents' characteristics was sent home with the adolescents.

Main Exposure: Psychological, biological, social, and familial characteristics.

Main Outcome Measures: Three core EDI subscales.

Results: After using multiple regression analyses, body mass index (calculated as weight in kilograms divided by height in meters squared) and depressive symptomatology for both sexes were positively associated with eating disorder symptomatology evaluated by the 3 core EDI subscales (drive for thinness, bulimia, body dissatisfaction). Parents' education had a significant positive effect on girls' drive for thinness and body dissatisfaction scores and a significant negative effect in boys' bulimia and body dissatisfaction scores.

Conclusions: Higher body mass index and higher depressive symptomatology were associated with more severe eating disorder symptomatology in both sexes. A sex effect on the association between socioeconomic status and eating disorder symptomatology was found; girls with higher socioeconomic status and boys with lower socioeconomic status presented more eating disorder symptomatology.

Arch Pediatr Adolesc Med. 2008;162(12):1126-1132

IN THE PREVIOUS DECADE, THE prevalence of eating disorders has progressively increased, whereas the severity of observed cases has progressively decreased.¹ The substantial number of subclinical cases as well as the high prevalence of intermediate forms of dieting and eating concerns led to the continuum hypothesis that is defended by several authors.¹⁻³ According to this hypothesis, eating disorders lie on a continuum ranging from normal eating to full-syndrome eating disorders. Studies regarding prevalence usually focus on the full-syndrome eating disorders, but less severe forms of eating disorders are believed to affect a large number of individuals, especially adolescent girls.⁴ According to the continuum hypothesis, subclinical levels of eating disorders differ only by degree. Those who exhibit subclinical eating disorders are considered at risk of developing full-syndrome eating disorders^{2,4,5}; early recognition and swift

treatment is imperative.⁶ This highlights the importance of studying the problem before the development of a full-blown disorder. In this context, it is essential to perform population-based studies that usually use self-reporting scales. High scores do not necessarily indicate a severe eating disorder; however, these scales can be useful to identify subjects at a subclinical level.^{7,8}

Biological, social, familial, and psychological factors seem to be associated with eating disorders. Overweight has been studied as a cause of body dissatisfaction and eating disorders,^{9,10} and evidence suggests that the normative body fat increase associated with the onset of pubescence may predispose girls to eating disorders.¹⁰ Moreover, high social class was typically associated with eating disorders, especially anorexia nervosa.¹¹ Familial and parental characteristics also have been considered significant in the development of eating disorders. Literature

Author Affiliations:
Department of Hygiene and Epidemiology, Medical School, University of Porto, Porto, Portugal.

shows that a family's concern for weight and shape can contribute to a climate for eating disorders¹² and parental modeling is correlated with weight-loss attempts and body esteem of the children.¹³ Considering psychological factors, depression and eating disorders, as clinical problems, are strongly associated.^{14,15}

Although all of these potential determinants have been studied, conflicting results are found in the literature and more research is needed to clarify the associations between these determinants and eating disorders. Furthermore, the main body of research concerns bulimia nervosa and anorexia nervosa, which occur mainly in adolescence and late adolescence; there still is a lack of research concerning the determinant factors of milder forms of eating disorders that occur at younger ages. The aim of the present study was to evaluate the association of psychological, biological, social, and familial characteristics with eating disorder symptomatology in 13-year-old Portuguese adolescents.

METHODS

PARTICIPANTS

Participants were evaluated in 2003 during the assembly of a cohort of urban adolescents born in 1990 enrolled at schools in Porto, Portugal, known by the acronym *EPITeen* (Epidemiological Investigation of Teenagers Health in Porto) and previously described in detail.¹⁶ The *EPITeen* study was approved by the ethics committee of the São João University Hospital and by Direção Regional de Educação do Norte, the official entity that provides general orientation and regional policies for all schools in Porto. Policies and procedures were developed to guarantee data confidentiality and protection and written informed consent was obtained both from the adolescents and their parents or legal guardians.

In Portugal, education is compulsory by law for 13-year-old adolescents, making schools an ideal sampling setting. The executive boards of every Porto school attended by 13-year-old adolescents (27 public and 24 private) were contacted; all public schools and 19 private schools (79%) agreed to participate.

We identified 2788 eligible adolescents (2126 in public and 662 in private schools). Forty-four (1.6%) could not be reached (missing classes during the study period) and 582 (20.9%) did not return signed consent forms and were considered refusals. This resulted in a 77.5% overall proportion of participation, similar in public and private schools (77.9% vs 77.0%; $P = .71$), with 2161 students providing information for at least part of the proposed assessment.

In addition, 125 (4.5%) were excluded because of no information on key variables for this work (Eating Disorders Inventory [EDI]). The final sample includes 2036 students (1052 girls [51.7%] and 984 boys [48.3%]).

MEASURES

The baseline evaluation comprised 2 self-administered questionnaires and a physical examination. Physical examinations were performed at school between 8AM and 10AM by a team of experienced nurses, nutritionists, and doctors. One questionnaire was completed at home and another was completed at school immediately before physical examination during the field team visit.

ADOLESCENT INFORMATION

At school, adolescents completed a general questionnaire comprising information on health-related behaviors. As part of this questionnaire, adolescents completed the EDI¹⁷ and the Beck Depression Inventory, Second Edition (BDI-II).¹⁸

The EDI is a self-report instrument designed to measure psychological and behavioral traits associated with eating disorders.¹⁷ It has 64 items divided into 8 subscales. Three core subscales assess attitudes and behaviors toward weight, eating, and body shape (drive for thinness, bulimia, body dissatisfaction) and the other 5 subscales measure general psychological features associated with, but not unique to, eating disorders (ineffectiveness, perfection, interpersonal distrust, interoceptive awareness, maturity fears). On a 6-point Likert scale, individuals indicate how each item applies to them, from "always" to "never." Scores are then weighted from 0 to 3, higher scores indicating worse symptomatology. Subscale scores are the sum of all items for that particular subscale.

The EDI is a widely used instrument with good psychometric properties,^{9,19} and the 3 core subscales also presented good psychometric properties when used with 13-year-old Portuguese adolescents.²⁰

The BDI-II¹⁸ is a 21-item self-report scale that assesses the severity of current (past 2 weeks) depressive symptoms and has shown good psychometric characteristics.¹⁸ Each item is rated on a 4-point scale from 0 to 3. The total score can range from 0 to 63, with higher scores reflecting more severe depression. The following cut-off score guidelines were pointed out¹⁸: 0 to 13, minimal depression; 14 to 19, mild depression; 20 to 28, moderate depression; and 29 to 63, severe depression. The BDI-II was previously validated in a Portuguese adolescent population, being considered an adequate measure of depressive symptoms in adolescents, and 13 was the cut-off indicated to define adolescents presenting depressive problems.²¹

The EDI subscale scores and BDI-II scores were only computed when the questionnaires had more than two-thirds of the items answered. In that case, any missing values were replaced with the mean score presented by the adolescent in each particular EDI subscale or BDI-II scale.

Anthropometrics were obtained at school with the subject in light indoor clothes and no shoes. Weight was measured using a digital Tanita scale (Tanita Corporation, Tokyo, Japan) in kilograms to the nearest tenth and height was measured in centimeters to the nearest tenth using a portable stadiometer. Body mass index (BMI; calculated as weight in kilograms divided by height in meters squared) was classified according to the age-specific percentiles developed by the United States Centers for Disease Control and Prevention²² as at risk of overweight (BMI between the 85th and the 95th percentile) and overweight (BMI above the 95th percentile). Because there were no physical conditions at school to assure the privacy needed to evaluate adolescents' pubertal development according to Tanner criteria,²³ age at menarche was recorded as a pubertal development indicator for girls.

PARENT INFORMATION

Through the home questionnaire, parents were asked to report the number of completed years of education, clinical information (namely previous diagnosis of depression), current height and weight, and desired weight.

Adolescents were classified, taking into account the parent with a higher level of education, and this information was used as a proxy for socioeconomic status. Exposure to parental depression was considered when at least 1 parent reported depression. Parental BMI was computed based on self-reported

Table 1. Characteristics of the Study Sample

Characteristic	No. (%)	
	Girls (n=1052)	Boys (n=984)
School		
Public	794 (75.5)	762 (77.4)
Private	258 (24.5)	222 (22.6)
Grade in school		
Fifth or sixth	93 (8.8)	118 (12.0)
Seventh	169 (16.1)	163 (16.6)
Eighth or ninth	790 (75.1)	703 (71.4)
Age at menarche, y		
≤10	92 (9.2)	
11	223 (22.3)	
12	353 (35.3)	
≥13	180 (18.0)	
Not yet	151 (15.1)	
BMI ^b		
Healthy weight	780 (74.7)	702 (72.1)
At risk of overweight	168 (16.1)	161 (16.5)
Overweight	96 (9.2)	111 (11.4)
Depressive symptomatology score (BDI-II)		
0-13	837 (81.4)	877 (92.5)
14-19	100 (9.7)	37 (3.9)
≥20	91 (8.9)	34 (3.6)
Parents' education, y		
≤4	140 (15.3)	111 (14.0)
5-12	552 (60.3)	465 (58.6)
≥13	224 (24.5)	218 (27.5)
Parents' depression		
None	592 (64.6)	549 (69.6)
At least 1 parent	324 (35.4)	240 (30.4)
Mother's BMI		
≤24.9	507 (59.0)	453 (60.4)
25.0-29.9	237 (27.6)	222 (29.6)
≥30.0	115 (13.4)	75 (10.0)
Father's BMI		
≤24.9	334 (43.7)	250 (37.4)
25.0-29.9	337 (44.2)	338 (50.6)
≥30.0	92 (12.1)	80 (12.0)
Body weight satisfaction, mother		
Satisfied	216 (26.4)	159 (22.6)
Dissatisfied ^a	602 (73.6)	546 (77.4)
Body weight satisfaction, father		
Satisfied	209 (30.4)	151 (25.9)
Dissatisfied ^a	478 (69.6)	431 (74.1)

Abbreviations: BDI-II, Beck Depression Inventory, Second Edition; BMI, body mass index (calculated as weight in kilograms divided by height in meters squared).

^aDifference between current and desired weight is more than 2 kg.

height and weight, and parents were classified according to the World Health Organization as normal (<25 kg/m²), overweight (≥25 and 30 kg/m²), or obese (≥30 kg/m²).²⁴ An indirect measure of body weight satisfaction was used, subtracting desired weight from the current self-reported weight. If the difference between current and desired weight was more than 2 kg, parents were classified as dissatisfied.

DATA ANALYSIS

Separate analyses were performed for boys and girls. Scores of EDI subscales were compared using the Mann-Whitney *U* test or Kruskal-Wallis test because the data were not normally distributed.

To evaluate the association between psychological, biological, social, and familial characteristics and eating disorder symp-

Table 2. EDI Subscale Scores for Girls and Boys

EDI Subscale	Girls		Boys		P Value ^a
	No.	Mean (SD)	No.	Mean (SD)	
Drive for thinness	1034	4.84 (5.35)	956	2.61 (3.56)	<.001
Bulimia	1022	1.39 (2.70)	943	1.64 (3.15)	.26
Body dissatisfaction	1026	7.63 (6.93)	947	4.47 (5.37)	<.001
Ineffectiveness	1032	3.85 (4.20)	952	2.72 (3.50)	<.001
Perfectionism	1022	5.66 (3.75)	949	6.90 (3.94)	<.001
Interpersonal distrust	1032	3.99 (3.28)	953	3.83 (3.09)	.48
Interceptive awareness	1021	5.27 (5.42)	938	4.92 (5.30)	.06
Maturity fears	1031	6.44 (4.39)	958	7.12 (4.60)	<.001

Abbreviation: EDI, Eating Disorders Inventory.

^aDifferences between boys and girls assessed with Mann-Whitney *U* test.

tomatology, simple linear regression was used. Drive for thinness, bulimia, and body dissatisfaction were the dependent variables, and type of school (public vs private), grade at school, age at menarche, BMI, depressive symptomatology, parents' education, mothers' and fathers' BMI (all as continuous variables), parents' depression (none vs at least 1), and mothers' and fathers' body-weight satisfaction (satisfied vs dissatisfied) were entered as independent variables. In the final model, multiple linear regression was used. Type of school, grade at school, age at menarche, BMI, depressive symptomatology, and parents' education were considered as potential confounders. Owing to the nonnormal distribution, a bootstrap method²⁵ was applied to resample and confirm the reliability of the 95% confidence intervals (CI) obtained from the full data set.

Statistical analyses were performed using SPSS version 14.0 (SPSS Inc, Chicago, Illinois) except for bootstrap analysis which was performed using R software version 8.0 (R Foundation, Vienna, Austria).

RESULTS

Sample characteristics are presented separately for boys and girls in **Table 1**. Boys' and girls' mean EDI subscale scores are compared in **Table 2**. Girls presented significantly higher mean scores than boys on the drive for thinness (4.84 vs 2.61; *P* < .001), body dissatisfaction (7.63 vs 4.47; *P* < .001), and ineffectiveness (3.85 vs 2.72; *P* < .001) subscales. Boys presented significantly higher mean scores on the perfectionism (6.90 vs 5.66; *P* < .001) and maturity fears (7.12 vs 6.44; *P* < .001) subscales.

Table 3 presents the 3 core EDI subscale mean scores according to adolescent characteristics. Adolescents in the lower school years with higher BMI and worst depressive symptomatology whose mothers had higher BMI and were dissatisfied with their own weight presented higher drive-for-thinness scores. Additionally, girls with an early age at menarche presented significantly higher mean scores in this subscale. Boys whose parents had less education and whose fathers had higher BMI and were dissatisfied with their own weight also scored higher in this subscale.

Adolescents who attended public schools, were in the lower school years, and presented the worst depressive symptomatology scored higher in the bulimia subscale. Additionally boys whose parents had less formal education also presented significantly higher scores in this subscale.

Table 3. EDI Subscale Scores According to Adolescents' Characteristics for Girls and Boys

Characteristic	Mean (SD)					
	Girls			Boys		
	DT	B	BD	DT	B	BD
School						
Public	4.8 (5.31)	1.5 (2.86)	7.7 (6.90)	2.8 (3.71)	1.8 (3.28)	4.7 (5.33)
Private	4.8 (5.48)	1.0 (2.06)	7.5 (7.04)	2.1 (2.94)	1.2 (2.63)	3.8 (5.44)
P Value ^a	.59	.002	.56	.08	.005	.003
Grade in school						
Fifth or sixth	7.1 (5.87)	3.4 (4.29)	8.8 (6.56)	4.5 (3.98)	3.6 (4.70)	5.6 (5.29)
Seventh	4.8 (5.06)	1.4 (2.50)	7.1 (6.33)	3.3 (4.07)	2.4 (3.73)	5.5 (5.66)
Eighth or ninth	4.6 (5.29)	1.2 (2.41)	7.6 (7.08)	2.1 (3.23)	1.2 (2.49)	4.1 (5.28)
P Value ^a	<.001	<.001	.07	<.001	<.001	<.001
Age at menarche, y						
≤10	7.0 (6.15)	1.9 (3.14)	11.7 (8.13)			
11	5.4 (5.32)	1.4 (2.61)	8.4 (6.77)			
12	4.7 (5.28)	1.2 (2.37)	7.5 (7.05)			
≥13	4.2 (5.29)	1.2 (2.51)	6.6 (6.73)			
Not yet	4.2 (5.17)	1.6 (3.31)	5.8 (5.66)			
P Value ^a	<.001	.17	<.001			
BMI						
Healthy weight	3.9 (4.92)	1.3 (2.48)	6.0 (5.92)	1.9 (2.91)	1.7 (3.20)	3.2 (4.04)
At risk of overweight	7.5 (5.49)	1.8 (3.26)	11.4 (7.76)	3.6 (4.16)	1.4 (2.99)	6.2 (6.03)
Overweight	7.9 (5.85)	1.5 (2.97)	14.5 (6.52)	5.5 (4.44)	1.7 (3.18)	9.5 (7.10)
P Value ^a	<.001	.30	<.001	<.001	.48	<.001
Depressive symptomology score (BDI-II)						
0-13	4.2 (4.94)	1.1 (2.33)	6.8 (6.58)	2.4 (3.36)	1.4 (2.80)	4.3 (5.32)
14-19	5.5 (5.59)	2.1 (3.18)	10.4 (7.41)	3.4 (3.25)	2.3 (3.35)	5.5 (5.35)
≥20	8.9 (6.47)	3.2 (3.87)	12.6 (6.97)	5.6 (5.29)	7.3 (5.67)	8.6 (5.71)
P Value ^a	<.001	<.001	<.001	<.001	<.001	<.001
Parents' education, y						
≤4	4.8 (4.94)	1.5 (2.74)	8.0 (6.72)	3.5 (4.23)	3.1 (4.71)	5.5 (5.61)
5-12	4.9 (5.49)	1.4 (2.79)	7.7 (6.98)	2.5 (3.54)	1.3 (2.52)	4.5 (5.31)
≥13	4.7 (5.23)	1.1 (2.24)	7.8 (6.99)	2.0 (3.07)	1.2 (2.61)	3.3 (4.93)
P Value ^a	.69	.06	.64	.002	<.001	<.001
Parents' depression						
None	4.6 (5.25)	1.3 (2.51)	7.7 (6.91)	2.3 (3.56)	1.4 (2.73)	4.2 (5.33)
At least 1	5.1 (5.51)	1.5 (2.83)	7.9 (7.10)	2.7 (3.48)	1.7 (3.48)	4.3 (5.12)
P Value ^a	.32	.42	.62	.22	.21	.79
Mother's BMI						
≤24.9	4.3 (5.06)	1.3 (2.66)	7.2 (6.63)	2.1 (3.35)	1.4 (3.05)	3.6 (4.83)
25.0-29.9	5.2 (5.52)	1.4 (2.42)	8.4 (7.36)	2.6 (3.28)	1.2 (2.42)	4.8 (5.52)
≥30.0	5.8 (5.81)	1.4 (3.07)	9.0 (7.21)	3.5 (4.08)	1.7 (2.66)	6.0 (5.86)
P Value ^a	.008	.91	.03	<.001	.22	<.001
Father's BMI						
≤24.9	4.3 (4.83)	1.4 (2.67)	6.8 (6.10)	1.9 (3.03)	1.3 (2.72)	3.5 (4.57)
25.0-29.9	5.1 (5.65)	1.4 (2.77)	8.4 (7.47)	2.4 (3.30)	1.5 (3.25)	4.3 (5.23)
≥30.0	5.3 (5.49)	1.3 (2.63)	9.8 (7.42)	3.5 (4.03)	1.2 (2.18)	6.8 (6.94)
P Value ^a	.16	.72	.001	.002	.30	<.001
Body weight satisfaction, mother						
Satisfied	4.3 (5.26)	1.2 (2.64)	6.8 (6.86)	2.2 (3.62)	1.9 (3.55)	3.4 (4.28)
Dissatisfied ^b	5.0 (5.32)	1.3 (2.44)	8.2 (7.09)	2.6 (3.46)	1.3 (2.59)	4.6 (5.57)
P Value ^a	.04	.11	.002	.03	.42	.02
Body weight satisfaction, father						
Satisfied	4.7 (5.35)	1.4 (2.84)	7.2 (6.53)	1.9 (2.84)	1.0 (2.01)	4.2 (4.81)
Dissatisfied ^b	4.8 (5.29)	1.3 (2.45)	8.1 (7.19)	2.6 (3.46)	1.4 (2.63)	4.4 (5.58)
P Value ^a	.44	.42	.12	.03	.07	.86

Abbreviations: B, bulimia; BD, body dissatisfaction; BDI-II, Beck Depression Inventory, Second Edition; BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); DT, drive for thinness, DEI, Eating Disorders Inventory.

^aDifferences assessed with Kruskal-Wallis and Mann-Whitney *U* test.

^bDifference between current and desired weight is more than 2 kg.

Table 4. Multiple Linear Regression Crude and Adjusted Coefficient Estimates for Boys and Girls With the EDI Subscales as Dependent Variables

EDI Subscale	Girls		Boys	
	β (95% CI)		β (95% CI)	
	Crude	Adjusted ^a	Crude	Adjusted ^a
Drive for thinness				
School (public vs private)	-0.01 (-0.77 to 0.74)	-0.08 (-0.84 to 0.69)	-0.63 (-1.17 to -0.10)	-0.21 (-0.76 to 0.34)
Grade in school	-0.97 (-1.45 to -0.49)	-0.57 (-1.16 to 0.01)	-1.12 (-1.41 to -0.83)	-0.89 (-1.24 to -0.54)
Age at menarche, y	-0.59 (-0.87 to -0.32)	0.14 (-0.14 to 0.43)		
BMI	0.56 (0.47 to 0.65)	0.55 (0.46 to 0.65)	0.35 (0.30 to 0.41)	0.36 (0.30 to 0.42)
Depressive symptomatology score	0.22 (0.18 to 0.26)	0.22 (0.18 to 0.26)	0.13 (0.09 to 0.16)	0.10 (0.06 to 0.14)
Parents' education, y	0.01 (-0.06 to 0.09)	0.10 (0.02 to 0.17)	-0.10 (-0.16 to -0.05)	-0.04 (-0.10 to 0.01)
Parents' depression (none vs at least 1)	0.41 (-0.32 to 1.13)	0.04 (-0.62 to 0.70)	0.18 (-0.36 to 0.73)	-0.11 (-0.60 to 0.37)
Mother's BMI	0.12 (0.04 to 0.20)	0.01 (-0.07 to 0.09)	0.10 (0.03 to 0.16)	-0.01 (-0.07 to 0.05)
Father's BMI	0.12 (0.01 to 0.23)	0.01 (-0.10 to 0.11)	0.15 (0.08 to 0.23)	0.02 (-0.05 to 0.09)
Body weight satisfaction, mother (satisfied vs dissatisfied)	0.78 (-0.02 to 1.59)	0.44 (-0.30 to 1.19)	0.39 (-0.22 to 1.00)	-0.21 (-0.76 to 0.34)
Body weight satisfaction, father (satisfied vs dissatisfied)	0.22 (-0.64 to 1.08)	0 (-0.78 to 0.78)	0.68 (0.07 to 1.29)	0.16 (-0.40 to 0.71)
Bulimia				
School (public vs private)	-0.56 (-0.94 to -0.18)	-0.21 (-0.62 to 0.19)	-0.56 (-1.03 to -0.08)	0.05 (-0.47 to 0.56)
Grade in school	-0.92 (-1.16 to -0.68)	-0.71 (-1.02 to -0.40)	-1.17 (-1.42 to -0.91)	-0.80 (-1.12 to -0.47)
Age at menarche, y	-0.08 (-0.22 to 0.05)	-0.02 (-0.17 to 0.13)		
BMI	0.04 (-0.01 to 0.09)	0.03 (-0.02 to 0.08)	-0.02 (-0.07 to 0.04)	0.02 (-0.04 to 0.08)
Depressive symptomatology score	0.09 (0.07 to 0.11)	0.08 (0.06 to 0.10)	0.15 (0.12 to 0.19)	0.11 (0.08 to 0.15)
Parents' education, y	-0.05 (-0.09 to -0.01)	0 (-0.04 to 0.04)	-0.11 (-0.16 to -0.06)	-0.07 (-0.12 to -0.02)
Parents' depression (none vs at least 1)	0.17 (-0.19 to 0.53)	0.05 (-0.30 to 0.39)	0.37 (-0.08 to 0.83)	0.16 (-0.29 to 0.61)
Mother's BMI	0.02 (-0.02 to 0.07)	0 (-0.04 to 0.04)	-0.01 (-0.06 to 0.04)	-0.06 (-0.12 to 0.01)
Father's BMI	-0.02 (-0.07 to 0.04)	-0.02 (-0.08 to 0.04)	0 (-0.06 to 0.06)	0 (-0.06 to 0.06)
Body weight satisfaction, mother (satisfied vs dissatisfied)	0.11 (-0.27 to 0.49)	0.10 (-0.28 to 0.48)	-0.48 (-0.99 to 0.02)	-0.70 (-1.21 to 0.20)
Body weight satisfaction, father (satisfied vs dissatisfied)	0 (-0.42 to 0.42)	-0.15 (-0.54 to 0.25)	0.42 (-0.05 to 0.88)	0.37 (-0.10 to 0.84)
Body dissatisfaction				
School (public vs private)	-0.16 (-1.14 to 0.83)	-0.84 (-1.77 to 0.08)	-0.84 (-1.65 to -0.03)	-0.49 (-1.32 to 0.33)
Grade in school	-0.34 (-0.97 to 0.28)	0.01 (-0.69 to 0.71)	-0.79 (-1.24 to -0.35)	-0.27 (-0.80 to 0.26)
Age at menarche, y	-1.17 (-1.52 to -0.82)	0.07 (-0.28 to 0.41)		
BMI	0.91 (0.81 to 1.02)	0.94 (0.82 to 1.05)	0.59 (0.50 to 0.67)	0.61 (0.52 to 0.70)
Depressive symptomatology score	0.29 (0.23 to 0.34)	0.30 (0.25 to 0.35)	0.19 (0.13 to 0.24)	0.19 (0.13 to 0.25)
Parents' education, y	0.01 (-0.09 to 0.11)	0.10 (0.00 to 0.19)	-0.15 (-0.23 to -0.07)	-0.11 (-0.19 to -0.03)
Parents' depression (none vs at least 1)	0.27 (-0.69 to 1.22)	-0.33 (-1.14 to 0.47)	0.04 (-0.78 to 0.86)	-0.39 (-1.13 to 0.36)
Mother's BMI	0.15 (0.04 to 0.26)	-0.04 (-0.14 to 0.06)	0.23 (0.13 to 0.32)	0.07 (-0.02 to 0.16)
Father's BMI	0.32 (0.18 to 0.46)	0.10 (-0.03 to 0.22)	0.24 (0.12 to 0.36)	0.02 (-0.09 to 0.14)
Body weight satisfaction, mother (satisfied vs dissatisfied)	1.55 (0.48 to 2.63)	0.65 (-0.27 to 1.57)	1.27 (0.33 to 2.21)	0.48 (-0.37 to 1.33)
Body weight satisfaction, father (satisfied vs dissatisfied)	1.01 (-0.13 to 2.15)	0.68 (-0.28 to 1.63)	0.31 (-0.69 to 1.31)	-0.61 (-1.51 to 0.29)

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); CI, confidence interval; EDI, Eating Disorders Inventory.

^aCoefficient estimates adjusted for type of school to grade at school to age at menarche to BMI to depressive symptomatology and parents' education.

Adolescents with higher BMI and the worst depressive symptomatology whose mothers and fathers had higher BMI and whose mothers were dissatisfied with their own weight presented significantly higher mean scores on the body dissatisfaction subscale. Girls with an early age at menarche also presented significantly higher mean scores. Boys who attended public schools and were in the lower school years whose parents had a lower level of formal education also presented significantly higher scores in this subscale.

Despite the results shown in Table 3 reflecting an effect of different variables in each of the 3 subscales, a common model was chosen for multivariate analysis. No multicollinearity was found between independent variables.

Table 4 presents crude and adjusted coefficients and 95% CI for boys and girls with the 3 core EDI subscales as dependent variables in linear multiple regression analysis. For drive-for-thinness scores for girls and boys, re-

spectively, BMI ($\beta=0.55$; 95% CI, 0.46-0.65 and $\beta=0.36$; 95% CI, 0.30-0.42) and depressive symptomatology ($\beta=0.22$; 95% CI, 0.18-0.26 and $\beta=0.10$; 95% CI, 0.06-0.14) remained significantly and positively associated. For boys, grade in school ($\beta=-0.89$; 95% CI, -1.24 to -0.54) presented a significant inverse relation with drive-for-thinness score but, for girls, parents' education ($\beta=0.10$; 95% CI, 0.02-0.17) had a significant positive effect in this subscale.

For both girls and boys, respectively, depression symptomatology ($\beta=0.08$; 95% CI, 0.06-0.10 and $\beta=0.11$; 95% CI, 0.08-0.15) had a significant positive association with bulimia, and grade in school ($\beta=-0.71$; 95% CI, -1.02 to -0.40 and $\beta=-0.80$; 95% CI, -1.12 to -0.47) presented significant negative association with this subscale. Additionally, for boys, parents' education ($\beta=-0.07$; 95% CI, -0.12 to -0.02) had a significant negative effect in this subscale.

Body mass index ($\beta=0.94$; 95% CI, 0.82-1.05 and $\beta=0.61$; 95% CI, 0.52-0.70) and depressive symptomatology ($\beta=0.30$; 95% CI, 0.25-0.35 and $\beta=0.19$; 95% CI, 0.13-0.25) were positively associated with body dissatisfaction score for girls and boys, respectively. Parents' education ($\beta=-0.11$; 95% CI, -0.19 to -0.03) had a negative effect on boys' body dissatisfaction scores but had a positive significant effect on girls' scores ($\beta=0.10$; 95% CI, 0.00-0.19).

COMMENT

Consistent with previous studies,²⁶⁻²⁹ our results showed that BMI was associated with eating disorder symptomatology. In the present study, in both sexes, as BMI increased, concern with dieting and weight (drive for thinness) and dissatisfaction with the overall shape of the body or with body parts (body dissatisfaction) also increased.

The association between depressive and eating disorders symptomatology found in the present study has also been previously reported for adolescents.^{10,29-32} In both girls and boys, we observed that depressive symptoms were positively associated with the subscales drive for thinness (concern about dieting and losing weight), bulimia (a tendency toward uncontrollable voracity and negative feelings associated with eating), and body dissatisfaction (dissatisfaction with body shape).

Also in accordance with previous research,^{33,34} age at menarche was not found to be a significant determinant of eating disorder symptomatology. However, we must consider that we had relied only on age at menarche as a pubertal development indicator for girls, which could be a methodological limitation when interpreting our results.

Research about the association between socioeconomic status and eating disorders has generated conflicting results. In the present study, a significant inverse association between parental education and eating disorder symptomatology was found for boys. For girls, parental education was positively related with eating disorders symptomatology.

There is general consensus by most, but not all, investigators that the prevalence of eating disorders is higher in those of higher socioeconomic status. A reverse relation between eating disorders and socioeconomic status was also demonstrated by several studies.^{11,26,35}

It is difficult to compare our results with other studies because most of them comprise only girls and use different methodologies to evaluate eating disorder symptomatology or socioeconomic status. Our study comprised girls and boys and it is rational to expect that there is a sex effect on the association between socioeconomic status and eating disorder symptomatology. Eating disorders are particularly prevalent in girls, and in 13-year-old Portuguese girls we hypothesize that this kind of symptomatology is still associated with elites (persons enjoying superior social or economic status) and that parents with higher education mediate attitudes that contribute to the development of eating disorder symptomatology. In boys, higher scores may be related to a global psychological impairment usually associated with lower socioeconomic status.

Besides parental education, academic performance and the type of school were considered. Poor academic performance is known to be associated with lower social class,³⁶ although we believe that in our sample this variable and parents' education do not measure equally. Independent of parents' education, for boys, the grade attended by the adolescent also presented a negative association with 2 of the 3 EDI subscales and, for girls, the grade attended had a significant negative effect only in the bulimia subscale score. The type of school did not present any significant association in boys or girls.

After adjustment, no relation was found between parents' BMI, depression, or body weight dissatisfaction and children's eating disorders in the present study.

This study was conducted with a large sample of 13-year-old adolescents. School education is compulsory in Portugal until 15 years of age and it is expected that all the adolescents born in 1990 were attending school; however, 22.4% of the adolescents were not evaluated (did not attend classes or did not return the consent form signed). In addition, adolescents who did not complete the EDI (1.6%) were excluded from analysis. Adolescents who completed the EDI had better academic performance (7.6 vs 7.2 years of school; $P < .001$) and had parents with higher levels of formal education (10.4 vs 9.0 years of school; $P < .001$). Although these differences reached statistical significance, the adolescents who did not complete the EDI were small in number and we believe that the results were not biased. Furthermore, no significant differences were found regarding the other variables analyzed.

The cross-sectional nature of this study limits the ability to determine temporal relations and only by following up this cohort will it be possible to determine the real effect of the exposures. However, we believe that, particularly for parents' characteristics (except parents' depression), the results were not affected by reverse causality.

In spite of the discussed limitations, this study identifies factors related to eating disorder symptomatology in a large sample comprising young girls and boys from a nonclinical population, a major strength of the study. The findings of this study are important to consolidate the existing knowledge concerning girls and add new knowledge concerning boys.

Submitted for Publication: January 8, 2008; final revision received May 7, 2008; accepted May 11, 2008.

Correspondence: Carla Lopes, PhD, Departamento de Higiene e Epidemiologia da, Faculdade de Medicina do Porto, Alameda Professor Hernâni Monteiro, 4200-319 Porto, Portugal (carlal@med.up.pt).

Author Contributions: The authors had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Statistical analysis was provided by Dr Severo.

Financial Disclosure: None reported.

Funding/Support: This study was supported by grants from Fundação Calouste Gulbenkian and grants POCTI/SAU-ESP/62399/2004 and SFRH/BD/11114/2002 (Dr Ramos) from Fundação para a Ciência e Tecnologia.

REFERENCES

1. Cotrufo P, Gnisci A, Caputo I. Brief report: psychological characteristics of less severe forms of eating disorders: an epidemiological study among 259 female adolescents. *J Adolesc*. 2005;28(1):147-154.
2. Franko DL, Omori M. Subclinical eating disorders in adolescent women: a test of the continuity hypothesis and its psychological correlates. *J Adolesc*. 1999; 22(3):389-396.
3. Morandé G, Celada J, Casas JJ. Prevalence of eating disorders in a Spanish school-age population. *J Adolesc Health*. 1999;24(3):212-219.
4. Shisslak CM, Crago M, Estes LS. The spectrum of eating disturbances. *Int J Eat Disord*. 1995;18(3):209-219.
5. Graber JA, Brooks-Gunn J. Co-occurring eating and depressive problems: an 8-year study of adolescent girls. *Int J Eat Disord*. 2001;30(1):37-47.
6. le Grange D, Loeb KL, Van Orman S, Jellar CC. Bulimia nervosa in adolescents: a disorder in evolution? *Arch Pediatr Adolesc Med*. 2004;158(5):478-482.
7. Wichstrøm L. Social, psychological and physical correlates of eating problems: a study of the general adolescent population in Norway. *Psychol Med*. 1995; 25(3):567-579.
8. Kjelsås E, Bjørnstrøm C, Gøtestam KG. Prevalence of eating disorders in female and male adolescents (14-15 years). *Eat Behav*. 2004;5(1):13-25.
9. Gardner RM, Stark K, Friedman BN, Jackson NA. Predictors of eating disorder scores in children ages 6 through 14: a longitudinal study. *J Psychosom Res*. 2000;49(3):199-205.
10. Killen JD, Hayward K, Wilson DM, et al. Factors associated with eating disorder symptoms in a community sample of 6th and 7th grade girls. *Int J Eat Disord*. 1994;15(4):357-367.
11. Eisler I, Szmukler GI. Social class as a confounding variable in the eating attitudes test. *J Psychiatr Res*. 1985;19(2-3):171-176.
12. Laliberté M, Boland FJ, Leichner P. Family climates: family factors specific to disturbed eating and bulimia nervosa. *J Clin Psychol*. 1999;55(9):1021-1040.
13. Smolak L, Levine MP. Parental input and weight concerns among elementary school children. *Int J Eat Disord*. 1999;25(3):263-271.
14. Blinder BJ, Cumella EJ, Sanathara VA. Psychiatric comorbidities of female inpatients with eating disorders. *Psychosom Med*. 2006;68(3):454-462.
15. Herzog DB, Keller MB, Sacks NR, Yeh CJ, Lavori PW. Psychiatric comorbidity in treatment-seeking anorexics and bulimics. *J Am Acad Child Adolesc Psychiatry*. 1992;31(5):810-818.
16. Ramos E. *Health Determinants in Porto Adolescents: the EPITeen Cohort* [PhD Thesis]. Porto, Portugal: Medical School of the University of Porto; 2006.
17. Garner DM, Olmstead MP, Polivy J. Development and validation of a multidimensional eating disorders inventory for anorexia and bulimia nervosa. *Int J Eat Disord*. 1983;2:15-34.
18. Beck A, Steer R, Brown G. *Manual for the Beck Depression Inventory-II*. San Antonio, TX: Psychological Corp; 1996.
19. Machado PPP, Gonçalves S, Martins C, Soares IC. The Portuguese version of the Eating Disorders Inventory: evaluation of its psychometric properties. *Eur Eat Disord Rev*. 2001;9(1):43-52.
20. Costa C, Ramos E, Barros H, Torres AR, Severo M, Lopes C. Psychometric properties of the Eating Disorders Inventory among Portuguese adolescents. *Acta Med Port*. 2007;20(6):511-524.
21. Coelho R, Martins A, Barros H. Clinical profiles relating gender and depressive symptoms among adolescents ascertained by the Beck Depression Inventory II. *Eur Psychiatry*. 2002;17(4):222-226.
22. Kuczmarski RJ, Ogden CL, Guo SS, et al. 2000 CDC Growth Charts for the United States: methods and development. *Vital Health Stat 11*. 2002;(246):1-190.
23. Tanner JM. *Growth at Adolescence*. 2nd ed. Oxford, England: Blackwell Scientific Publications; 1962.
24. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: executive summary: Expert Panel on the Identification, Evaluation, and Treatment of Overweight in Adults. *Am J Clin Nutr*. 1998;68(4):899-917.
25. Efron B, Tibshirani RJ. *An Introduction to the Bootstrap*. New York, NY: Chapman & Hall; 1993.
26. Striegel-Moore RH, Schreiber GB, Lo A, Crawford P, Obarzanek E, Rodin J. Eating disorder symptoms in a cohort of 11 to 16-year-old black and white girls: the NHLBI growth and health study. *Int J Eat Disord*. 2000;27(1):49-66.
27. Wilfley DE, Schreiber GB, Pike KM, Striegel-Moore RH, Wright DJ, Rodin J. Eating disturbance and body image: a comparison of a community sample of adult black and white. *Int J Eat Disord*. 1996;20(4):377-387.
28. Wiseman CV, Peltzman B, Halmi KA, Sunday SR. Risk factors for eating disorders: surprising similarities between middle school boys and girls. *Eat Disord*. 2004;12(4):315-320.
29. Neumark-Sztainer D, Hannan PJ. Weight-related behaviors among adolescent girls and boys: results from a national survey. *Arch Pediatr Adolesc Med*. 2000; 154(6):569-577.
30. Keel PK, Klump KL, Leon GR, Fulkerson JA. Disordered eating in adolescent males from a school-based sample. *Int J Eat Disord*. 1998;23(2):125-132.
31. Thomas CL, James AC, Bachmann MO. Eating attitudes in English secondary school students: influences of ethnicity, gender, mood, and social class. *Int J Eat Disord*. 2002;31(1):92-96.
32. Tomori M, Rus-Makovec M. Eating behavior, depression, and self-esteem in high school students. *J Adolesc Health*. 2000;26(5):361-367.
33. Ackard DM, Peterson CB. Association between puberty and disordered eating, body image, and other psychological variables. *Int J Eat Disord*. 2001;29(2):187-194.
34. McCabe MP, Vincent MA. The role of biodevelopmental and psychological factors in disordered eating among adolescent males and females. *Eur Eat Disord Rev*. 2003;11(4):315-328.
35. Story M, French SA, Resnick MD, Blum RW. Ethnic/racial and socioeconomic differences in dieting behaviors and body image perceptions in adolescents. *Int J Eat Disord*. 1995;18(2):173-179.
36. Pincus T, Callahan LF. Associations of low formal education level and poor health status: behavioral, in addition to demographic and medical, explanations? *J Clin Epidemiol*. 1994;47(4):355-361.

Once, Antigonus was told his son was ill and went to see him. At the door he met some young beauty. Going in, he sat down by the bed and took his pulse. "The fever," said Demetrius, "has just left me." "Oh yes," replied the father. "I met it going out at the door."

—Plutarch, circa 46-120 BCE