Body Mass Index Accuracy in Preadolescents: Can We Trust Self-Report or Should We Seek Parent Report?

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Objectives To assess the accuracy of self- and parent-report of weight, height, and body mass index (BMI) in children between 8 and 12 years of age and to determine whether self- or parent-report should be preferred for preadolescents' subjective measures.

Study design Through at-home questionnaires, 875 preadolescent children (44% boys; 56% girls) and their parents (N = 821) were asked to report the children's weight and height. Objective weight and height were measured at school by trained interviewers.

Results Correlations between objective, self-reported, and parent-reported measures were strong for weight, height, and BMI, but children and parents generally underestimated the children's weight by about 1 kg, their height by less than 1 cm, and their BMI by less than 0.25 kg/m^2. The magnitude of the underestimation varied by age, sex, and BMI category, with older children, girls, and children in the overweight and obese BMI categories underestimating their weight to a greater extent. Weight estimates provided by girls' parents tended to be lower than the real values more often than those of boys' parents.

Conclusions Children and parents are likely to misreport children's weight, height, and BMI. For most youths aged 8 years of age and older, self-report appears as accurate as parent-report and could, therefore, be used interchangeably. *(J Pediatr 2015;167:366-71)*.

Body mass index ([BMI] kg/m^2) is the most widely used proxy measure of overweight and obesity for both clinical and epidemiologic studies.[1] Whereas many studies have investigated the accuracy of self-reported anthropometric measures in adults[2,3] and adolescents,[4-6] it has been overlooked in children. Nevertheless, children's self-reported weight and height are used in many epidemiologic studies, as well as in studies conducted in school settings.[7,8] In addition, a significant proportion of researchers rely on parent-report for children's anthropometric measures, even though children, especially older ones, may be able to provide this information themselves. Determining whether it is better to ask parents or preadolescents themselves about their weight and height could help in choosing the most accurate, and cost-effective, subjective anthropometric measures for children. The current study, therefore, evaluates the accuracy of children's self-reported and parent-reported anthropometric measures and compares them with determine whether one is more accurate than the other.

The main objective of this study is to assess the accuracy of self- and parent-report of weight, height, and BMI based on the reported measures in children between 8 and 12 years of age, by comparing them with objective measures of weight, height, and BMI. Potential differences by sex, age, and BMI category will be taken into account when assessing accuracy. A subsequent objective is to determine whether self- or parent-report should be preferred for subjective measures of preadolescents' weight and height.

Methods

In 2010, 1134 children between 8 and 12 years of age and their parents were recruited through 27 public elementary schools in 2 large cities in the province of Québec (Canada). They took part in a 3-year longitudinal study focusing on body weight, body image, and eating and physical activity habits. Children and parents filled out questionnaires at home. Children who returned their questionnaires to school were subsequently seen individually, and their anthropometric (weight and height) measures were taken. The research ethics committee of the Université du Québec en Outaouais reviewed and approved this study.

To remain in the final sample, children needed to provide valid objective measures, as well as subjective measures of height and weight obtained from the child's and/or parent's questionnaire. Participants with extreme weight, height, and BMI values (±3 SD) were identified and excluded from the sample. There was no difference in sociodemographic characteristics (age, sex, BMI, parental

BMI Body mass index

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income, and parental BMI) between the excluded children and those remaining. The final sample was composed of 875 preadolescents (44% boys; 56% girls) with a mean age of 10.34 years (SD 1.19) and a mean BMI of 17.85 (SD 3.28). Almost all the children were born in Canada (95%), spoke French at home (97%), and came from a family where parents were either married or living in a civil union (84.5%). These children also came from wealthy families, with nearly one-third having an annual income of $100 000 or more. Parents (N = 821) had a mean age of 39.8 years (SD 5.7), a mean BMI of 26.2 (SD 5.0), and a postsecondary diploma in 72.8% of the cases.

BMI was calculated by dividing the measured body weight in kilograms by the square of the measured height in meters. Weight and height were measured twice by trained interviewers, who used a numeric scale and a stadiometer. Height was measured to the nearest 0.1 cm, and weight was measured to the nearest 0.1 kg. Children were classified as underweight, normal, overweight, or obese based on the BMI cut-off points adjusted for sex and age proposed by Cole et al.[9,10]

Through at-home questionnaires, children and parents were asked to report the children's height in centimeters or inches and their weight in pounds or kilograms. Children's self-reported and parent-reported BMIs were estimated using measures of height and weight converted to the metric scale. Children's BMI groups were created according to recommendations by Cole et al.[9,10]

Statistical Analyses

Pearson correlations were calculated to evaluate the strength of the association between subjective and objective measures, as well as between self- and parent-reported measures. Then, mean differences between subjective and objective anthropometric measures were estimated for the complete sample, and paired *t* tests were used to identify statistically significant differences between subjective and objective measures. Mean differences were also assessed by sex, age, BMI group, sex-by-age, sex-by-BMI, and age-by-BMI. Factorial multivariate ANOVAs were used to identify statistically significant between-group differences.

To determine the accuracy of the subjective reports, BMI group misclassifications were identified by comparing the classifications based on subjective measures with those based on objective measures. The accuracy of self-reports vs parent reports was assessed using repeated-measured ANOVAs, and the agreement between the data sources (children, parents, objective) was determined using 4 × 4 contingency tables. Kappa statistics aimed at investigating the degree of concordance of the BMI classifications. To assess the agreement between the self-reported and objective anthropometric measures, 95% limits of agreement were calculated using the Bland-Altman method.[11] Differences between the subjective and objective BMIs were plotted against the means of the subjective and objective BMIs, with the mean difference ± 1.96 SD. All the analyses were performed using IBM SPSS Statistics v 20 (SPSS Inc, Armonk, New York).[12]

Results

Correlations between objective, self-reported, and parent-reported measures were strong for weight, height, and BMI (**Table I**). Nevertheless, paired *t* tests revealed that subjective measures were significantly underestimated compared with objective ones. Children and parents generally underestimated the children's weight by about 1 kg ($P < .001$), their height by less than 1 cm ($P < .001$), and their BMI by less than 0.25 kg/m^2 ($P < .001$) (**Table II**). Comparison of mean differences in weight, height, and BMI between self- and parent-reports through repeated-measures ANOVAs indicated no significant differences between the 2 sources.

Children were classified in the 8- to 9-year-old group or the 10- to 12-year-old group. Although both age groups underestimated their weight and height, older children underestimated their weight ($F[1, 771] = 17.41$; $P < .001$) and BMI ($F[1, 771] = 12.56$; $P < .001$) significantly more than younger children. Parent-reports led to an underestimation of their child's weight, height, and BMI, no matter their child's age-group.

Both boys and girls underestimated their weight, height, and BMI, but boys' underestimation of their weight ($F[1, 771] = 13.01$; $P < .001$) and BMI ($F[1, 771] = 4.45$; $P = .035$) was significantly lower than that of girls. In general, parents underestimated their child's weight, height, and BMI when compared with objective measures. However, parents of girls tended to underestimate their daughter's weight to a greater extent than parents of boys ($F[1, 734] = 8.50$; $P = .004$).

Overweight and obese children's self-reported weight ($F[3, 2319] = 6.85$; $P < .001$) and BMI ($F[3, 2309] = 3.43$; $P = .017$) underestimations were significantly greater than those of children in the normal weight and the underweight categories. Similarly, parents of overweight and obese children tend to underestimate their child's weight to a greater extent than parents of underweight children.

We tested for the impact of different interactions (sex-by-age and sex-by BMI group) on the accuracy, but the only significant interaction was found for age-by-BMI group in self-reported measures. The under-reporting of weight observed in younger children was similar no matter their BMI group ($F[3, 773] = 0.119$; $P = .949$). However, among older children, the underestimation of self-reported weight ($F[3, 773] = 14.90$; $P > .001$) was especially marked for overweight and obese children when compared with the other groups and for the normal weight category compared with the underweight group. No significant interaction was observed for parent's reports.

As shown in **Table III**, self-misclassification occurred for 25.5% of the children in the underweight category, 12.5% of those in the normal BMI category, 35.4% in the overweight category, and 28.6% in the obese category. Misclassified children ended up mostly in the nearest lower category for normal weight, overweight, and obese children