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ORIGINAL ARTICLE

Is thinness more prevalent than obesity in Portuguese adolescents?

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Summary
Background & aims: There is little information regarding the prevalence of thinness in European adolescents. This was assessed in a convenience sample of children and adolescents from the Lisbon area (Portugal).
Methods: Cross-sectional study including 2494 boys and 2519 girls aged 10–18 years. Body mass index (BMI), waist and hip were measured using standardized methods; thinness was defined using international criteria. Body fat was assessed by bioelectrical impedance.
Results: In girls, prevalence of thinness, overweight and obesity were 5.6%, 19.7% and 4.7%, respectively, whereas the corresponding numbers in boys were 3.9%, 17.4% and 5.3%. Prevalence of thinness increased whereas obesity decreased with age: from 1.5% to 7.6% for thinness and from 9.2% to 3.8% for obesity in girls aged 10 and 18, respectively. In boys, the corresponding trends were from 0% to 7.3% for thinness and from 10.6% to 3% for obesity. After adjusting for age, differences were found between BMI groups for weight, body fat percentage, fat mass, lean mass, waist and hip, while no differences regarding height were found between thin and normal weight participants.
Conclusions: The prevalence of thinness is more frequent than obesity after age 14 in girls and 16 years in boys. Thinness is associated with a decreased body weight and body fat, whereas no consistent effect on height was noted.

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Introduction

Childhood obesity has been increasing worldwide, both in industrialized as in developing countries.[1] The considerable amount of epidemiological data on child and adolescent obesity contrasts to the paucity of data regarding the prevalence of thinness or underweight among adolescents at the European level. In most European countries, teenagers are being pressured to pursue an unreal beauty ideal of thinness,[2] which may lead to risky weight-management practices and eating disorders.[3] Thinness is frequently associated with nutritional deficiencies, menstrual irregularity and eating disorders,[4] and some studies have shown that underweight/thinness might actually be more frequent than obesity.[5] However, between- country comparisons are difficult due to the different cut points used to define underweight/thinness.[6,7]

Recently, body mass index (BMI) cut- offs to define thinness in children and adolescents have been published, which would enable the comparison of prevalence rates between surveys.[8] Thus, we decided to assess the prevalence of thinness, overweight and obesity in a large sample of children and adolescents aged 10—18 years living in Lisbon, Portugal.

Methods

Sampling

Between May 2000 and May 2002, children and adolescents from a convenience sample of 25 schools of Lisbon and the greater Lisbon area were surveyed. The schools were invited to participate by the Sports Department of the Lisbon City Hall and the Universidade Lusófona de Humanidades e Tecnologias. Authorization from the school and parents' boards was obtained in every school; all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during this research. As the evaluation of fitness (including height and weight) is part of the educational curriculum and thus compulsory for all schoolchildren in Portugal, it was not necessary to obtain approval from an Ethics Committee, provided adequate measures were taken to maintain the anonymity of the data. All children (excluding those on sick leave or with any counter- indication for physical activity) were screened; screening was performed during physical education classes with the collaboration of physical education teachers and previous- year students from the Sports and Physical Education course of the Universidade Lusófona de Humanidades e Tecnologias. Prior to initiating the survey, all students received training on how to perform the anthropometric tests.

Data collection

Data were collected anonymously. In order to compute age, the month and year of birth were collected and children were considered as being born on the 15th of the birthday month; omitting the day of birth allowed complete anonymity of the data.

Height was measured to the nearest 0.5 cm using a stadiometer (Seca, Hamburg, Germany). Weight was measured to the nearest 0.1 kg using a digital scale (Seca, Hamburg, Germany) with the subject in light sports clothing and without shoes. Thinness, overweight and obesity were determined using BMI according to published criteria.[8,9] Waist was measured at midpoint between the lowest rib and the iliac crest and hip at the largest part of the hips using a non-stretchable tape.

Percentage of body fat was assessed by bioelectrical impedance using a bipolar handheld device (Omron BF-300, Omron, Japan)[10] and the results were expressed as percentage of body weight. Briefly, the subject stood with the feet slightly separated, holding the device in both hands, arms stretched out at an angle of 90 degrees relative to the body; the instrument records impedance from hand to hand and subsequently calculates % body fat to the nearest 0.1% based on age, gender, height and weight.[11] No information regarding the formulas used to calculate the % of body fat could be obtained from the manufacturer. Fat mass was computed as weight $\times$ body fat percentage, and lean mass was computed as (weight $-$ fat mass).

Statistical analysis

Statistical analysis was conducted using SAS version 9.1 (SAS Institute Inc., Cary, NC, USA) and Stata version 9.2 (Stata Corp., TX, USA) for Windows. Qualitative variables were expressed as number and (percentage); quantitative variables were expressed as mean $\pm$ standard deviation. The z-scores for height, weight and BMI were calculated using the LMS method and the reference data available from the 1990 British Growth Reference [12] using the zanthro function of Stata. Comparisons were performed using chi-square for qualitative and *t*-test or ANOVA for quantitative variables. Adjustment for age was performed using a general linear model and the results expressed as adjusted mean $\pm$ standard error. Post-hoc comparisons between NWO and the other weight categories were performed using Scheffé's method.[13] Scheffé's method ensures that the chance of incorrectly rejecting one or more hypotheses in the set so tested cannot exceed alpha and might be more powerful than the Bonferroni or Sidak methods if the number of comparisons is large relative to the number of means. Conversely, Scheffé's method also results in a higher than desired type II error rate, by imposing a severe correction. Statistical significance was considered for $p < 0.05$.

Results

Overall, 5013 subjects aged 10—18 were assessed (2494 boys and 2519 girls). Their main characteristics are summarized in Table 1. No differences were found between genders regarding age. Boys were significantly taller and heavier but their mean BMI and fat mass were lower than girls. Boys also had a higher waist and a lower hip than girls. When z-scores were used, boys presented higher z-scores than girls: for height, -0.02 ± 0.98 (mean $\pm$ standard deviation) vs. -0.15 ± 0.99; for weight, 0.40 ± 1.08 vs. 0.29 ± 1.11; for BMI, 0.57 ± 1.11 vs. 0.49 ± 1.07 (all $p < 0.05$).

Prevalence of thinness, overweight and obesity according to age and gender are summarized in Table 2. Overall, girls presented a higher prevalence of thinness and a lower