

Original article

The role of underestimating body size for self-esteem and self-efficacy among grade five children in Canada



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ABSTRACT

Purpose: Underestimating body size hinders healthy behavior modification needed to prevent obesity. However, initiatives to improve body size misperceptions may have detrimental consequences on self-esteem and self-efficacy.

Methods: Using sex-specific multiple mixed-effect logistic regression models, we examined the association of underestimating versus accurate body size perceptions with self-esteem and self-efficacy in a provincially representative sample of 5075 grade five school children. Body size perceptions were defined as the standardized difference between the body mass index (BMI, from measured height and weight) and self-perceived body size (Stunkard body rating scale). Self-esteem and self-efficacy for physical activity and healthy eating were self-reported.

Results: Most of overweight boys and girls (91% and 83%); and most of obese boys and girls (93% and 90%) underestimated body size. Underestimating weight was associated with greater self-efficacy for physical activity and healthy eating among normal-weight children (odds ratio: 1.9 and 1.6 for boys, 1.5 and 1.4 for girls) and greater self-esteem among overweight and obese children (odds ratio: 2.0 and 6.2 for boys, 2.0 and 3.4 for girls).

Conclusions: Results highlight the importance of developing optimal intervention strategies as part of targeted obesity prevention efforts that de-emphasize the focus on body weight, while improving body size perceptions.

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Introduction

The prevalence of overweight and obese children in developed countries has more than doubled since 1980. In Canada, there are nearly 2 million (31%) children aged 5 to 17 years classified as overweight or obese [1]. Despite these trends and associated health risks [2,3], an estimated 70% to 80% of children underestimate their weight, and this discrepancy is particularly common among overweight children [4–6]. Among obese children aged 7 to 10 years presenting for treatment at a hospital-based weight management

program, nearly 40% did not perceive themselves as obese (28% and 11% considered themselves to be “average weight” and “underweight”, respectively) [7]. Previous studies have found child's younger age, lower socioeconomic status, living in rural areas, Hispanic background, and increased peer weight to be associated with less accurate perceptions of overweight [8–11]. Body size perceptions also appear to be gender patterned. Studies report that normal-weight girls perceive their body size more accurately than boys [12–16], and overweight and/or obese girls underestimate their body size more than boys [6]. However, other studies do not replicate this gender difference in body size misperceptions [4]. Body size misperceptions have also been linked with engaging in unhealthy weight-control behaviors (e.g., meal skipping, excessive dietary restrictions, use of laxatives, and diet pills, self-induced vomiting, and binge eating) among overweight and obese children [5,14,17–21]. For example, inaccurate perceptions have been

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reported to be associated with exercising for less than 60 minutes five times per week, and consuming food with more calories, including less than five servings of fruits and vegetables [14,17] nor having taken recent action to lose weight [22]. In fact, perceiving oneself as overweight, rather than objective weight status, was the strongest predictor of the intention to lose weight [17]. Targeting body size awareness has been suggested as an important leverage point for interventions designed to prevent overweight or reduce obesity [7,23,24], on the premise that it promotes the adoption and maintenance of healthy behaviors [25]. However, opponents of this strategy are concerned that such interventions may have detrimental consequences, such as low self-esteem, self-efficacy, and other psychological sequelae related to excess weight (e.g., anxiety, depression) [26].

The ability to make and maintain healthy behavior changes may be compromised by poor psychosocial health, particularly lower self-efficacy [27]. Yet, overweight has been linked prospectively with compromised psychosocial health among children [28]. Overweight and/or obese children, particularly girls, are found to be at high risk for depression and anxiety through psychosocial processes involving weight-related stigmatization, social isolation, and body dissatisfaction [12,20]. However, the role of underestimating excess weight for psychosocial health in children has not been previously considered. Before targeting inaccurate body size perceptions to improve the effectiveness of interventions to prevent overweight and reduce obesity in children, we need to know whether underestimating excess weight may be protective against poor self-esteem and self-efficacy among children, and whether this relationship varies by weight status. Moreover, we need to consider gender dynamics because both inaccurate weight perceptions [11,12,14] and the negative impact of overweight and/or obesity on psychosocial health in children [29] are gender patterned. In the present study, we examined the importance of underestimating weight versus accurate weight perceptions for self-esteem and self-efficacy in a large provincially representative sample of grade five school children in Nova Scotia, Canada.

Material and methods

Study population

Children's Lifestyle And School-performance Study (CLASS) II is a large, serial cross-sectional, provincially representative study designed to evaluate the nutrition and dietary behavior, physical activity, mental health, and school performance of grade five students in Nova Scotia, Canada in 2011. The vast majority of the grade five-student population in Nova Scotia attends public schools; all public schools were invited to participate. Of 286 schools, 269 (94.1%) agreed to participate; and 5913 parents provided their consent, resulting in an average response rate of 67.4% per school. Children were on average aged 11 years (range, 9 to 13 years). Students completed questionnaires administered at school. Detailed protocols which describe all data collection procedures, including questionnaires, are available online at <http://www.nsclass.ca>. The Health Research Ethics Board at the University of Alberta and Dalhousie University approved the CLASS study protocol and data analyses of the present study.

Measures

Outcomes

Self-esteem. Self-esteem was assessed using a three-point scale consisting of 10 items (four positive and six negative), where children were asked to choose an answer that best describes them [30–32]. Positive descriptors were as follows: “My future looks

good to me”; “I like the way I look”; “I like myself”; and “If I have problems there is someone I trust to go to for advice”. Negative descriptors were as follows: “I feel like I do not have any friends”; “I feel unhappy or sad”; “I worry a lot”; “I am in trouble with my teacher(s)”; “I have trouble paying attention”; and “I have trouble enjoying myself”. Response categories included the following: “never or almost never”, “sometimes”, and “often or almost always” and were each assigned a score from 1 to 3. Negative descriptors were reverse scored. An aggregate measure of self-esteem was created by summing scores across the 10 items to create a scale ranging from 10 to 30, with higher values indicating greater self-esteem [33]. The scale appears to be internally consistent (Cronbach alpha = 0.70). Factor analysis with varimax rotation of these items extracted two factors (one including all the positive descriptors and another including all the negative descriptors) with loadings greater than 0.60 for each, and each accounted for more than 40% of the total variance.

Self-efficacy. To assess self-efficacy for healthy eating and self-efficacy for physical activity, students were asked nine questions as follows: “If you wanted to, how confident are you that you could...”: be physically active no matter how tired you may be; be physically active even if you have a lot of homework; ask your parent or other adult to play a physical activity or a sport with you; and be physically active for at least 60 minutes on 5 more days per week; eat healthy food if at school; choose a healthy snack between school and dinner time; eat healthy food if you are alone at home; choose a healthy snack when you are bored; and choose a healthy snack when you are sad [34,35]. Response categories included “not at all confident”, “a little bit confident”, “quite confident”, and “very confident” and were each assigned a score from 1 to 4. An aggregate measure of self-efficacy was created by summing separately scores (5 for healthy eating and 4 for physical activity) across the items to create a scale ranging from 4 to 16 for physical activity and 5 to 20 for healthy eating, with higher values indicating greater self-efficacy. The internal consistency of the scales was acceptable (Cronbach alpha, 0.69 and 0.84, respectively). Factor analysis with varimax rotation of the items for physical activity and healthy eating analyzed separately, extracted one factor with loadings more than 0.60 and more than 0.70, respectively, and accounted for 52% and 60% of the total variance.

Exposure

Inaccurate body size perceptions. Weight status was based on measured height and weight. Height was measured to the nearest 0.1 cm without shoes using a stadiometer and weight to the nearest 0.1 kg using a calibrated digital scale. Body mass index (BMI) was calculated to the nearest 0.01 kg/m². BMI z scores and weight status categories (underweight, normal weight, overweight, and obese) were created according to the World Health Organization age-specific and gender-specific reference values [36].

Perceived body size was assessed using the Stunkard body rating scale, a visual analog scale consisting of seven sex-specific drawings of the same height, with weight ranging from underweight to obese [37]. Participants selected the drawing they perceived best corresponded to their current appearance. Perceived body size categories (underweight, normal weight, overweight, and obese) corresponded to drawings 1–2; 3–4; 5; and 6–7, respectively [38–40].

Two body size perceptions categories (underestimate vs. accurate) were created and treated as a categorical variable in regression analyses, with the latter as a reference category. Specifically, normal weight, overweight, and obese children who selected silhouettes 1–2; 1–4; and 1–5, respectively, were classified as underestimating body size (weight status > perceived body size). Normal weight, overweight, and obese children who selected silhouettes 3–4; 5;

and 6–7, respectively, were classified as accurately perceiving body size (weight status = perceived body size).

Confounders. Demographic characteristics included student's gender (boy vs. girl), region of residence, household income, and parents' education. Region of residence (urban [reference category] vs. rural) was assigned based on the second character of the forward sortation area in the Canadian postal code; rural postal codes contain "0" as the second character. Parents reported their highest level of education and current annual household income in Canadian dollars from all sources. Three categories were created for education (elementary school [reference category], secondary school and/or college diploma, and university degree or higher) and income ($\leq \$60,000$ [reference category], \$60,001–\$100,000, and $> \$100,000$) to ensure sufficient number of respondents in each category.

Data analyses

Differences in outcomes across body size perception categories were tested using Rao-Scott χ^2 test, which is suitable for clustered data. The distribution of the outcomes' scales was negatively skewed (Pearson's moment coefficient of skewness: -0.7 for self-esteem; -0.4 for two self-efficacy scales), and transformations (natural log, log 10, inverse, and square root) did not approximate a normal distribution. Therefore, scores less than or equal versus greater than the median (26 for self-esteem; 12 and 15 for two self-efficacy scales) were dichotomized and treated as a categorical variable in regression analyses, with the latter as a reference category. To evaluate the independent effect of underestimating versus accurate body size perceptions (reference category) on self-esteem and self-efficacy (\leq median vs. $>$ median), multiple mixed-effect logistic regression models were estimated, adjusting for household income, parental education, and area of residence. The nested data structure (i.e., clustering of students' observations within schools) was taken into account through multilevel (mixed effect) modeling with random intercepts for schools. The models were stratified by student's weight status (normal weight, overweight, and obese) and gender (boy and girl) to take into account that the association between inaccurate body size perceptions and psychosocial outcomes may vary by weight status and/or gender. We excluded 318 children with no measured BMI and 81 children without perceived body size. We also excluded 86 children who overestimated body size because of small sample size and to maintain the focus on underestimating versus accurately perceiving body size in the context of obesity prevention. Analyses were based on 5075 grade five students, of whom 98% were 10–12 years old (mean age = 11.0, SD = 0.37). Sensitivity analyses included models that eliminated data on 26 children classified as underweight who did not overestimate body size (i.e., had accurate body size perceptions). As results remained robust, we present results from the most parsimonious models based on the largest sample size (i.e., merging the underweight and normal-weight categories). All analyses were weighted for nonresponse bias. Descriptive analyses were conducted using Stata version 12 (StataCorp, College Station, TX), and regression analyses were conducted using R (version 3.0.2).

Results

Students' characteristics are listed in Table 1. About half (52%) were girls, and 43% were overweight or obese. Overall, 53% underestimated body size. Among overweight boys and girls, 91% and 83% of underestimated body size; and 93% and 89% underestimated body size among obese girls and boys (Table 2).

Table 1

Characteristics of grade five students in Nova Scotia, Canada, 2011

Characteristic	Total, n (%) n = 5075	Boy, n (%) n = 2445 (48.0)	Girl, n (%) n = 2630 (52.0)
Body size perceptions			
Accurate	2389 (47.0)	1157 (47.0)	1232 (47.0)
Underestimate	2686 (53.0)	1288 (53.0)	1398 (53.0)
Self-esteem			
\leq median	2857 (57.0)	1456 (60.0)	1401 (54.0)
$>$ median	2218 (43.0)	989 (40.0)	1229 (46.0)
Self-efficacy for physical activity			
\leq median	3095 (61.0)	1412 (58.0)	1683 (64.0)
$>$ median	1980 (39.0)	1033 (42.0)	947 (36.0)
Self-efficacy for healthy eating			
\leq median	2759 (55.0)	1436 (59.0)	1323 (51.0)
$>$ median	2316 (45.0)	1009 (41.0)	1307 (49.0)
Weight status			
Normal	2927 (57.0)	1320 (54.0)	1607 (61.0)
Overweight	1173 (23.0)	564 (23.0)	609 (23.0)
Obese	975 (20.0)	561 (23.0)	414 (16.0)
Parent's education			
Elementary school	848 (19.0)	383 (17.0)	465 (20.0)
Secondary school/ community college	1952 (42.0)	956 (43.0)	996 (41.0)
University	1884 (39.0)	926 (40.0)	958 (39.0)
Household income			
$\leq \$60,000$	1621 (43.0)	757 (41.0)	864 (44.0)
\$60,000–100,000	1250 (32.0)	622 (33.0)	628 (31.0)
$> \$100,000$	1054 (25.0)	515 (26.0)	539 (25.0)
Region of residence			
Rural	1825 (36.0)	879 (36.0)	946 (36.0)
Urban	3250 (64.0)	1566 (64.0)	1684 (64.0)

Overall, substantial proportions reported having lower (i.e., \leq median) self-esteem and self-efficacy for physical activity and healthy eating (57%, 61%, and 55%, respectively), and these proportions were slightly higher among overweight and obese children (Fig. 1). However, there were important differences in the prevalence of lower self-esteem and self-efficacy between body size perception categories. Among overweight and obese children, boys and girls who underestimated body size were more likely to have greater self-esteem, compared with their peers who had accurate perceptions ($P < .05$). For self-efficacy, normal-weight boys and girls who underestimated body size were more likely to have greater self-efficacy for physical activity and healthy eating, compared with their peers who had accurate perceptions ($P < .05$). A similar finding was observed for overweight girls but not overweight boys.

Multiple mixed-effect logistic regression models, listed in Table 3, corroborated these differences. Normal-weight boys who underestimated versus accurately perceived body size were more likely to have greater self-efficacy for physical activity and healthy eating (odds ratio [OR], 1.86 and 1.65, respectively), compared with those who had accurate perceptions. Overweight and obese boys who underestimated versus accurately perceived body size were more likely to have greater self-esteem (OR, 2.02 and 6.21, respectively), compared with those who had accurate perceptions. The results for girls were similar to boys although less pronounced (OR, 2.04 and 3.45). Additionally, overweight girls who underestimated versus accurately perceived body size were more likely to have greater self-efficacy for physical activity and healthy eating (OR, 1.76 and 1.64, respectively), compared with those who had accurate perceptions.

Discussion

In this study, we examined if inaccurate body size perceptions (i.e., underestimate vs. accurate) were associated with psychosocial

Table 2
Prevalence of body size perceptions among grade five students by weight status and gender

Weight status	Boys, n (%)			Girls, n (%)		
	Accurate	Underestimate	<i>P</i> *	Accurate	Underestimate	<i>P</i> *
Normal weight	1069 (81.0)	251 (19.0)	<.001	1089 (67.0)	518 (33.0)	<.001
Overweight	52 (9.0)	512 (91.0)		102 (17.0)	507 (83.0)	
Obese	36 (7.0)	525 (93.0)		41 (11.0)	373 (89.0)	

* Based on Rao-Scott χ^2 test.

health among elementary school children; and if this relationship varied according to children's weight status (overweight and obese vs. normal weight) and by gender. Three key findings emerged from this study. First, among normal-weight children, underestimating body size was protective against lower self-efficacy for physical

activity and healthy eating. Second, among overweight and obese children, underestimating body size was protective against lower self-esteem. Third, overweight girls were particularly vulnerable to the influence of having accurate perceptions of excess body size on psychosocial health.

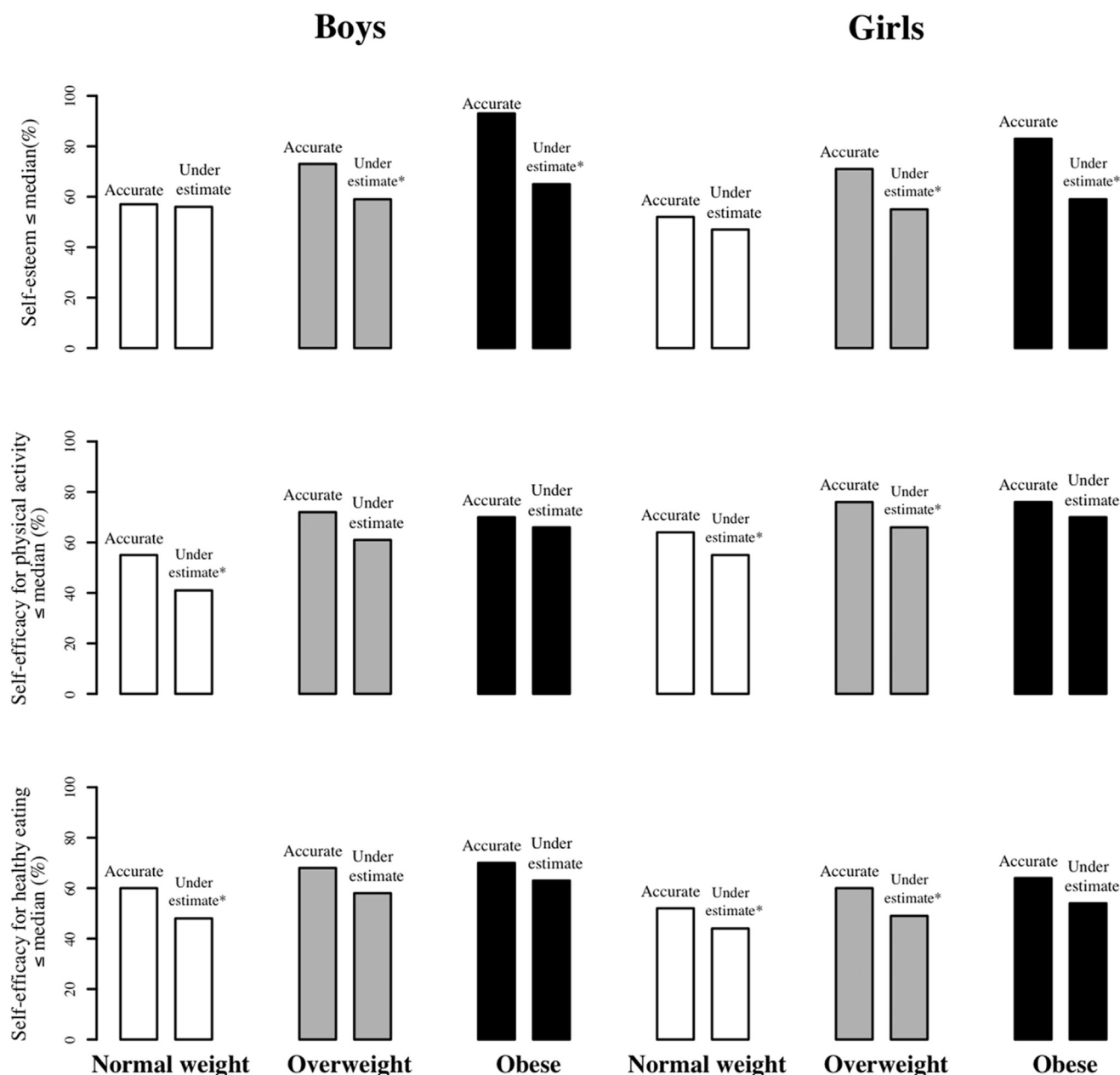


Fig. 1. Percentage of grade five students reporting lower self-esteem and self-efficacy by body size perceptions, weight status and gender. **P* < 0.05 for the bivariate associations based on Rao-Scott χ^2 test.

Table 3

Association of underestimating versus accurately perceiving body size with self-esteem and self-efficacy among grade five students in Nova Scotia, Canada by weight status and gender

Outcome	Boys, OR (95% CI)*	Girls, OR (95% CI)*
Normal weight		
Self-esteem (>median = reference)	1.05 (0.78–1.42)	1.24 (0.99–1.55)
Self-efficacy for physical activity (>median = reference)	1.86 (1.38–2.51)	1.47 (1.17–1.85)
Self-efficacy for healthy eating (>median = reference)	1.65 (1.23–2.22)	1.44 (1.15–1.80)
Overweight		
Self-esteem (>median = reference)	2.02 (1.02–4.01)	2.04 (1.25–3.31)
Self-efficacy for physical activity (>median = reference)	1.81 (0.92–3.55)	1.76 (1.05–2.95)
Self-efficacy for healthy eating (>median = reference)	1.60 (0.83–3.08)	1.64 (1.03–2.59)
Obese		
Self-esteem (>median = reference)	6.21 (1.76–21.86)	3.45 (1.51–7.90)
Self-efficacy for physical activity (>median = reference)	1.05 (0.49–2.26)	1.30 (0.60–2.79)
Self-efficacy for healthy eating (>median = reference)	1.35 (0.62–2.91)	1.26 (0.64–2.47)

*OR (95% CI): Odds Ratios and 95% confidence intervals from multivariate mixed-effect logistic regression models, adjusted for household income, parental education, and area of residence.

To the best of our knowledge, this is the first study to link inaccurate body size perceptions with psychosocial health in children. Corroborating previous reports [4–6], we found substantial proportions of elementary school children underestimated body size. The limited success of interventions to prevent overweight and reduce obesity among children [41,42] underscores the need to consider innovative targets such as body size misperceptions to improve healthy behavior modification [43]. Making and maintaining healthy behavior changes can be challenging when children have poor psychosocial health [44]. The results of this study show that proportions of children with lower self-esteem and self-efficacy were high regardless of weight status but were even higher among overweight and obese children. These findings are concerning given the high prevalence of overweight and obesity among children [1] and the persistence (or tracking) of overweight and/or obesity from childhood to adulthood [45]. The challenge of making healthy behavior choices when mental or psychosocial health is compromised may impede the success of obesity prevention efforts and contribute to increases not only in the prevalence of chronic diseases associated with overweight and obesity in childhood, but also poor mental health [44].

Poor self-esteem and self-efficacy are predictive of participation in a range of unhealthy and/or adverse weight-control behaviors (e.g., meal skipping, excessive dietary restrictions, use of laxatives and diet pills, self-induced vomiting, and binge eating) during childhood and young adulthood [20,21]. As lower self-esteem and self-efficacy are common among overweight and obese children, it is perhaps not surprising that overweight and/or obese children are found to be at higher risk than their healthy weight peers for adverse (extreme) weight-control behaviors [46]. Our finding that accurate body size perceptions are associated with lower psychosocial health among elementary school children suggests that interventions to prevent overweight and reduce obesity in children should promote the development and implementation of optimal strategies that de-emphasize the focus on body weight while improving body size perceptions. Research is emerging to illustrate that such strategies may be promising. For example, a recent 6-month physical activity skill-building intervention that was not designed to target body size perceptions, improved the accuracy of perceptions in US preadolescents aged 8 to 11 years without explicit reference to body size, weight, or image [38].

Several studies provide empirical evidence to support the hypothesis that accurate body size perceptions motivate children to adopt and maintain healthy behaviors or gain less weight. Among 880 overweight and obese grade 9 to 12 adolescents, those who had accurate body size perceptions had intentions to lose weight and were actively engaged in weight-related behavior change [47]. More recently, accurate perceptions of excess body size were positively associated with weight loss attempts among 4691 overweight or obese children, aged 8 to 15 years, who participated in the 2005–2010 National Health and Nutrition Examination Survey [48]. Accurate body size perceptions were also linked to attempts to lose weight in a school-based sample of 1432 students aged 11 to 17 years in the Seychelles [5]. Emerging evidence in adults also suggests that inaccurate body size perceptions are associated with less physical activity and less interest in or attempts at weight loss among overweight and obese adults who participated in the 2003–2006 National Health and Nutrition Examination Survey [25]. However, these studies do not consider the role of compromised mental health in making healthy behavior or weight loss choices.

If compromised psychosocial health impedes healthy behavior modification, our finding that accurate body size perceptions are associated with lower self-esteem among overweight and/or obese children extends the current literature regarding factors associated with body size misperception. It underscores the importance of assessing body size perceptions in the design of obesity prevention interventions to help facilitate healthy behavior changes. Our study has also identified overweight girls as being particularly vulnerable to the effect of having accurate body size perceptions on psychosocial health. This finding is not surprising. Although issues of body-weight preoccupation are heightened during adolescence and overweight girls may be particularly susceptible to cultural and societal pressures to be thin, societal weight stigma is meted out more harshly on overweight girls than overweight boys [49]. Previous studies have reported on the high prevalence of body dissatisfaction, anxiety, depression, a host of unhealthy weight-control behaviors, and eating disorders, including bulimia and anorexia nervosa, in this population [20,46].

Strengths of this study include the use of a large representative population-based sample of elementary school children, with a high-response rate for school-based survey research. Another strength was measured height and weight. Many previous studies relied on self-reported height and weight for BMI calculation to model the deviation between individuals' actual and perceived body size [4,9,14], both of which are prone to measurement error and gender biases in perceptions [13]. Limitations included the study's cross-sectional design that precludes making causal inferences about the impact of body size perceptions on psychosocial health. Longitudinal studies are required to elucidate the nature of the relationship. Although the Stunkard Body Rating Scale, used to quantify inaccurate body size perceptions, is not directly matched to BMI, the drawings are highly correlated ($r = 0.79$) with measured BMI percentiles [50,51] and have been used successfully in previous research on inaccurate weight perceptions [11,38–40]. Although body size perceptions are influenced by ethnic and cultural background [12], we had no measure of participants' ethnic or cultural background. The Nova Scotia population is primarily Caucasian and relatively ethnically homogenous compared with other Canadian provinces; we would expect a low proportion of non-Caucasian population in CLASS II. CLASS II did not collect information on unhealthy weight-control behaviors, whereas physical activity and dietary behaviors were based on students' self-report, which is prone to measurement error, social desirability, and gender biases.

Conclusions

Childhood obesity prevention interventions have had limited success to date [41]. It has been suggested that targeting body size awareness may prime children to be more receptive to adopting healthy lifestyle behaviors and may improve the effectiveness of obesity prevention interventions. This study identified body size perceptions as an important factor for psychosocial health among elementary school children. Results highlight the importance of promoting the development and implementation of optimal intervention strategies that de-emphasize the focus on body weight while improving body size perceptions. It may also be prudent to assess body size misperceptions in targeted intervention efforts to help facilitate and motivate healthy behavior changes.

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