Self-reported weight loss attempts and weight-related stress in childhood: heightening the risk of obesity in early adolescence

Running title: Weight loss attempts in children

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Abstract word count: 238

Main text word count: 3890

Number of references: 51

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ACKNOWLEDGEMENTS

Funding source

This work is embedded in the QUALITY cohort, which is supported by the Canadian Institutes of Health Research [grant numbers OHF-69442, NMD-94067, MOP-97853 and MOP-119512]; the Heart and Stroke Foundation of Canada [grant number PG-040291]; and the Fonds de recherche du Québec – Santé. Soren Harnois-Leblanc is supported by a doctoral scholarship from the Fonds de recherche du Québec – Santé. Catherine M. Sabiston is funded by the Canada Research Chairs Program. Mélanie Béland and Isabelle Doré were supported by a postdoctoral fellowship from the Fonds de recherche du Québec – Santé at the time of manuscript preparation. Marie-Pierre Sylvestre and Andraea Van Hulst are supported by Junior 1 Salary Award from the Fonds de recherche du Québec – Santé. D^{r} Mélanie Henderson is supported by Junior 2 salary award from the Fonds de recherche du Québec – Santé and the Canadian Society of Endocrinology and Metabolism Young Investigator Award. The funding sources had no involvement in the study design, in the collection, analysis and interpretation of data, in the writing of the report and in the decision to submit the article for publication.

Other acknowledgements

D[r] Marie Lambert (July 1952 – February 2012), pediatric geneticist and researcher, initiated the QUALITY cohort. Her leadership and devotion to QUALITY will always be remembered and appreciated. The cohort integrates members of TEAM PRODIGY, an inter-university research team including Université de Montréal, Concordia University, Centre INRS - Institut Armand-Frappier, Université Laval, and McGill University. The research team is grateful to all the children and their families who took part in this study, as well as the technicians, research assistants, and coordinators involved in the QUALITY cohort project.

Conflict of interest statement

D[r] Mélanie Henderson is recipient of the Canadian Society of Endocrinology and Metabolism Young Investigator Award. The other authors have no conflict to declare.

ABSTRACT

Objective. Weight loss attempts occur as early as childhood. The impacts of weight loss attempts and weight-related stress on the occurrence of obesity during childhood remain unknown. We aimed to: 1) assess the prevalence of self-reported weight loss attempts and weight-related stress in 8-10 year-old children and 2) determine associations with adiposity two years later.

Method. Data were collected from a cohort study of 564 Canadian children aged 8-10 years having one or both biological parents with obesity (QUALITY cohort). Self-reported weight loss attempts and weight-related stress were assessed at baseline in the child's questionnaire. Adiposity was measured at baseline and two years later using body mass index z-scores (zBMI), waist-to-height ratio (WHtR) and percentage of body fat (%BF) obtained from dual energy x-ray absorptiometry. Linear and logistic regression analyses were used while adjusting for potential confounders.

Results. Forty-eight percent of children reported previous weight loss attempts and 20% reported weight-related stress. Self-reported weight loss attempts and weight-related stress were associated with higher zBMI, WHtR and %BF two years later in adjusted models, although estimates were attenuated when including baseline adiposity measures. Self-reported weight loss attempts, but not weight-related stress, increased the risk of becoming overweight among children who were normal weight at baseline.

Discussion. Weight loss attempts are prevalent in children with parental obesity. Children reporting weight loss attempts and weight-related stress tend to have higher adiposity two years later and are more likely to become overweight.

Key words: weight loss attempts, dieting, weight-related stress, children, adolescents, obesity, adiposity, fat mass, body mass index, waist-to-height ratio

INTRODUCTION

Currently, an estimated 27% of Canadians aged 3 to 19 years have overweight or obesity (Rodd & Sharma, 2016). Yet children and adolescents are surrounded by messages promoting thinness and weight loss (Fouts & Burggraf, 1999; Perloff, 2014). Not surprisingly, estimates as high as 58% of girls and 24% of boys in Canada report trying to control their weight (Patte & Leatherdale, 2016). Dieting and other unhealthy weight loss behaviors (e.g. purging, using laxatives) manifest in up to 75% of adolescents (Balantekin et al., 2015; Ha et al., 2013). Controlling weight might lead to paradoxical results, as emerging evidence suggests that weight loss attempts constitute a determinant for later obesity (Neumark-Sztainer et al., 2012; Quick et al., 2013; Yoon et al., 2020).

Indeed, dieting and attempts to lose weights may lead to weight regain through positive feedback signals from weight loss through increased appetite, reduced thermogenesis and more efficient fat uptake by adipocytes (Dulloo et al., 2015). Moreover, dieting during adolescence is a shared risk factor for overweight/obesity and disordered eating (Haines et al., 2010; Neumark-Sztainer et al., 2007), both of which track from adolescence to adulthood (Guo et al., 1994; Liechty & Lee, 2013). To counteract the development of a chronic and interconnected relationship between disordered eating and excess weight, preventing unnecessary and unhealthy weight loss attempts before adolescence is essential.

Despite evidence that weight loss behaviors are manifest by the age of 8 years (Aimé et al., 2015), there is a paucity of literature on their impact in childhood on later adiposity. Furthermore,

the perception of what constitutes weight loss behaviors is not always clear for children (Neumark-Sztainer & Story, 1998). The ability of children to identify specific weight loss methods (e.g. physical activity for weight loss versus for fun, knowledge of purging or laxative use) may be limited. Hence, we were interested in using a broad, self-perceived definition of weight loss attempts in children and to test the relationship with subsequent obesity risk. Existing studies on self-reported weight loss attempts in American children show that these are common (55%) (Brown et al., 2019) and are associated with a greater obesity risk in children and adolescents (Lam et al., 2019; Zhang et al., 2016). However, existing studies predominantly use cross-sectional designs, impeding our ability to decipher whether weight loss attempts lead to obesity or whether children with obesity are more likely to report weight loss attempts. The few longitudinal studies in children focused on dieting as a specific weight loss attempt and found some evidence for an association between dietary restraint at eight years of age and higher BMI z-score (zBMI) three years later (Christiansen et al., 2017). Similarly, dieting at 11 years old was linked to a greater risk of incident obesity 4 years later, but in girls only after adjusting for confounders (Assunção et al., 2012).

Weight loss attempts may co-occur with weight-related stress (i.e., negative emotion focused on weight, preoccupation with body fat, fears of being fat), although there is limited focus on weight-related stress among children (Liu & Umberson, 2015; van Jaarsveld et al., 2009). For example, psychosocial stress is associated with an increased risk of emotional eating and eating in the absence of hunger in childhood (Miller et al., 2018). Weight concerns (preoccupation with being thin, fear of gaining weight) constitute an important determinant of obesity in adolescents (Haines et al., 2010; Haines et al., 2007; Neumark-Sztainer et al., 2007).

In addition, differences in weight loss attempts exist between boys and girls (Ha et al., 2013; Patte & Leatherdale, 2016) and across weight status (Chen et al., 2014; Megalakaki et al., 2013). Consequently, investigating how the associations between weight loss attempts, weight-related stress and adiposity differ by sex and by weight status is critical for the development of tailored interventions to prevent weight loss attempts and weight-related stress occurrence.

Our study aims to: 1) assess the prevalence of self-reported weight loss attempts and weight-related stress in a cohort of children aged 8-10 years; 2) determine whether self-reported weight loss attempts and weight-related stress experienced during childhood are associated with adiposity during adolescence; 3) examine whether these associations differ between boys and girls or across levels of childhood adiposity. We hypothesize that self-reported weight loss attempts and weight-related stress at 8-10 years of age will be independently associated with greater adiposity in early adolescence.

METHODS

Design and setting

Data stem from the Quebec Adipose and Lifestyle Investigation in Youth (QUALITY) cohort study, aiming to describe the natural history of obesity and its cardiometabolic consequences during childhood. Complete methodology of the study has been published elsewhere (Lambert et al., 2012).

Participants

Recruitment was school-based among second to fifth-grade students in elementary schools of three major urban centers in the province of Quebec. The children were recruited at 8-10 years if they had at least one biological parent with obesity (defined as a BMI $\geq$ 30 kg/m^2 or a waist circumference > 102 cm in men and > 88 cm in women) (Grundy et al., 2005). The cohort was restricted to children from European ancestry, in order to avoid genetic admixture, given that one of the overarching objectives of the cohort was to study the genetic determinants of obesity. Children were excluded if they presented any of the following: i) diagnosis of type 1 or 2 diabetes; ii) a serious illness, psychological condition or cognitive disorder that hindered participation to the study; iii) treatment with anti-hypertensive medication or steroids (except if administered topically or through inhalation); iv) adherence to a very restricted diet (<600 kcal/day); or their family planned to move out of the province. A total of 630 children participated in the baseline evaluation, and 564 were re-evaluated 2 years later (retention rate = 89%).

The study was conducted following the principles of the Declaration of Helsinki and approved by the ethical research committees of the CHU Sainte-Justine and the Quebec Heart and Lung Institute (MP-21-2005-79, November 22nd, 2019). Informed assent and consent were obtained from the child and one parent, respectively.

Measures

Exposure variables

Self-reported weight loss attempts and weight-related stress were assessed at baseline using an interviewer-administered questionnaire to the children. The questionnaire was designed and pretested for a provincial survey on children and adolescents health (Institut de la statistique du Québec, 2002). Self-reported weight loss attempts were measured based on two questions: "*Have you ever tried to lose weight?*" (1 = yes, 0 = no); and "*Currently, what are you doing about your weight?*" (1 = trying to lose weight, 2 = trying to gain weight, 3 = want to maintain my weight, 4 = not doing anything about my weight). For this question, we compared the children who were trying to lose weight with those who were doing nothing about their weight. Weight-related stress was assessed using a four-point Likert scale question: "*During the past three months, have you been worried or stressed by your weight?*" (1 = not at all, 2 = a little bit, 3 = quite a bit, 4 = a whole lot). We decided *a priori* to combine the children who answered "A little bit", "Quite a bit" or "A whole lot" given that we expected only a small number of children reporting higher levels of weight-related stress. Thus, children who experienced weight-related stress at any level were compared to "Not at all".

Outcomes

Children's adiposity was assessed at baseline and at two-year follow-up. Weight, height and waist circumference were measured by trained research nurses following standardized protocols (Lambert et al., 2008; Lohman et al., 1988; Paradis et al., 2003). Age and sex adjusted BMI z-score were computed using the Center for Disease Control and Prevention (CDC) growth charts and BMI categories were attributed based on the CDC percentiles: underweight if $< 5^{th}$; normal weight if between the $\geq 5^{th}$ and $< 85^{th}$; overweight if $\geq 85^{th}$ and obese if $\geq 95^{th}$ (2000 Centers for Disease Control and Prevention Growth Charts, 2000). Incidence of overweight was

defined as becoming overweight at follow-up in the children who were normal weight at baseline. Incidence of obesity was defined as becoming obese at follow-up in the children who were normal weight or overweight at baseline. Body composition was measured by dual-energy x-ray absorptiometry (DEXA, Prodigy Bone Densitometer System, DF+14664, GE Lunar Corporation, Madison, WI, USA) and adiposity was expressed as percent body fat (%BF). The waist-to-height ratio (WHtR) was calculated by dividing waist circumference (cm) by height (cm). In children, WHtR is a stronger predictor of adverse cardiometabolic outcomes than whole-body adiposity (Sharma et al., 2015).

Covariates

Pubertal development according to Tanner stages (Marshall & Tanner, 1969, 1970) was assessed by a trained nurse. Mother's and father's BMI were calculated from the measured weight and height at baseline following standardized protocols (Lambert et al., 2012). Highest parental educational attainment was self-reported by parents at baseline as a proxy for socioeconomic position.

Statistical analyses

We conducted sex-specific descriptive analyses using means (with standard deviations [SD]) or proportions (%) to characterize participants at baseline and follow-up. Changes in adiposity measures (zBMI, WHtR and %BF) between baseline and follow-up were calculated with paired Student's T tests and stratified by sex. Linear regression analyses were used to examine whether self-reported weight loss attempts and weight-related stress were associated with each of

zBMI, WHtR and %BF two years later. Each predictor was estimated separately using distinct models for each of weight loss attempt or weight-related stress variable. We estimated both unadjusted and adjusted models controlling for the child's age, sex, pubertal stage (ordinal: stage 1, stage 2, stage 3, stage 4/5), father's and mother's BMI and parental education. We investigated two-year change in adiposity measures by estimating models that were further adjusted for the corresponding baseline adiposity measure (e.g. zBMI at baseline for the model examining the association with zBMI at follow-up). Fit of the linear regression models was examined with residual plots.

We verified whether associations between weight loss attempts, weight-related stress and adiposity two years later differed between girls and boys by including the appropriate interaction term in the model. Similarly, an interaction term was added to the model to assess whether associations differed according to the child's baseline adiposity.

We also estimated the associations between self-reported weight loss attempts and weight-related stress with incident overweight or obesity using logistic regression, as these outcomes are clinically relevant. Due to the small number of participants who moved to a higher BMI category, models were only adjusted for sex and pubertal stage.

Analyses were conducted using R version 4.0.2 (© 2020 The R Foundation for Statistical Computing, Vienna, Austria). Statistical significance was determined at the 0.05 level.

RESULTS

Characteristics of the children at baseline and follow-up

Characteristics of children at baseline and follow-up are presented by sex in **Table 1**. At 8-10 years, 48.2% of girls and boys had ever tried to lose weight and 39.0% of girls and 35.9% of boys were currently trying to lose weight. Many girls (18.8%) and boys (21.6%) reported being stressed by their weight in the past three months. A higher proportion of children who were overweight or obese at baseline had ever tried to lose weight compared to children who were normal weight (80.3% vs. 27.3%, $p < 0.001$). Children who were overweight or obese reported more weight-related stress compared to children who were normal weight (41.8% vs 6.9%, $p < 0.001$). Older children at baseline were more likely to report weight loss attempts and to experience weight-related stress (**Table S1, Supporting information file**).

The children lost to follow-up (10.5%) displayed a higher mean %BF and lower parental education level at baseline compared to those who stayed in the cohort (**Table S2, Supporting information file**). Moreover, children lost to follow-up were more likely to report past weight loss attempts, although the difference was not statistically significant, and to have been stressed by their weight compared to the children who completed both assessments.

In girls, %BF increased by 1.38% on average (95% CI -0.34 ; 3.10) and in boys, by 2.39% (95% CI 0.68 ; 4.09), while zBMI and WHtR did not vary significantly across the 2 years of follow-up **(Table 2)**. Among the 321 children who were normal weight at baseline, 5.6% became

overweight after two years and 21.8% of the 110 children who were overweight at baseline became obese at follow-up. None of the children went from normal weight to obesity across two years.

Self-reported weight loss attempts, weight-related stress and adiposity two years later

Unadjusted models show statistically significant associations between self-reported weight loss attempts, weight-related stress and all adiposity measures two years later (**Table 3)**. The adjusted models (controlling for child's age, sex, Tanner stage, father and mother's BMI and parental education) resulted in a similar impact of weight loss attempts and weight-related stress on later zBMI, WHtR and %BF, albeit slightly attenuated. When further adjusting for the corresponding baseline adiposity measure so as to examine associations with two-year changes in adiposity measures, all associations became almost null and were no longer statistically significant. An exception was the small inverse relationship observed between weight-related stress and zBMI. No statistically significant interactions by sex or by child's baseline adiposity were found in the associations between self-reported weight loss attempts, weight-related stress and measures of adiposity.

Self-reported weight loss attempts, weight-related stress and incidence of overweight or obesity

Normal weight children who reported weight loss attempts were three to four times more at risk of developing overweight two years later when adjusting for sex and pubertal stage (**Table 4**). Self-reported weight loss attempts were not associated with incident obesity. No statistically significant associations were observed between weight-related stress and new onset overweight or obesity.

DISCUSSION

In this study, self-reported weight loss attempts and weight-related stress were examined, as well as their impact on later adiposity, in a large sample of young, mostly prepubertal Canadian children. Weight loss attempts were reported by one child out of two, and one child out of five was worried about his/her weight in the last three months. These findings highlight the excessive and unhealthy focus on weight even at a very young age.

The prevalence of self-reported weight loss attempts in our study is comparable to findings observed in Korean adolescents (Ha et al., 2013), Canadian adolescent girls (Patte & Leatherdale, 2016), American children (Brown et al., 2019), Native American children (Davis & Lambert, 2000; Stevens et al., 1999; Story et al., 2001) as well as in Chinese children (Lu et al., 2017), but lower than has been reported in a study of 15-year old American girls, where 75% of girls were dieting (Balantekin et al., 2015). It is possible that in our study, having a parent with obesity increases the susceptibility to engage in weight loss attempts in childhood. Indeed, adults with overweight and obesity are more likely to diet to lose weight compared to adults of normal weight (Yaemsiri et al., 2011). Children may shape their relationship with food by modeling parental behaviors (Savage et al., 2007).

In the present study, we found that self-reported weight loss attempts were associated with higher zBMI, WHtR and %BF two years later. However, associations were null when the models were adjusted for baseline adiposity to model change in measures of adiposity over the two years

follow-up. In other words, we found no difference in zBMI at follow-up between children who reported weight loss attempts and those who did not when the zBMI at baseline was considered in the model (and equivalently for WHtR and %BF). The results corroborate findings of Wade *et al.* (Wade et al., 2017), who reported that problematic eating attitudes at 11.5 years of age increased the risk of new onset obesity at 16 years of age, but not when adjusting for BMI at 11.5 years. In our study, associations between self-reported weight loss attempts and change in adiposity may not have been observed due to insufficient variability in adiposity measures across two years. Most longitudinal studies in preteens and adolescents have found effects of weight loss attempts on BMI over longer periods of time (Assunção et al., 2012; Neumark-Sztainer et al., 2012; Quick et al., 2013; Wade et al., 2017), even after adjusting for baseline BMI (Field et al., 2003; Neumark-Sztainer et al., 2012; Quick et al., 2013).

When looking at %BF as a measure of adiposity, Tanofsky-Kraff *et al* (Tanofsky-Kraff et al., 2006) observed that children aged 6 to 12 years who reported dieting at least once in the past had a 19% greater increase in body fat across four years of follow-up compared with the children who reported never dieting, independently of baseline body fat. The wider age interval of the children recruited in the Tanofsky-Kraff study, the smaller sample size, the higher attrition (27%) and the specific assessment of dieting rather than more broadly engaging in any weight loss attempts, might explain differences in findings between our study and theirs.

We observed that among children who were normal weight at baseline, children who reported weight loss attempts were significantly more at risk of incident overweight than those who did not report weight loss attempts, which lends support to the hypothesis that weight loss

attempts could lead to overweight or obesity development in children. Alternatively, reported weight loss attempts did not increase the risk of incident obesity in children who were overweight at baseline. The small number of events of new onset overweight and obesity limited the number of potential confounders included in the model. Thus, residual confounding may have occurred. Dieting and engaging in extreme weight loss behaviors increased the risk of incident overweight over five years in American adolescents, and engaging in such behaviors was a stronger and more consistent risk factor than other behaviors such as soft drink consumption and sedentary behaviors (Haines et al., 2007). These findings highlight the need to establish awareness that the prevention of weight loss attempts is as important as adopting healthy lifestyle habits to promote healthy body weight in children.

We observed that weight-related stress was associated with a higher zBMI, WHtR and %BF two years later. Only, in the zBMI model accounting for the baseline measure, weight-related stress was associated with a decrease in zBMI two years later. Given the lack of consistency across adiposity measures, these findings should be interpreted judiciously. Moreover, weight-related stress was not associated with a higher risk of new onset overweight or obesity. It is possible that a longer period of follow-up may be required to detect a potential impact of weight-related stress on adiposity variation, given that longitudinal studies investigating childhood stress and weight change found deleterious associations after five years (Liu & Umberson, 2015; van Jaarsveld et al., 2009).

Associations between self-reported weight loss attempts and weight-related stress with adiposity two years later did not differ between girls and boys in our sample. Previous studies

examining interactions between weight loss attempts and sex in adolescents and adults have found conflicting results, with some studies reporting differences between girls and boys (Patte & Leatherdale, 2016; van Strien et al., 2014), while others did not (Assunção et al., 2012; Neumark-Sztainer et al., 2012; Quick et al., 2013). Participants in our study were significantly younger compared to previous studies, suggesting that these relationships may be similar across sexes in childhood. Similarly, there were no differences in the associations according to baseline adiposity. Absence of significant interactions for sex or baseline adiposity in this study should not discard their plausibility, given that we were underpowered to detect these.

We observed that the proportion of children having ever tried to lose weight was lower at follow-up than at baseline. Indeed, 92 children reported having ever tried to lose weight at baseline, but to have never tried to lose weight at follow-up. This might be due to misreporting of past weight loss attempts at baseline. Alternately, children who were lost to follow-up were more likely to report past weight loss attempts at baseline compared to the children who completed follow-up (**Table S2, Supporting information file**). This may also explain the lower percentage of weight loss attempts at follow-up.

The current study included important methodological strengths. First, our study adds to the few prospective studies among children, allowing for a better understanding of the temporality between self-reported weight loss attempts, weight-related stress and obesity risk. Second, the low attrition rate mitigated the risk of selection bias, although presence of bias cannot be excluded. The children who completed both assessments reported less weight loss attempts and weight-related stress and presented a lower %BF compared to the children who were lost to follow-up. Our results

are therefore likely conservative, with estimates diluted towards the null. Furthermore, unlike most studies which relied on BMI to characterize adiposity (Assunção et al., 2012; Balantekin et al., 2015; Liechty & Lee, 2015; Neumark-Sztainer et al., 2012), ours also examined WHtR and %BF, which are informative about abdominal adiposity and whole-body adiposity, respectively. Finally, the consistency of the associations between self-reported weight loss attempts, weight-related stress and all adiposity measures strengthen our conclusions.

Some limitations must be noted. The broad definition of weight loss attempts did not allow for the distinction between healthy and unhealthy methods of weight loss. This is relevant given that 41-60% of adolescents tend to engage in dieting and other extreme weight loss behaviors (Balantekin et al., 2015; Ha et al., 2013), reaching as high as 73% among girls with obesity (Lampard et al., 2016). Another limitation is that our sample only included Caucasians children. Although the conclusions can not be inferred to children of other ethnic groups, our population remains representative of many Canadians, with 78% of adults being of European ancestry (Statistics Canada, 2017). Additionally, the follow-up duration may have been insufficient to allow detection of an important change in adiposity in the children at risk of obesity. A longer period of follow-up, into late puberty and early adulthood, would provide critical information on the impact of precocious self-reported weight loss attempts and weight-related stress in childhood on later obesity risk.

To conclude, the current study suggests that self-reported weight loss attempts and weight-related stress begin before puberty and are prevalent, even among children who are normal weight. We found that in children aged 8-10 years, self-reported weight loss attempts and weight-related

stress were associated with a higher zBMI, WHtR and %BF two years later, while we did not observe associations with change in adiposity over the two-year period. Nonetheless, we found that self-reported weight loss attempts increased the risk of new onset overweight two years later. These findings suggest that while adiposity at 8-10 years of age is the main determinant of adiposity at 10-12 years of age, weight loss attempts and weight-related stress may be contributing factors. Future research should investigate the role of weight loss attempts and weight-related stress on obesity risk earlier in life, expand to children without a parental history of obesity and those from different ethnic backgrounds, include a longer follow-up and use more comprehensive measures of weight loss behaviors, namely on the type of strategies used and their frequencies. Given the high prevalence of extreme weight loss behaviors in adolescents, all efforts should be made to prevent their development prior to this period. More awareness campaigns and education tools focusing on healthy lifestyle behaviors and body acceptance, no matter the child's weight, need to be implemented in a multi-sectorial approach to prevent early weight loss attempts and weight-related stress occurrence.

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Table 1. Characteristics of the participants at baseline and follow-up for girls (n= 251) and boys (n=313)

	Baseline mean (SD) n (%)		**Follow-up** mean (SD) n (%)	
	Girls	Boys	Girls	Boys
Age	9.6 (0.9)	9.7 (0.9)	11.6 (1.0)	11.7 (0.9)
Tanner stage				
Stage 1 (prepubertal)	162 (64.5%)	286 (91.4%)	44 (17.6%)	142 (45.8%)
Stage 2 (pubertal)	75 (29.9%)	26 (8.3%)	85 (34.0%)	96 (31.0%)
Stage 3 (pubertal)	13 (5.2%)	1 (0.3%)	88 (35.2%)	47 (15.2%)
Stage 4 (pubertal)	1 (0.4%)	0 (0.0%)	25 (10.0%)	23 (7.4%)
Stage 5 (post-pubertal)	-	-	8 (3.2%)	2 (0.6%)
zBMI	0.67 (1.08)	0.71 (1.04)	0.66 (1.07)	0.70 (1.10)
BMI categories				
Underweight	6 (2.4%)	5 (1.6%)	7 (2.8%)	6 (1.9%)
Normal weight	143 (57.0%)	178 (56.8%)	145 (57.8%)	182 (58.2%)
Overweight	45 (17.9%)	65 (20.8%)	45 (17.9%)	53 (16.9%)
Obese	57 (22.7%)	65 (20.8%)	54 (21.5%)	72 (23.0%)
WHtR	0.48 (0.07)	0.48 (0.07)	0.47 (0.08)	0.48 (0.08)
% BF	29.0 (10.1)	23.8 (10.7)	30.9 (10.0)	26.4 (11.2)
Ever tried to lose weight	121 (48.2%)	151 (48.2%)	103 (41.0%)	137 (43.8%)
Currently doing what with weight				
Trying to lose weight	98 (39.0%)	112 (35.9%)	86 (34.4%)	107 (34.3%)
Trying to gain weight	4 (1.6%)	16 (5.1%)	2 (0.8%)	14 (4.5%)
Trying to maintain weight	53 (21.1%)	67 (21.5%)	67 (26.8%)	79 (25.3%)
Not doing anything	96 (38.2%)	117 (37.5%)	95 (38.0%)	112 (35.9%)
Worried or stressed by weight	58 (18.8%)	54 (21.6%)	75 (29.9%)	66 (21.2%)
Parental education				
≥ 1 parent with high school degree or less	20 (8.0%)	20 (6.4%)	-	-
≥ 1 parent with college degree[†]	93 (37.2%)	116 (37.2%)	-	-
≥ 1 parent with university degree	137 (54.8%)	176 (56.4%)	-	-
Mother's BMI (kg/m^2)	29.00 (6.22)	29.69 (6.72)	-	-
Father's BMI (kg/m^2)	30.83 (5.68)	30.39 (5.29)	-	-

Abbreviations: BMI = body mass index; %BF = percentage of body fat; WHtR = waist-to-height ratio

[†]College, vocational or trade school degree.

Table 2. Difference in means of zBMI, WHtR and %BF between baseline and follow-up, for girls and boys

	Girls (n= 251) Difference in means (95% CI)	**Boys (n=313)** Difference in means (95% CI)
zBMI	-0.04 (-0.23 ; 0.14)	-0.02 (-0.18 ; 0.15)
WHtR	-0.01 (-0.03 ; 0.00)	0.00 (-0.01 ; 0.01)
% BF	1.38 (-0.34 ; 3.10)	**2.39 (0.68 ; 4.09)**

Abbreviations: BMI = body mass index; %BF = percentage of body fat; WHtR = waist-to-height ratio.

Table 3. Estimated linear regression coefficients from unadjusted and adjusted models of the association between self-reported weight loss attempts/weight-related stress at baseline and zBMI, WHtR and %BF two years later

	zBMI (n = 549), $\hat{\beta}$ (95% CI)		
	Unadjusted model	Adjusted model[†]	Adjusted model[†] + baseline zBMI
Ever tried to lose weight (vs. never)	**1.12 (0.96 ; 1.27)**	**0.96 (0.81 ; 1.12)**	0.03 (-0.05 ; 0.11)
Currently trying to lose weight (vs. doing nothing)	**1.15 (0.98 ; 1.33)**	**1.01 (0.84 ; 1.18)**	0.05 (-0.05 ; 0.14)
Worried or stressed by weight (vs. not)	**0.92 (0.71 ; 1.13)**	**0.75 (0.54 ; 0.96)**	**-0.10 (-0.19 ; -0.004)**
	WHtR (n = 549), $\hat{\beta}$ (95% CI)		
	Unadjusted model	Adjusted model	Adjusted model + baseline WHtR
Ever tried to lose weight (vs. never)	**0.08 (0.07 ; 0.09)**	**0.07 (0.06 ; 0.08)**	0.01 (-0.001 ; 0.01)
Currently trying to lose weight (vs. doing nothing)	**0.08 (0.07 ; 0.09)**	**0.07 (0.05 ; 0.08)**	0.01 (-0.001 ; 0.01)
Worried or stressed by weight (vs. not)	**0.07 (0.05 ; 0.08)**	**0.06 (0.04 ; 0.07)**	-0.01 (-0.02 ; 0.001)
	%BF (n = 547), $\hat{\beta}$ (95% CI)		
	Unadjusted model	Adjusted model	Adjusted model + baseline %BF
Ever tried to lose weight (vs. never)	**11.11 (9.55 ; 12.67)**	**9.84 (8.31 ; 11.36)**	0.31 (-0.57 ; 1.19)
Currently trying to lose weight (vs. doing nothing)	**11.60 (9.80 ; 13.41)**	**10.43 (8.66 ; 12.20)**	0.57 (-0.47 ; 1.60)
Worried or stressed by weight (vs. not)	**9.91 (7.78 ; 12.03)**	**8.20 (6.10 ; 10.29)**	-0.64 (-1.67 ; 0.39)

Abbreviations: BMI = body mass index; %BF = percentage of body fat; CI = confidence intervals; WHtR = waist-to-height ratio

[†]All adjusted models include age, sex, parental education (1 or 2 parents with high school degree or less; 1 or 2 parents with CEGEP/vocational or trade school degree; 1 or 2 parents with university degree), Tanner pubertal stage (ordinal: 1, 2, 3, 4/5) and mother's and father's BMI.

Table 4. Odds ratio from logistic regressions examining the associations between self-reported weight loss attempts/weight-related stress and incident overweight and obesity two years later, adjusted for sex

	Normal weight children (n = 321)		**Children who are overweight (n = 110)**	
	No. of new onset overweight	OR (95% CI) †	No. new onset obesity	OR (95% CI) †
Ever tried to lose weight (vs. never)		**2.98 (1.12 ; 7.93)**		1.17 (0.43 ; 3.56)
Currently trying to lose weight (vs. doing nothing)	18	**4.24 (1.16 ; 17.20)**	24	2.16 (0.69 ; 8.26)
Worried or stressed by weight (vs. not)		0.94 (0.05 ; 5.11)		0.47 (0.14 ; 1.37)

Abbreviations: CI = confidence intervals; OR = odds ratio

†All models were adjusted for sex and Tanner pubertal stage (ordinal: 1, 2, 3, 4/5).

SUPPORTING INFORMATION

Table S1. Self-reported weight loss attempts and weight-related stress in the participants at 8, 9 and 10 years of age, by sex

	Girls n (%)			**Boys** n (%)		
	8 years (n = 82)	9 years (n = 79)	10 years† (n = 90)	8 years (n=82)	9 years (n=104)	10 years† (n=127)
Ever tried to lose weight	32 (39.0%)	35 (44.3%)	54 (60.0%)	36 (43.9%)	53 (51.0%)	62 (48.8%)
Currently doing what with weight						
Trying to lose weight	27 (32.9%)	26 (32.9%)	45 (50.0%)	28 (34.1%)	41 (39.8%)	43 (33.9%)
Trying to gain weight	3 (3.7%)	0 (0.0%)	1 (1.1%)	1 (1.2%)	8 (7.8%)	7 (5.5%)
Trying to maintain weight	17 (20.7%)	17 (21.5%)	19 (21.1%)	18 (22.0%)	21 (20.4%)	28 (22.0%)
Worried or stressed by weight	14 (17.1%)	19 (24.1%)	21 (23.3%)	14 (17.2%)	20 (19.4%)	24 (19.2%)

†The 10-year-olds include 10 girls and 18 boys who had recently turned 11 years of age at the moment of the evaluation.

Table S2. Participants' baseline characteristics compared[†] between those who completed the follow-up (n = 564) and those who did not (n = 66)

	Complete mean (SD) n (%)	**Missed follow-up** mean (SD) n (%)	***p* value**
Age	9.6 (0.9)	9.4 (0.9)	**0.031**
Girls	251 (44.5%)	36 (54.5%)	0.156
Ever tried to lose weight	272 (48.2%)	40 (60.6%)	0.076
Currently trying to lose weight	210 (37.3%)	27 (40.9%)	0.244
Worried or stressed by weight	112 (20.0%)	22 (33.3%)	**0.020**
zBMI	0.69 (1.1)	0.88 (1.2)	0.233
WHtR	0.48 (0.1)	0.50 (0.1)	0.090
%BF	26.1 (10.8)	30.0 (11.7)	**0.012**
Parental education			
≥ 1 parent with high school degree or less	42 (7.4%)	10 (15.2%)	
≥ 1 parent with college degree[††]	209 (37.1%)	28 (42.4%)	**0.037**
≥ 1 parent with university degree	313 (55.5%)	28 (42.4%)	
Mother's BMI	29.4 (6.5)	30.1 (7.7)	0.504
Father's BMI	30.6 (5.5)	31.5 (5.5)	0.230

Abbreviations: BMI = body mass index; %BF = percentage of body fat; WHtR = waist-to-height ratio

[†]Student's T tests and Chi-Square tests were used to compare the baseline characteristics between the children who completed the follow-up to the children who did not.

[††]College, vocational or trade school degree.