

# Body Composition, Eating Behavior, Food-Body Concerns and Eating Disorders in Adolescent Girls

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## Key Words

Adolescence · Body composition · Dietary habits ·  
Eating disorder inventory · Eating disorders

## Abstract

**Aims:** Dieting is a behavioral phenomenon which is becoming more frequent among adolescents and the search for weight loss, through dieting, may result in an unbalanced nutrition both quantitatively and qualitatively. Our study intended to look at the eating habits and behavior on a cohort of adolescent girls to verify the presence of unbalanced diets and the prevalence of eating disorders with particular attention to the partial syndromes (EDNOS). **Methods:** A cross-sectional double-stage study was carried out on a group of schoolgirls in the suburbs of Naples. We assessed anthropometrical measures, body composition (skinfolds and bioimpedance analysis), dietary intake by means of 3-day food records and we administered the Eating Disorder Inventory 2 and Psychosocial Factor Risk Questionnaire. A multidisciplinary and double-stage approach had been used to get a better diagnosis of eating disorders in our sample. **Results:** 156 adolescent girls, 14–18 years old, took part in our study. Height, weight, and BMI were

160.38 cm, 58 kg and 22.6, respectively. Analysis of food intake showed that all the values reported, with the exception of lipids and sodium, were below the recommendations by LARN. We observed a prevalence of 1.28% of bulimia nervosa, 1.28% of binge eating, and 10.25% of eating disorders not otherwise specified. EDI 2 and PRFQ confirmed how important drive for thinness and body dissatisfaction dimensions are when we deal with adolescent girls and with the phenomenon of dieting. The study confirmed the validity of the PRFQ questionnaire to evaluate mass media influence on body perception and eating behavior of adolescents. **Conclusion:** Multidisciplinary and well-designed studies are needed to systematically and accurately study eating habits and behavior of adolescents to tackle more efficiently the increasing spread of eating disorders and obesity.

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## Introduction

Adolescence is a delicate phase of life. The never-ending sequence of physical and psychological adaptations of adolescents has a remarkable influence on the social and behavioral aspects of their lives [1, 2].

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The standardized model of beauty in our society that prefers and emphasizes just particular physical aspects like slimness and thinness influences adolescents' beliefs of physical growth. Mass media, by means of confusing and subliminal messages, affect adolescents' lives to a certain extent and they tend to perceive these 'modern virtues' as targets to be achieved [3–6].

Dieting, a behavioral phenomenon which is becoming more and more common among adolescents as a result of their persistent endeavors to modify their physical appearance, is certainly involved in the pathogenesis of eating disorders (EDs) [7–11] which, depending on the psychobehavioral attitudes of each subject, may evolve into partial or full syndromes: eating disorders not otherwise specified (EDNOS), binge eating disorders (BED), bulimia (BN) and anorexia (AN), respectively.

The lack of connection between the real and the ideal perception of their own body (body dissatisfaction) and the firm willingness to modify their body and shape so as to attune them to the social concept of thinness (drive for thinness) are some of the main reasons responsible for the resolute and constant adolescents' drive to pursue such ideal values [4, 12–15].

The physical growth of adolescents is characterized by an intense anabolic phase, and adequate amounts of energy, nutrients, vitamins and minerals are required. Therefore, the relentless and obsessive search for weight loss through dieting may result in an unbalanced nutrition both quantitatively and qualitatively [16–18]. During this important developmental phase, nutritional deficiencies and unbalanced diets may become a serious problem to tackle since adolescents' eating behavior is modified by the establishment of new relationships within the family and the outside world (desire to be independent of family ties, peer competitiveness and dating). Nutrition becomes an aspect of the adolescent's life gradually more detached from the family, more fragmentary, quicker and disorganized: fast food, misleading advertisements contrast with more traditional and healthier eating habits. [2, 4, 19, 20–22].

Our study intends to look at the eating habits and behavior distress on a cohort of adolescent girls and try to analyze the degree of body dissatisfaction and the drive for thinness related to them (Eating Disorder Inventory 2) [23]. Part of the intent of our study was to assess the Psychological Risk Factor Questionnaire (PRFQ) [24] in an adolescent sample as we believe it is a valid tool to use when assessing adolescents' psychological distress for thinness derived from the mass media.

Furthermore, subjects' anthropometrical measures, body composition, energy, and macro- and micronutrient intake have been assessed in order to verify the presence of unbalanced diets. Finally, since dieting has been widely recognized as one of the triggering factors of EDs, we have also inquired on the meaning of being dieters in a population of adolescent girls.

## Methods

### *Subjects*

The cross-sectional double-stage study was carried out on a sample of adolescent girls aged between 14 and 18 years recruited from a high school in the suburbs of Naples (Italy).

Participation in the study was on a voluntary basis and only by those girls who had obtained parental permission. The study, which consisted of weekly meetings over a period of approximately 4 months, was preceded by a collective lecture, held by dietitians and eating disorder specialists, addressed to all the high school students. We had an initial 191 subjects enrollment, but due to a drop-out rate of 18%, the final number amounted to 156 subjects.

### *Study Design*

The first stage of the study involved the collection of sociodemographic and physiological data along with the nutritional anamnesis (history) of each subject. The nutritional history of each subject was analyzed by asking whether, in an effort to lose weight, there had been self-limitations of the habitual energetic intake over the last 3 months and whether they had consulted a specialist for some guided advice. The assessment of the current dieting was instead based on the following blunt question, which, by the way, had already proved efficient and valid in past literature: 'At the moment, are you actually trying to lose weight?' [25]. Moreover, we tried to detect the intake of calories and drugs and to evaluate their weight loss rates, weight cycling, etc., and subjects were asked to describe what type of diet they were on.

During this first stage of the program, each girl received a nutritional diary which was thoroughly explained. They were asked to fill it out for 3 days including a not-working day. The evaluation of the intake of calories and nutrients was measured by drawing the mean values of the 3-day diary, in order to avoid eventual differences between working and not-working days. During this first stage, the examiners, by using visual materials, carefully explained how the diary had to be filled out, especially as regards the serving sizes and their standardization [26].

The subject was also asked to report in the diary whether the meal was eaten in solitude or with other people by ticking the related two entries: by yourself or with other people. Finally, the subjects were also asked to report in the diary the level of psychological distress associated with meal consumption and it was measured by means of a Likert scale with the following answers: 1 = relaxed; 2 = slightly tense; 3 = tense; 4 = upset. We considered the answers 3 (tense) and 4 (upset) as expression of psychological distress.

### *Anthropometry and Body Composition*

The anthropometrical measurements were taken with a standard scale equipped with a stadiometer. Height and weight were measured

to the nearest 0.5 cm and 0.1 kg, respectively. Next, waist and hip were measured along with the bicipital, tricipital, subscapular and suprailiac skinfolds. All of these measurements were taken by the same operator following the main rules of the anthropometric standardization [27]. The evaluation of the skinfolds, done with a Holtain calipers, was carried out in triplicate in order to draw mean values.

The Body Mass Index (BMI) and the waist-hip ratio (WHR) were calculated; the degree of overweight was measured by using the BMI age-specific data provided by Cole et al. [28].

Next, we carried out the sum of the skinfold measurements and we applied Durnin's formula to obtain fat mass (FM) percentage [29]. We have used the same formula as well for adolescents 14 and 15 years old. The difference between body weight and FM gave us the fat-free mass (FFM). Then, following the main rules for standardization of bioimpedance measurement [30], we performed the bioimpedance analysis, with a single frequency 50 Hz device, to assess the subjects' body composition (Akern, BIA Model 101). From the resistance and reactance values, we drew the fat mass and the fat-free mass.

#### *Psychometric Questionnaires and Eating Disorder Diagnosis*

Each girl filled out the Eating Disorder Inventory 2 (EDI2), the EDI2 Symptom Check List and the PRFQ [24]. To simplify the answers of the PRFQ, the calculations of the scores were differentiated from the original questionnaire by reducing from 7 to 5 the possible answers of the Likert scale and by assigning to the wrong answers the pathological points 1 to 3 (table 4). The convergent validity was evaluated by correlating the total score of the PRFQ with the Drive for Thinness and Body Dissatisfaction Scales of the EDI2. The questionnaires that were wrongly filled out were discarded, so that by the time we accomplished a thorough check of all of them, all EDI2 questionnaires and 140 PRFQ questionnaires turned out valid.

Besides the questionnaires, additional questions were made to each subject so as to examine particular eating habits such as the use of fresh or cooked vegetables, salting food, night snacking, and the emotional reaction to reproaches.

After having accurately evaluated the EDI2 questionnaires and carefully analyzed the answers of the Symptom Check List, we selected those subjects whose scores were above the pathological minimum threshold in the Drive for Thinness, Bulimia and Body Dissatisfaction scales and those who had manifested abnormal eating habits (binging, vomiting, use of drugs and diuretics) according to the Symptom Check List.

Then, having previously informed the high-school principal, we arranged a session to interview subjects in order to achieve a more accurate diagnostic evaluation. As for the total participation in the session, based as the whole project on a voluntary basis, 14.28% of the girls decided not to take part: out of 35 subjects, 30 actually underwent the interviews. Using the DSM IV criteria, we diagnosed subjects affected by full syndromes as bulimia nervosa, anorexia nervosa, whereas those subjects that were affected by at least two of the criteria proposed for bulimia and anorexia were diagnosed as ED-NOS partial syndromes. We consider binge eating disorder as a specific eating disorder and not as EDNOS.

#### *Food Intake*

All the serving sizes were converted in grams and milliliters. The data processing of the food diary, done with Dieta 2000 for Windows (CompuTek Software, Italy), was always done by the same operator in

order to avoid the problem of 'interobserver' inaccuracy. The questionnaires and food diaries that had not been filled out correctly were discarded. We were able to determine the energy daily intake by each subject (kcal/day), the amount (g) and the percentages of nutrients (proteins, lipids, carbohydrates), the amount of proteins in relation to body weight (g/kg), cholesterol, fiber, vitamins (vitamins A, E, C, B<sub>12</sub>, thiamine, riboflavin, niacin, pyridoxine, folic acids) and minerals (calcium, phosphorous, magnesium, iron, zinc, sodium, potassium). For each subject, the estimate value of each single nutrient was obtained by drawing the mean over the 3-day diet.

#### *Statistics*

All of the examined variables were expressed in terms of number of subjects, percentages and mean values, indicating as measures of variability the standard deviation and range. The evaluation of eventual statistically significant differences was carried out with the t test for independent samples. The internal consistency of the PRFQ was estimated with Cronbach's alpha coefficient calculation. Pearson's linear correlation was used for evaluating the convergent validity existing between the IM and the IC scales of the EDI2 Test and the total score of the PRFQ and for evaluating the correlation between EDI2 subscales and PRFQ Score with anthropometrical and body composition variables. Finally, the elaboration of data and statistical analyses was achieved through the software Statistica 5 for Windows (StatSoft. Inc, Tulsa, Okla., USA).  $p < 0.05$  was considered statistically significant.

## **Results**

We are going to illustrate the results of the study by analyzing each aspect separately.

#### *Anthropometrical Data and Dietetic History*

The mean age of the subjects was 16.25 years. Their height, weight, waist and hip measurements were 160.38 cm, 58 kg, 71.74 cm and 95.92 cm, respectively.

The BMI and the WHR mean values were 22.6 and 0.75, respectively. The mean thickness of bicipital, tricipital, subscapular and suprailiac skinfolds were 12.3, 19.74, 14.71, and 25.39 mm, respectively. It amounted to a sum of 71.92 mm.

There were 34.61% girls who claimed to have been on spontaneous diets and/or assisted by medical advice. Eight subjects had a BMI  $< 18$  (5.12%).

#### *Body Composition*

The estimate values of the fat mass (FM) gave us values for the skinfold and the bioimpedance measurements (BIA) of 30.89 and 29.75%, respectively. Fat-free mass (FFM) estimate value obtained with the skinfold measurements was 69.1%, whereas, it was 70.24% with the BIA. The correlation between the two techniques shows a correlation coefficient  $r$  of 0.67.

**Table 1.** Eating Disorder Inventory 2 (EDI2): subscale scores of all subjects and differences of the scores between subjects with (full syndromes + partial syndromes) and without eating disorders (data presented as frequency, relative frequency, mean and SD)

	All subjects (n = 156)	Eating disorders (n = 20)	No eating disorders (n = 136)
Drive for thinness (DT)	5.1 ± 5.94 [12.17%]	14.95 ± 3.76***	3.66 ± 4.7
Bulimia (B)	1.18 ± 2.24 [2.56%]	4.35 ± 3.58***	0.72 ± 1.5
Body dissatisfaction (BD)	10.31 ± 7.57 [25%]	18.9 ± 7.32***	9.05 ± 6.76
Ineffectiveness (IN)	6.01 ± 3.29 [22.43%]	8.65 ± 4.98***	5.63 ± 2.78
Perfectionism (P)	3.45 ± 3.18 [7.05%]	4.2 ± 5.1	3.34 ± 2.8
Social interpersonal disrupt (SID)	2.95 ± 2.95 [8.97%]	5.1 ± 4.07***	2.63 ± 2.62
Enterceptive awareness (IA)	3.39 ± 3.74 [6.41%]	7.1 ± 5.19***	2.84 ± 3.15
Maturity fears (MF)	6.21 ± 4.14 [27.56%]	7.25 ± 4.74	6.06 ± 4.05
Asceticism (ASC)	3.9 ± 2.79 [8.33%]	7.35 ± 4.3***	3.39 ± 2.07
Impulsivity (IMP)	3.96 ± 4.64 [19.23%]	7.7 ± 7.02***	3.41 ± 3.93
Social inadequacy (SI)	3.89 ± 3.32 [14.74%]	6.63 ± 4.34***	3.51 ± 2.97

Cut-off for each subscale: DT: >4; B >8; BD >16; IN >8; P >8; SID >8; IA >10; MF >8; ASC >8; IMP >8; SI >8 (cut-off values obtained by analysis of data on clinical adolescent group with EDs – Professional Manual of EDI2 by Garner et al.). Percentage of subjects above the cut-off value is shown in square brackets.

Statistical significance on t test for independent sample: \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001.

#### *Eating Disorder Inventory 2 (table 1)*

The mean scores of each subscale of EDI2 are drive for thinness: 5.1; bulimia: 1.18; body dissatisfaction: 10.31; ineffectiveness: 6.01; perfectionism: 3.45; social interpersonal distrust: 2.95; enterceptive awareness: 3.39; maturity fears: 6.21; asceticism: 3.9; impulsivity: 3.96; and social inadequacy: 3.89. According to Garner's cut-off value of a population affected by eating disorders, we demonstrated that 25, 27 and 22.45% of the examined subjects reached scores above the cut-off values as regards body dissatisfaction, ineffectiveness and maturity fears, respectively. Having compared the EDI2 scores of subjects affected by EDs (full syndrome + partial syndrome) with the scores of subjects without EDs, there was statistically significant difference in the following subscales: drive for thinness (p < 0.001), bulimia (p < 0.001), body dissatisfaction (p < 0.001), ineffectiveness (p < 0.001), social interpersonal distrust (p < 0.001), interceptive awareness (p < 0.001), ascetism (p < 0.001), impulsivity (p < 0.001) and social inadequacy (p < 0.001).

#### *Psychological Risk Factor Questionnaire (table 2) and Eating Habits*

Pearson's linear correlation showed that the PRFQ mean value of the score had a statistically significant correlation with the Drive for Thinness scale (r = 0.45; p <

0.001) and the Body Dissatisfaction scale (r = 0.67; p < 0.001) of the EDI2 questionnaire.

The internal consistency of the questionnaire, evaluated by means of Cronbach's alpha value coefficient, was 0.75. In effect, using Nunnally's cut-off value of 0.70 [31], PRFQ appears to have a good internal consistency. The PRFQ mean score resulting from the overall population was 24.28. A cut-off value of 27 was suggested for the evaluation of psychosocial risks. In fact, the subjects that reached scores above 16 on the Body Dissatisfaction scale and above 14 on the Drive for Thinness scale, reported mean PRFQ scores of 30.65 and 30.33, respectively. Furthermore, the indicated cut off value 27 allowed us to discriminate between 80% (16) of the subjects affected by full syndromes and partial syndromes; the PRFQ mean score of people affected by EDs was 31.65.

Examining the subjects' eating habits, it emerged that 20% of the girls did not eat fresh vegetables, 14% ate no cooked vegetables, 13% regularly added salt to their meals, 22% ate quickly, 15% woke up at night to eat and, finally, 8% and 28% stated that they reacted to reproaches by eating more food or more desserts, respectively.

#### *Eating Disorders and Overweight*

The double-stage study allowed us to obtain an accurate diagnostic evaluation of our sample. We observed a

**Table 2.** Psychosocial Risk Factor Questionnaire (PRFQ) – questions included in the questionnaire and description of the method utilized to calculate the total score. Calculation of the total score of our sample (mean  $\pm$  SD) and assessment of the convergent validity against EDI2 subscales (drive for thinness and body dissatisfaction) by means of Pearson correlation

The way I look is extremely important to me (↓)	
When I see girls in clothing commercials, I compare myself to them (↓)	
Most people expect to be thin (↓)	
Commercials, TV shows and magazines favour girls with thin bodies (↓)	
People notice how attractive I am (↑)	
I am a very good looking individual (↑)	
I compare myself to models in fashion magazines (↓)	
Looking my best is worth the effort (↓)	
I have the type of body that people want to look at (↑)	
Thin girls get treated better than girls who are heavy (↓)	
I am very concerned about my appearance (↓)	
People are envious of my good looks (↑)	
Most people think that girls should have a thin body (↓)	
I wish I looked more like the models shown in fashion magazines (↓)	
I would feel embarrassed if I was around people and did not look my best (↓)	
My looks are very appealing to others (↑)	
People are nicer to girls who are thin (↓)	
It is important that I always look good (↓)	
Mean total score ( $\pm$ SD)	24.28 $\pm$ 6.23
Correlation with Drive for Thinness subscale	r = 0.45 (p < 0.001)
Correlation with Body Dissatisfaction subscale	r = 0.67 (p < 0.001)

#### Method used to obtain the total score of the PRFQ.

The possible answers to each question are on a Likert scale. The answers are: 1 = strongly agree; 2 = agree; 3 = I don't know; 4 = disagree; 5 = strongly disagree.

The score assigned to each answer varied between 0 and 3.

The arrow (↑) indicates that the score assigned to each answer is derived by an increasing way: 1 (strongly agree) = 0; 2 (agree) = 0; 3 (I do not know) = 1; 4 (disagree) = 2; 5 (strongly disagree) = 3.

The arrow (↓) indicates that the score assigned to each answer is derived by a decreasing way: 1 (strongly agree) = 3; 2 (agree) = 2; 3 (I do not know) = 1; 4 (disagree) = 0; 5 (strongly disagree) = 0.

The calculation of the total score was obtained by summing up the score assigned to each answer.

prevalence of 1.28% of bulimia nervosa (2); 1.28% (2) of binge eating, and 10.25% (16) of eating disorders not otherwise specified. The prevalence of overweight subjects was 23.07%.

#### Energy and Nutrient Intake (table 3)

Energy intake was 1,916.44 kcal/day; a protein intake of 66.62 g/day (13.9%; 1.14 g/kg body weight); a carbohy-

drate intake of 227.23 g/day (47.42%) and a lipid intake of 86.43 g (40.58%). The consumption of cholesterol and fiber amounted to 205.1 mg/day and 9.63 g/day, respectively.

As far as the intake of vitamins is concerned, we found out these values: 384.82  $\mu$ g/day of vitamin A; 2.82 mg/day of vitamin E; 54.75 mg/day of vitamin C; 831.54  $\mu$ g/day of thiamine; 1,187.88  $\mu$ g/day of riboflavin; 8.42 mg/day of niacin; 548.16  $\mu$ g/day of pyridoxine; 81.81  $\mu$ g/day of folic acid; 0.86  $\mu$ g/day of vitamin B<sub>12</sub>.

The mineral intake values of calcium, phosphorous, magnesium, iron, zinc, copper, sodium, and potassium were 660.95, 1,011.72, 91.93, 5.94, 3.62, 0.26, 1,807.83 and 1,731.09 mg/day, respectively. All the values reported, with the exception of lipids and sodium, were below the ones recommended by LARN [32].

#### Dieting (table 4)

In our study 54 subjects were dieters and 102 were not. There was a statistically significant difference between the two groups for age (p < 0.01), weight (p < 0.001), drive for thinness (p < 0.001), bulimia (p < 0.05) and body dissatisfaction (p < 0.001). There was no difference, instead, between the two groups as regards the other EDI2 subscales and the energy, macronutrients (proteins, carbohydrates, lipids), minerals, vitamins, cholesterol and fiber.

#### Anthropometry, EDI2 and PRFQ: Correlation (table 5)

The analysis of the correlation between the anthropometrical and body composition variables (age, weight, height, BMI, hip, bicipital, tricipital, suprailiac and subscapular skinfolds, fat mass and fat-free mass) and the EDI2 and PRFQ questionnaires highlighted how both questionnaires were correlated with most of the variables. In particular, the IC scale of EDI2 and PRFQ showed a statistically significant correlation with the same variables: weight, BMI, waist circumference, hip circumference, bicipital skinfold, tricipital skinfold, subscapular skinfold, suprailiac skinfold, FM and, inversely, with the FFM.

Moreover, it is important to highlight that only weight was correlated with the Drive for Thinness scale.

#### Nutrition and Psychosocial Aspects of Eating (fig. 1)

As we described in 'Methods', food diary allowed us to analyze deeply the eating habits of adolescents, particularly the association between psychological distress, eating in solitude and specific food consumption. We be-

**Table 3.** Mean energy, fibre, macro- and micronutrients intake

	Mean $\pm$ SD [range]	Recommended value
Energy intake, kcal/day	1,916.44 $\pm$ 275.35 [1,278.66–2,358.66]	
Proteins, g	66.62 $\pm$ 12.33 [38.66–96]	
Proteins, %	13.9	10–15 (=)
Carbohydrates, g	227.23 $\pm$ 49.93 [103–339.66]	
Carbohydrates, %	47.42	55–60 (↓)
Lipids, g	86.43 $\pm$ 16.46 [41–107.33]	
Lipids, %	40.58	25–30 (↑)
Cholesterol, mg	205.1 $\pm$ 85.25 [9–450.33]	300 mg/day (↓)
Fiber, g	9.63 $\pm$ 4.14 [1.33–22.33]	30 g/day (↓)
Vitamin A, $\mu$ g	384.82 $\pm$ 260.46 [12.66–1,121]	600 $\mu$ g/day (↓)
Vitamin E, mg	2.82 $\pm$ 2.59 [0–8]	8 mg/day (↓)
Vitamin C, mg	54.75 $\pm$ 34.2 [8–174]	60 mg/day (↓)
Thiamine, $\mu$ g	831.54 $\pm$ 296.06 [239–1,989.33]	900–1,200 $\mu$ g/day (↓)
Riboflavin, $\mu$ g	1,187.88 $\pm$ 358.28 [344–2,253.33]	1,300–1,600 $\mu$ g/day (↓)
Niacin, mg	8.42 $\pm$ 4.16 [2.33–16.66]	14–18 mg/day (↓)
Pyridoxine, $\mu$ g	548.16 $\pm$ 412.72 [0–1,479]	1,500 $\mu$ g/day (↓)
Folic acid, $\mu$ g	81.81 $\pm$ 67.92 [0–313.33]	200 $\mu$ g/day (↓)
Vitamin B <sub>12</sub> , $\mu$ g	0.86 $\pm$ 1.62 [0–8]	2 $\mu$ g/day (↓)
Calcium, mg	660.95 $\pm$ 224.07 [153.66–1,661.66]	800–1,200 mg/day (↓)
Phosphorous, mg	1011.72 $\pm$ 224.54 [501–1,769]	800–1,200 mg/day (↓)
Magnesium, mg	91.93 $\pm$ 71.77 [0–207]	150–500 mg/day (↓)
Iron, mg	5.94 $\pm$ 1.71 [2–9.66]	10–18 mg/day (↓)
Zinc, mg	3.62 $\pm$ 2.17 [0.33–12.66]	7–10 mg/day (↓)
Copper, mg	0.26 $\pm$ 0.43 [0–3]	0.8–1.2 mg/day (↓)
Sodium, mg	1,807.83 $\pm$ 854.13 [194–3,523]	1,500–1,800 mg/day (=)
Potassium, mg	1,731.09 $\pm$ 434.53 [895.66–2,612]	3,200 mg/day (↓)

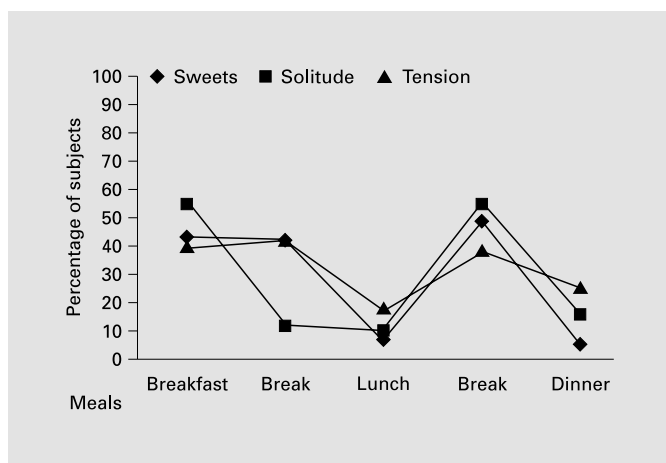
Recommended values by LARN and details of adequate (=), higher (↑) and lower (↓) intake in comparison to recommended daily allowances for adolescents [LARN] are shown.

lieve, also, that it is essential to underline that 16.77% of the subjects skipped breakfast but almost nobody skipped lunch (2.73%). In our study, 53% of the subjects had breakfast alone at home in contrast to lunch and dinner which were regularly eaten with other people by 90 and 84% of the girls, respectively. The examination of the girls' psychological state, during the consumption of their meals, indicated an increase of the level of tension during the first half of the day but a decrease during the second half of the day, particularly at lunch time and it came out that the consumption of desserts and sweets showed the same trend as psychological distress associated with meal consumption and eating in solitude.

## Discussion

These data obtained from a population of female adolescents attending a Neapolitan high school were aimed to provide a general picture of the typical aspects related to nutrition, body composition and behavioral attitudes characterizing adolescents.

The results related to body composition and nutritional aspects were within the normal and we had a prevalence of overweight subjects (23.07%), comparable to previous research conducted in Italy as well as in other Western countries [33]. The analysis of body composition values showed a shift of the FM and the FFM from the normal values (30 and 70%, respectively). The estimates that are expressed as mean, do not exactly discriminate between subjects with different nutritional conditions (underweight, normal weight, overweight) and the different levels of physical activity; nevertheless, since we are dealing with a sample above all of normal weight subjects



(BMI = 22.6), these values make us think that they may be related to a quite sedentary life style. Previous studies have demonstrated similar results [34], along with others that have underlined the fact that female adolescents are more physically inactive than males – a phenomenon that increases even more as adolescents get older [17, 18].

**Fig. 1.** Relationship between psychological distress related to food consumption (tension), eating in solitude (solitude) and sweets consumption (sweets) evaluated by analyzing food diary information from our sample. Data are expressed as percentage of subjects distributed over the main meals of the day (breakfast, break – morning, lunch, break – afternoon, dinner). See ‘Methods’ and ‘Results’.

**Table 4.** Anthropometrical data, Eating Disorders Inventory 2, energy and food intake (nutrients, cholesterol and fibre) between dieters and not-dieters: data presented as frequency, relative frequency, mean and SD

	Dieters	Not dieters
Number of subjects	54 (34.61%)	102 (65.39%)
<i>Anthropometrical data</i>		
Age, years	16.68 ± 1.45**	16.01 ± 1.42
Weight, kg	62.25 ± 8.86***	55.97 ± 7.46
Height, cm	160.19 ± 4.49	160.49 ± 5.75
Body Mass Index (BMI), kg/m <sup>2</sup>	24.23 ± 3.08***	21.73 ± 2.79
Waist circumference, cm	74.79 ± 8.08***	70.13 ± 6.66
Hip circumference, cm	99.64 ± 6.86***	93.95 ± 6.23
Waist-hip ratio (WHR)	0.75 ± 0.05	0.74 ± 0.47
<i>Eating Disorders Inventory 2</i>		
Drive for thinness (DT)	7.85 ± 6.53***	3.65 ± 5.06
Bulimia (B)	1.70 ± 2.75*	0.91 ± 1.87
Body dissatisfaction (BD)	13.27 ± 7.24***	8.74 ± 7.29
Ineffectiveness (I)	6.09 ± 3.45	5.98 ± 3.21
Perfectionism (P)	3.25 ± 3.03	3.55 ± 3.27
Social interpersonal disrupt (SID)	3.40 ± 3.33	2.71 ± 2.71
Enterceptive consciousness (EC)	4.18 ± 4.3	2.97 ± 3.35
Maturity fears (MF)	6.07 ± 4.06	6.29 ± 4.21
Asceticism (ASC)	4.31 ± 2.92	3.68 ± 2.7
Impulsivity (I)	4.29 ± 4.49	3.79 ± 4.74
Social inadequacy (SI)	4.33 ± 3.53	3.66 ± 3.19
<i>Energy and nutrients intake</i>		
Energy intake, kcal/day	1,897.64 ± 267.42	1,925.98 ± 280.86
Proteins, g	68.07 ± 14.07	65.88 ± 11.4
Carbohydrates, g	226.43 ± 49.55	227.64 ± 50.5
Lipids, g	84.78 ± 17.8	87.27 ± 15.81
Cholesterol, mg	198.21 ± 68.99	208.61 ± 92.73
Fibre, g	9.65 ± 4.82	9.63 ± 3.8

BMI: weight (kg)/height (m)<sup>2</sup>; WHR: waist circumference/hip circumference.

Statistical significance on t test for independent sample: \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001.

The food diary did present some limitations both in its completion and data elaboration. To involve more effectively the girls and to keep alive their commitment, we adopted the photographic method so as to standardize the serving sizes and we limited the period of its completion to three days. We do realize that such brief period of collect data might not have thoroughly reflected the girls' actual dietary habits, and it could have produced an 'iatrogenic dieting', altering the collection of the data. We also recognized the possible underestimation of the dieters' energy intake as a result of the larger number of overweight subjects (in the sub-sample of dieters). However, we maintain that since the girls were well instructed and highly motivated to fill out the diary, the diary becomes a valuable tool for collecting data concerning dietary intake [16, 17, 35, 36]. The analysis of the energy and nutrients intake revealed lower values compared to the recommended daily allowance for adolescents by LARN. Examining eating habits of adolescents through food diaries, other authors have also reported similar disorders partic-

ularly as regards the excessive intake of fat and the deficient intake of vitamins and minerals [16, 17, 35, 36]. Skipping breakfast and 'high fat' snacking are also reported in other studies as negative nutritional habits of adolescents and as causes of the high levels of fat and sodium intake [16, 17, 21, 33].

The validation of the PRFQ originally was based on a non-clinical population of 72 adult females and the questionnaire had four subscales: the pressures of the media and society on physical thinness, concerns about physical appearance and perception of physical appearance. In our study, the questionnaire showed a good internal consistency and convergent validity in spite of our decision to integrate the scales in one single total score and to reduce the number of questions so as to simplify the adolescents' task. Therefore, the PRFQ turned out to be an effective technique for assessing the degree of influence that mass media and social pressures exert over adolescents' drive for thinness.

**Table 5.** Correlation analysis: evaluation of the association between anthropometrical and body composition variables with EDI2 and PRFQ questionnaires

	DT	BD	IN	P	MF	I	PRFQ
Age, years			-0.19 p = 0.015	-0.16 p = 0.036			
Weight, kg	0.158 p = 0.049	0.40 p = 0.000					0.33 p = 0.000
BMI, kg/m <sup>2</sup>		0.43 p = 0.000					0.33 p = 0.000
Waist, cm		0.38 p = 0.000					0.32 p = 0.000
Hip, cm		0.38 p = 0.000				-0.18 p = 0.02	0.34 p = 0.000
Bicipital, mm		0.30 p = 0.000					0.31 p = 0.000
Tricipital, mm		0.28 p = 0.000			0.17 p = 0.02		0.28 p = 0.000
Subscapular, mm		0.32 p = 0.000					0.23 p = 0.013
Suprailiac, mm		0.19 p = 0.017			0.18 p = 0.02		0.25 p = 0.006
Fat mass, %		0.34 p = 0.000			0.20 p = 0.012		0.28 p = 0.003
Fat-free mass, %		-0.34 p = 0.000			-0.20 p = 0.012		-0.28 p = 0.003

DT = Drive for thinness; BD = body dissatisfaction; IN = ineffectiveness; P = perfectionism; MF = maturity fears; I = impulsivity; PRFQ = Psychosocial Risk Factor Questionnaire. Fat mass and fat-free mass derived by skinfold thickness measurements.

The administration of the EDI2 and PRFQ questionnaires combined with other additional inquiries so as to deepen particular aspects showed that when the IM and IC values are compared with the estimates of a non-clinical population of female adolescents, the strong impact of social pressures on girls' drive for thinness emerged clearly and, we think, it is a result of their body dissatisfaction [23]. The linear correlation has shown that anthropometrical and body composition variables are closely related to body dissatisfaction but fat-free mass is, instead, inversely correlated to them confirming how adolescents' obsessive search for more tonic and muscular bodies reduces the level of body dissatisfaction. In our sample we did not find out that any single particular area of the body associated with body dissatisfaction and the anthropometrical measures, taken from different parts of the body, were significantly correlated with body dissatisfaction. Surprisingly, we found that only weight affected drive for thinness; however, such result should not be so unexpected if we consider that skin folds, waist and hip circumferences are rarely monitored by adolescents and what is obsessively checked is their weight.

As already highlighted by previous literature, adolescent girls are often concerned by 'drive for thinness' and 'body dissatisfaction' [7, 37–40] and eating disorders, often hidden and not declared, may arise. Therefore, it is easy to infer that possible subjects with unusual eating behavior, which were suspected by some high school teachers, willingly refused to take part in our study. Similar prevalence of bulimia and EDNOS found in our study were also present in another study conducted in the same geographical area [41].

We stratified subjects in 'dieters' and 'not-dieters' (intending with the former group those subjects that answered affirmatively to our questions concerning previous dietary treatments) and we noticed that dieters had higher score in the Drive for Thinness and Body Dissatisfaction scales than not-dieters who reported normal values in all the EDI2 subscales. Moreover, we detected an energy intake, and macro- and micronutrients below the values recommended by the LARN and, since the dieters were close to the overweight threshold, we identified, with other authors, that body dissatisfaction, drive for thinness and dieting closely follow BMI increase [34, 42].

We are convinced that several factors bring adolescents to become dieters and dieting could vary from healthy eating behaviors and increasing physical activities to far extreme forms of eating behaviors typical of EDs (starvation, vomiting and drugs). [2, 6, 42–45].

Our food diary allowed us to collect data on specific aspects of eating behavior that might be directly related with eating disorders onset and perpetuation. We observed that 22% of the adolescents in our sample eat very fast without looking at their plates, 17% wake up at night to eat and 28% react to their families' and schools' reproaches by eating more sweet food. At the same time, the food diary has allowed us to examine the tight correlation existing between eating in solitude, psychological distress associated with eating and sweet food consumption showing the same trend; in fact, there is an increase of sweet food consumption with the increase of eating in solitude and psychological distress. The only dissimilarity we had was related to snacking in the morning because adolescents ate meals with their peers but without reduction of the psychological distress and intake of sweet food [5].

This study wants to demonstrate how difficult it is to deal with adolescents' problems, particularly when we try to explore psychological and behavioral aspects of their lives. One of the most common diseases of adolescent girls are eating disorders but, both for the still fervent debate about their precise diagnosis and the high rate of drop out and misreporting by subjects, this kind of problems are to some extent undefined and many aspects need to be furthermore studied. Our study tries to analyze these problems by means of a comprehensive approach, integrating physiology and nutrition with behavior and psychology, to obtain more significant results. At the same time we are conscious that many other aspects need to be studied deeper, like for example the progression of EDNOS and full syndromes over time by means of longitudinal studies, the influence of physical activity on food choices and eating disorders onset and maintenance, etc.

Therefore, multidisciplinary and well designed studies are needed to study systematically and accurately eating habits and behavior of the adolescents to tackle more efficiently the increasing spreading of eating disorders and obesity.

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