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Predictors of Erroneous Perception of Being Overweight among Adolescents

Maria Rosaria Galanti[a] Maria Paola Caria[a,b] Rino Bellocco[c,d] Ylva Trolle Lagerros[e]

[a] Department of Public Health Sciences, Karolinska Institutet, Stockholm, Sweden
[b] Department of Clinical and Experimental Medicine, Avogadro University, Novara, Italy
[c] Department of Medical Epidemiology and Biostatistics, Karolinska Institutet, Stockholm, Sweden
[d] Department of Statistics, University of Milano-Bicocca, Milano, Italy
[e] Unit of Clinical Epidemiology, Karolinska Institutet, Stockholm, Sweden

Keywords

Adolescent · Body image · Exercise · Overweight · Weight perception

Summary

Objective: Adolescents' perception of overweight often disagrees with objective measurements; if factors explaining this discrepancy are potentially modifiable is unclear. **Methods:** We analyzed cross-sectional data from a cohort of 2,001 Swedish adolescents (1,026 females, 975 males) at the age of 15 years in 2003. Erroneous perception of overweight was defined as the perception of being overweight in relation to normal or lower than normal BMI (kg/m^2). BMI measured by the school nurse at 11 years, school-based education on nutrition/physical activity, smoking, alcohol consumption, physical activity, and healthy/unhealthy eating were examined as potential predictors/correlates of overweight misperception in multivariate logistic regression models. **Results:** At the age of 15 years, 32% of girls and 10% of boys misclassified themselves as overweight. Overweight at 11 years predicted misperception of overweight 4 years later (adjusted odds ratio (OR) = 2.3, 95% confidence interval (95% CI) = 1.4–3.6 in boys; OR = 1.9, 95% CI = 1.3–2.8 in girls). Among girls, smoking was associated with a higher probability of misperception (adjusted OR = 1.6, 95% CI = 1.2–2.2). Among boys, physical activity (>6 h/week) was associated with a lower probability of misperception (OR = 0.4, 95% CI = 0.2–0.7). No association was observed with school-based education on nutrition and physical activity. **Conclusion**: Preventing overweight in pre-adolescence may be a way to avoid later unjustified weight concerns in adolescence.

Introduction

Concerns about ideal body weight and overall body image are gradually increasing in adolescents [1]. Pubertal physiological change usually occurs at the same time one is creating self-perception; thus a healthy body image during adolescence is crucial [2]. Perceiving oneself as overweight may lead to unhealthy weight reduction practices, including excessive dieting [3], purging [4, 5], and clinically diagnosed eating disorders [6, 7]. In addition, the perception of overweight has also shown to increase the risk of future mental health problems [8]. However, the contributing factors to misperceptions of body weight and body image are not clear. If they occur at the individual level, they could potentially be prevented through educational and clinical interventions.

In an attempt to identify possible preventable predictors of distorted body size, we analyzed data from a sample of 15-year-old adolescents who were recruited for a longitudinal study 4 years earlier. Specifically, we aimed to study how modifiable factors such as pre-adolescent overweight and school health education were linked to overestimation of adolescents' body mass.

Material and Methods

Study Sample

The study sample consisted of adolescents who participated in the BROMS Cohort Study, a longitudinal prospective study running in a random sample of schools with 5th graders in the Stockholm region of Sweden starting in 1998. The aim of the study was to establish risk factors for tobacco use. Details on the design of the study and recruitment of the study population have been published elsewhere [9, 10] and will only be summarized here.

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Ylva Trolle Lagerros, MD, PhD
Unit of Clinical Epidemiology, Karolinska Institutet
T2, 171 76, Stockholm, Sweden
Tel. +46 8 517 79-183, Fax -304
ylva.trolle@ki.se

Table 1. Measured and perceived overweight among 15-year-old adolescents[a]

	Perceived overweight, number and percentage		
	no	yes	total
Females			
Overweight			
No	*629 (61.3%)*	328 (32.0%)	957
Yes	9 (0.9%)	*60 (5.8%)*	69
Total	638	388	1,026 (100%)
Males			
Overweight			
No	*742 (76.1%)*	101 (10.4%)	843
Yes	57 (5.8%)	*75 (7.7%)*	132
Total	799	176	975 (100%)

[a]The BROMS Cohort Study, Stockholm, Sweden, 2003.
χ^2_{1df} for gender differences in total concordance (italics) = 74.36, $p < 0.01$.
χ^2_{1df} for gender differences in concordance for overweight = 18.66, $p < 0.01$.
χ^2_{1df} for gender differences in concordance for non-overweight = 122.70, $p < 0.01$.

Briefly, the BROMS cohort encompassed 3,020 adolescents of both sexes with a mean age of 11.6 years, who in 1998 participated in a baseline survey after parental consent. They were subsequently invited to participate in a similar annual survey during the next 4 years. The annual retention rate ranged from 96% at follow-up 1 to 89% at follow-up 4 (age 15).

We analyzed data from 1,026 females and 975 males (n = 2,001) who participated in the follow-up school survey at 15 years of age and who reported information on their height, weight, and perception of body size.

The study was approved by the Regional Ethical Review Board at Karolinska Institutet.

Data Collection

Weight and height were measured at baseline by the school nurses. At the same time we also collected the teachers' reports of school education on healthy eating and physical activity as well as parental education as reported by the parents.

At follow-up, information on dietary patterns, physical activity, current smoking, and alcohol drinking was self-reported by the adolescents using a paper-and-pencil questionnaire. In addition, the adolescents were asked about their perceived body mass. They were given five response alternatives on a Likert scale ranging from 'I think I am much too thin' to 'I think I am much too fat'. A score of 4 ('A little too fat') or 5 ('Much too fat') was categorized as perception of overweight. An out-of scale further response option was given 'I never thought of it' to allow for unawareness or lack of interest. This question has previously been used in the cross-national Health Behaviour in School Aged Children (HBSC) study [11], conducted by the WHO.

On the same occasions, subjects were asked to report their height in cm and weight in kg (without shoes and undressed). Reports deemed unreliable based on longitudinal observations or on extreme values were excluded from the analysis Thus, 1-year increases greater than 30% in weight and 10% in height were considered unreliable, as were 1-year decreases exceeding 20% in weight and 2% in height.

Height and weight were self-reported annually. Total concordance between the classification of overweight based on self-reported weight and height at the age 14 and the weight and height measured by the nurse at the same age was 94.7%; kappa statistic for inter-rater agreement was 0.76. The concordance was higher for girls (96.8%, kappa = 0.80), than for boys (92.6%, kappa = 0.73) [12].

Statistical Analyses

The dichotomous outcome variable in this analysis was 'misperception of overweight'. This was defined as a subject's perception of overweight concurrent with a normal or low BMI, based on self-reported measures of weight and height. All other combinations of these two variables were considered as 'no misperception of overweight'.

BMI was calculated as the ratio weight (kg) / height $(m)^2$. The BMI cut-point for overweight for each sex at each year of age was equalized to the adult cut-point (BMI ≥ 25 kg/m^2), according to the widely adopted International Obesity Task Force (IOTF) index to assess overweight in children and adolescents [13].

A reduced version of a tabular question on dietary habits developed as part of the WHO HBSC study [11] was used to assess principles of healthy diet (very healthy, average, unhealthy). It was based on self-reported average frequency of consumption of the following foods items: fruits, raw vegetables, cooked vegetables, French fries, chips, soft drinks, and sweets.

Physical activity was assessed by asking number of hours of vigorous exercise a week. The answers were categorized into three levels 'less than 2 hours', 'from 2 to 6 hours', 'more than 6 hours'.

Current smoking was categorized as 'yes' if the subject reported smoking at least monthly, and as 'no' otherwise. The frequency of drinking wine, beer, and heavy liquors was assessed and dichotomized into 'weekly' versus 'less than weekly'. Overweight at 11 years and class curricula on nutrition and physical activity were both categorized as yes/no.

Parental education was used in order to adjust for potential confounding based on socioeconomic circumstances. We categorized the parental reports into 'compulsory school', 'senior high school', and 'college'. Primarily we used mother's education, as this has been shown to have the highest impact on adolescents' health-related dietary habits [14]. If mother's education was unavailable, father's education was used.

In bivariate analyses the chi-square statistic was used to test for significant differences between proportions, with conventional statistical significance at the 5% level. Unconditional multiple logistic regression models were then fitted to analyze the association of potential predictors and correlates with misperception of overweight, adjusting for attained age and parental education. As measures of associations, odds ratios (OR) and corresponding 95% confidence intervals (95% CI) were used. All analyses were carried out separately by gender.

All statistical analyses were performed using Stata, version 10 (StataCorp, College Station, TX, USA).

Table 2. Misperception of overweight among 15-year-old male and female adolescents, according to social and behavioral characteristics[a]

Predictor	N	Misperception of overweight, %		Difference between genders, p value
		girls	boys	
Parental education				
Compulsory school	218	30.0	9.0	<0.01
Senior high school	768	34.0	11.1	<0.01
College	992	31.4	10.2	<0.01
Overweight at age 11				
No	1,649	30.3	8.6	<0.01
Yes	312	45.9	18.1	<0.01
School-based education on nutrition or physical activity at age 11				
None	216	33.3	10.2	<0.01
Any	1,544	31.4	10.6	<0.01
Current dietary pattern				
Very healthy	429	35.8	8.7	<0.01
Average	1,275	31.0	11.2	<0.01
Not very healthy	296	28.0	9.0	<0.01
Current smoking				
No	1,626	29.3	10.0	<0.01
Yes	355	39.8	13.4	<0.01
Current weekly alcohol drinking				
No	1,286	34.1	9.7	<0.01
Yes	183	44.2	14.4	<0.01
Current physical activity				
Less than 2 h/week	659	30.9	14.1	<0.01
2–6 h/week	840	34.4	11.1	<0.01
More than 6 h/week	478	27.8	6.0	<0.01

[a]The BROMS Cohort Study, Stockholm, Sweden, 2003.

Results

In both genders, misperception was most prevalent in subjects who were overweight at the age of 11 years and who were current smokers or weekly alcohol drinkers at the age of 15 years. In contrast, the prevalence of misperception was lower in subjects who reported frequent physical activity at the same age.

At the age of 15, 201 adolescents (10.0%) were overweight based on their reported height and weight while 564 (28.2%) perceived themselves as overweight. Despite the fact that the prevalence of overweight was higher in boys, girls were more likely to endorse the belief of being overweight (table 1). As a consequence, the total concordance between overweight based on self-reported weight and height (BMI) and perceived overweight was higher in boys than in girls ($p < 0.01$) (table 1) while more girls (32.0%) than boys (10.4%) endorsed an erroneous perception of overweight.

The bivariate association between misperception of overweight and social and behavioral characteristics is shown in table 2. Pronounced gender differences were found across all strata of correlates and predictors, with girls consistently showing a higher prevalence of misperception of overweight.

The multivariate association between potential predictors/correlates and misperception of overweight is displayed in table 3. The following variables remained positively associated to the outcome: being overweight at 11 years (in both genders) and current smoking (in girls). A negative association was apparent between frequent intense physical activity and misperception of overweight in boys, but not in girls. No association was found between teacher-reported school-based education on nutrition and physical activity and misperception of overweight at age 15.

Goodness of fit was assessed using both Pearson and Lameshow-Hosmer tests, and no departure from model assumptions was evident.

Discussion

This study reveals a significant association between being overweight at 11 years and misperception of overweight later in adolescence – regardless of sex. It reinforces previous results that misperception of overweight in adolescence is at least twice as prevalent in girls compared to boys [5, 15].

Table 3. OR and corresponding 95% CI of misperception of overweight among 15-year-old adolescents according to potentially modifiable health-related factors[a]

	Girls		Boys	
	OR[b]	95% CI	OR[b]	95% CI
Overweight age 11				
No	Ref	–	Ref	–
Yes	1.9	1.3–2.8	2.3	1.4–3.6
School-based education on nutrition or physical activity age 11				
None	Ref	–	Ref	–
Any	0.9	0.6–1.4	1.0	0.5–2.0
Current dietary pattern				
Very healthy	1.2	0.9–1.7	0.8	0.4–1.4
Average	Ref	–	Ref	–
Not very healthy	0.8	0.5–1.3	0.8	0.5–1.4
Current smoking				
No	Ref	–	Ref	–
Yes	1.6	1.2–2.2	1.5	0.8–2.5
Current weekly alcohol drinking				
No	Ref	–	Ref	--
Yes	1.5	1.0–2.4	1.6	0.9–3.1
Current physical activity				
Less than 2 h/week	Ref	–	Ref	–
2–6 h/week	1.2	0.9–1.6	0.8	0.5–1.2
More than 6 h/week	0.9	0.6–1.3	0.4	0.2–0.7

Ref = Reference value

[a]The BROMS Cohort Study, Stockholm, Sweden, 2003.

[b]Adjusted for attained age (continuous) and parental education (categories).

Among the adolescents in our study, smoking was cross-sectionally associated with the perception of being overweight. This relationship has been found in several other studies, indicating an association between perception of overweight and risky behavior such as excess alcohol drinking, smoking, and marijuana use [16–18]. This finding can have different interpretations. First, taking up smoking may be part of a socially learned response to feeling overweight. In fact, in several studies smoking was included in strategies for losing weight by adolescents [5, 16, 18]. This is not surprising, as the tobacco industry associates images of cigarette smoking with glamorous thinness [19]. Second, feeling overweight appears to go hand-in-hand with poor self-esteem [20], which could mediate the onset of substance use [21]. Third, perceived overweight during adolescence may reflect earlier sexual maturation, resulting in the precocious adoption of adult behaviors. In fact, Kaufman et al. [22] found that perceived weight per se was not predictive of smoking in adolescent girls, but the more developed a girl felt compared to peers, the more likely she was to take up smoking [22].

Teenage girls in our study incorrectly perceiving themselves as overweight also chose a healthier dietary pattern in contrast to counterparts without this misperception. This raises the question whether smoking and unusually healthy dietary pattern are in fact strategies to pursue thinness. In comparison, there was a strong correlation between the performance of regular vigorous exercise and correct perception of body mass in boys. This is in line with Stein et al. [23] who showed that self-perception scores increased by 45% when physical activity was increased by 10 or more h/week in boys and that the reverse was also true – decreased activity led to decreased self-perception scores [23].

Study Limitations and Strengths

There were some limitations in this study. First, some information was collected prospectively, such as weight and height at the age of 11 years, while other predictor variables including alcohol, smoking, and physical activity were obtained concurrently to the assessment of perception of body mass. Future longitudinal studies are therefore warranted in order to assess the direction of effects and possible causal relationships. Second, active parental consent was a prerequisite for enrolment into the study. This may have resulted in a selection of study participants with a higher socioeconomic background [9], which would affect the generalizability of the results. For example, young people from higher socioeconomic groups have been shown to have a greater awareness of social ideals of slimness and to more often use healthy methods to control their weight [24]. This may have increased the proportion of adolescents with a misperception of overweight in our sample compared to a general population sample.

Missing information is a common problem in questionnaire studies. In an earlier study on the same cohort, missing information on co-variates was addressed comprehensively according to recommended procedures [25]. However, in sensitivity analyses, it was clear that results were stable and very close to those obtained with complete case analysis [12]; thus we used the latter approach in our analyses.

One of the strengths of this study was the large sample size. The cross-sectional data was collected from a cohort study with repeated assessments. As a result we could follow the same individuals at different points in time and rely on predictors collected prospectively with respect to the study outcome. The retention was very high, being close to 90% at the end of the follow-up period; thus selection bias is expected to be minimal. Furthermore, in addition to self-reported data, we obtained anthropometric measurements at baseline.

Conclusions

In summary, we found that being overweight at 11 years is a strong predictor for perception of overweight during teenage years. Our results may give valuable insight to researchers and public health practitioners. Preventing overweight, promoting physical activity, educating children that smoking is not related to thinness, and increasing focus on enhancing teenagers' self-perception and self-esteem are therefore of great importance. In the current era, when nutrition and physical education classes are routinely being cut in many countries, practitioners need to develop new strategies for health promotion and education. We believe that these results may have direct practical implications for their efforts to support adolescents towards a healthier lifestyle.

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Disclosure Statement

The authors declared no conflict of interest.

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