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Original article

Weight Status and Mental Well-Being Among Adolescents: The Mediating Role of Self-Perceived Body Weight. A Cross-National Survey

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A B S T R A C T

Purpose: Overweight and obesity are associated with poor mental health in adolescents. However, little is known about whether the influence of overweight and obesity on mental well-being is mediated by self-perceived body weight. Exploring the mechanisms underlying the relationships between obesity and mental well-being is of interest to policy makers and others working in the field of adolescent health.

Methods: This study was based on nationally representative data from adolescents (age 15 years) who participated in the 2017/2018 Health Behaviour in School-aged Children study (47 countries, N = 76,998). Mixed regression models that included gender and socioeconomic status as covariates were used to identify associations between weight status and mental well-being (life satisfaction and subjective health complaints) and to explore whether self-perceived body weight (feeling too thin or too fat) has a mediating effect. Associations between weight status, self-perceived weight,

IMPLICATIONS AND CONTRIBUTION

The present results should be considered when developing policy aimed at regulating external pressures related to body weight in adolescents. Fostering appreciation of the body in the context of its functionality instead of focusing on size and shape

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and mental well-being were further assessed country by country.

Results: Self-perceived body weight mediated the observed associations between overweight or obesity and mental well-being. Perceiving one's body weight as "too thin" or "too fat" was associated with poorer mental well-being, regardless of weight status. Self-perceived body weight varied by gender, socioeconomic status, and country.

Discussion: Self-perceived body weight may explain, to a greater extent than body mass index, variation in mental well-being among adolescents. These results are important to policy makers, clinicians, and others targeting adolescent health.

may improve young people's mental well-being.

Overweight and obesity are considered important determinants of poor mental health in the adolescent population. Previous studies have reported associations between overweight or obesity and mental illness [1] as well as subjective mental health [2]. Self-perceived weight perception is suggested to explain why higher body mass index (BMI) tends to be associated with poor mental health [3]. However, few studies have focused on the associations between weight status, self-perceived weight, and positive mental health, such as mental well-being in the adolescent population. The decline in adolescent mental well-being observed in many countries over the last decades [4] has developed in the context of high and even increasing prevalence of overweight, obesity [5], and weight reduction behaviors [6]. Addressing associations between young people's weight status, mental well-being, and underlying pathways is thus relevant for clinicians and public health professionals.

Mental well-being is a nonclinical measure of positive mental health and a fundamental component of the World Health Organization definition of health [7]. Mental well-being is associated with self-rated health [8] and perceived stress and anxiety [9] but is not a proxy of mental illness. Mental well-being encompasses a more global dimension of a person's psychological well-being [10]. Good mental well-being in childhood is critical to ensuring a healthy transition to adulthood and has implications for overall well-being, growth, and development [5], and thus an important health issue. Concern has arisen about the observed decrease in adolescent mental well-being during the past 2 decades, which has developed in the context of increased prevalence of overweight and obesity [5]. Examining the associations between weight status and mental well-being may provide a broader understanding of adolescent health and may have important implications for policy and practice.

Mental well-being can be measured by indicators of life satisfaction and subjective health complaints [4,5]. Lower life satisfaction is reported among people living with overweight or obesity compared with those with normal weight [11]. The possible link between subjective health complaints and weight status has not been examined thoroughly. Subjective health complaints are inversely associated with physical activity levels and food habits [12], both of which are related to overweight and obesity. The impact of weight status on mental well-being has been highlighted in studies showing that youths living with obesity report lower quality of life than their counterparts with cardiac conditions, diabetes, or gastrointestinal conditions [13] and at the same level as those with cancer [14]. These findings suggest that living with overweight or obesity may have a significant impact on a young person's life and suggest a link between weight status and mental well-being either directly through BMI or through other associated health issues.

In the project "Confronting obesity: Co-creating policy with youth," which identified adolescents' views on the drivers of obesity [15], adolescents emphasized the perception of one's own body weight as an important factor in the relationship between weight status and mental health. An Iranian study [11] suggested that self-perceived overweight was a stronger predictor of life satisfaction than the actual weight and hypothesized that self-perceived weight may be a mediator in the relationship between BMI and mental well-being. Similarly, a German study [16] suggested that adolescents' weight perceptions, rather than actual weight, are associated with personal resources, such as self-esteem, self-efficacy, optimism, and sense of coherence.

Evidence for such associations in cross-national population-based samples is limited. One research gap of interest is whether associations between weight status, self-perceived body weight, and mental well-being are generic phenomena or determined by gender, socioeconomic status (SES), or other sociocultural differences. Adolescents' weight status and mental health vary by gender, country, and SES [5], and studies exploring these relationships, including mediating factors, may be useful for policy makers, adolescent health service providers, and others working in the field of adolescent health.

The present study explored the associations between weight status (assessed by BMI z-score for age and sex) and mental well-being (life satisfaction and subjective health complaints). The study had a particular focus on the possible mediating role of self-perceived body weight and differences related to gender, SES, and country in nationally representative samples of 15-year-olds from 47 countries who participated in the Health Behaviour in School-aged Children study (HBSC) 2017/2018. To our knowledge, this is the first time such associations have been studied in a large, cross-national sample of adolescents.

Methods

This study was based on national representative data from the HBSC study, a World Health Organization collaborative cross-national study, whose overall aim is to generate greater understanding of health and health behavior and their context in the lives of young people aged 11, 13, and 15 years [5]. For the present study, to reduce the complexity, we considered samples of only 15-year-old students from 47 countries/regions, collected during the 2017/2018 school year. The primary sampling unit was the school class or, in some countries, the school. The students completed an internationally standardized questionnaire at school after receiving instructions from their teacher. Oral and written information outlining the confidentiality of their responses was provided, and participation was anonymous and voluntary. School and student response rates varied between the

countries. Schools/classes declining to participate and students absent on the day the survey was completed were the two main sources of nonresponse and were not followed up. Ethical consent was required from the institutional ethics committee(s) or any relevant board in each country. Informed consent of parents (or guardians) and the adolescents participating in the study was required in most of the countries included; a minority of countries used informed passive consent. Researchers followed the standardized international research protocol to ensure consistency in survey instruments, data collection, and processing procedures. The HBSC Data Management Centre checked the quality of the data collected, performed appropriate cleaning of the data, and merged national data sets into an international data file. Detailed information about the study is available at www.hbsc.org.

Measures

Weight status was based on self-reported weight and height reported in answer to the following questions: "How much do you weigh without clothes?" and "How tall are you without shoes?" BMI (in kilogram per square meter) was calculated and classified into "thinness," "normal weight," "overweight," and "obesity" based on the international standardized age- and sex-specific cutoff points proposed by Cole and Lobstein [17] for the International Obesity Task Force. Self-reported BMI is considered a reliable proxy measure across age, sex, and race/ethnicity subpopulations of adolescents [18]. Implausible values were identified as system missing data by the HBSC Data Management Centre.

Self-perceived body weight, the subjective interpretation of an individual's weight status, was assessed by the following question: "Do you think your body is…? with the possible answers, "much too thin," "a bit too thin," "about the right size," "a bit too fat," and "much too fat." This item was developed by the HBSC study and has shown good test–retest stability (intraclass correlation = 0.81; 95% confidence interval [CI] = 0.76–0.85) [19]. Similar questions have been used in several other health-related questionnaires of proven validity [20]. For the presented study, responses were recoded into three categories: "too thin," "about the right size," and "too fat." Norway and Macedonia used different response categories and were therefore excluded from the respective analyses.

Life satisfaction is defined as "A cognitive global judgement of one's life as a whole" [10]. Participants rated their life satisfaction using a single-item question referred to as the Cantril ladder [21]: "Here is a picture of a ladder. The top of the ladder '10' is the best possible life for you and the bottom '0' is the worst possible life for you. In general, where on the ladder do you feel you stand at the moment?" The Cantril ladder has shown good reliability and convergent validity among adolescents [22].

Subjective health complaints are a subjective measure of complaints that may have both psychological and somatic origins; a higher prevalence of complaints associated with psychological than somatic health [5]. Based on the HBSC Symptom Checklist (HBSC-SHC), the adolescents were asked how often they experienced the following symptoms over the past 6 months: headache, abdominal pain, backache, feeling low, irritability or in a bad mood, feeling nervous, sleeping difficulties, and dizziness. The five response categories were "about every day," "more than once a week," "about every week," "about every month," and "rarely or never." The HBSC-SHC has adequate test–retest reliability and validity properties [23]. For the present study, the average of the sum score was used and ranged from 1 (all eight symptoms about every day) to 5 (rarely or never any symptoms). Data on subjective health complaints were not available in the Macedonian sample, and therefore, this sample was excluded from the analysis of subjective health complaints.

SES was assessed using the family affluence scale [24], which comprises six items and is a measure of material affluence derived from the characteristics of the family's household. The individual family affluence scale responses were combined and standardized using ridit transformation to provide a linear SES score (0–1) within each country and an overall mean score of 0.5. The scores were then categorized into the lowest 20%, middle 60%, and highest 20% within each country.

In the total sample, 16.6% had missing data for BMI and were excluded from the analysis. In the remaining sample, the percentages of missing data were as follows: self-perceived body weight 1.2%, life satisfaction 1.5%, subjective health complaints 2.5%, and SES 4%.

Statistics

Mixed linear regression models were used to analyze the total sample and each country included. Weight status, gender, and SES were considered independent variables and mental well-being indicators (life satisfaction and subjective health complaints) dependent variables (model 1). Self-perceived body weight was included in model 2.

Mixed logistic regression models were used to assess the relationships between weight status, gender, and SES as independent variables and self-perceived body weight indicators ("feeling too thin" as well as "feeling too fat") as dependent variables. In all mixed models, country and school class nested within country were included as random effect variables.

Formal testing of the categorical mediator (self-perceived weight) was performed as suggested by Iacobucci [25]. Because the independent variable (weight status) was multicategorical, mediation was estimated for the relevant paths separately [26] using indicator coding with "normal weight" as the base level for weight status and "about right size" as the base level for self-perceived body weight. The $z_{Mediation}$ score was calculated based on these parameters, illustrated in Figure 1; path **c** was estimated by model 1, paths **b** and **c'** were estimated by model 2, path **a** was estimated by model 3.

Statistical analysis was performed in R, version 4.0.4 (nlme package for mixed linear regression models and lme4 and emmeans for mixed logistic regression models).

Results

In the present study population (N = 64,229), 51.4% were girls, and the median age was 15.5 years. Country-specific sample characteristics and descriptive statistics are shown in Table 1.

Weight status, self-perceived body weight, and mental well-being

Associations between weight status and mental well-being are shown in Table 2. Model 1a was used for life satisfaction, and model 1b was used for subjective health complaints. The intercepts estimate mental well-being among boys classified with normal weight and high SES (life satisfaction $\beta = 8.04$, 95% CI 7.93, 8.15; subjective health complaints $\beta = 4.05$, 95% CI 3.99,

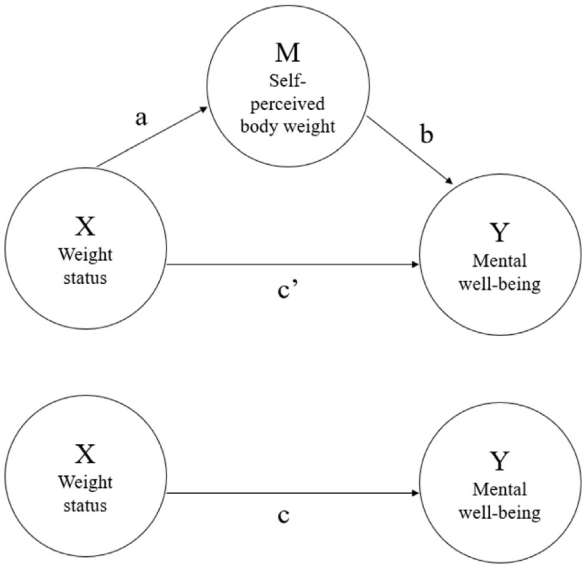

Figure 1. Model of mediation analysis.

4.11). Living with overweight or obesity, but not thinness, was associated with lower scores for both indicators of mental well-being. Obesity had a larger negative effect (life satisfaction $\beta = -0.47$, 95% CI −0.55, −0.38; subjective health complaints $\beta = -0.16$, 95% CI −0.2, −0.12) than overweight (life satisfaction $\beta = -0.18$, 95% CI −0.22, −0.13; subjective health complaints $\beta = -0.09$, 95% CI −0.11, −0.07). Being a girl and having medium or low SES were also associated with lower scores for both indicators of mental well-being.

When self-perceived body weight was included (model 2), the negative associations between overweight or obesity and mental well-being observed in model 1 were no longer significant. That is, no significant associations were identified between living with obesity and mental well-being, and slightly positive associations were seen between overweight and mental well-being. Perceiving one's own body weight as "too fat" or "too thin" was negatively associated with both indicators of mental well-being. Feeling "too fat" had a larger negative effect (life satisfaction $\beta = -0.73$, 95% CI −0.76, −0.69; subjective health complaints $\beta = -0.34$, 95% CI −0.35, −0.32) than feeling "too thin" (life satisfaction $\beta = -0.36$, 95% CI −0.40, −0.32, subjective health complaints $\beta = -0.19$, 95% CI −0.21, −0.17). The country-specific estimates for these associations are presented in Supplementary Table 1. Living with overweight or obesity was associated with lower scores for mental well-being in half of the countries, self-perceived weight was associated with mental well-being in most of the countries examined.

As shown in Table 3, adolescents who perceived themselves as "too fat" were more likely to live with overweight (odds ratio [OR] 9.06, 95% CI 8.44, 9.73) or obesity (OR 32.64, 95% CI 27.5, 38.68) than those with normal weight. Those who perceived themselves as "too thin" were more likely to live with thinness (OR 6.69, 95% CI 6.23, 7.19). Girls with normal BMI were more likely to feel "too fat" (OR 3.16, 95% CI 3.02, 3.31) and less likely to feel "too thin" (OR 0.38, 95% CI 0.36, 0.40) than were boys. Low SES was associated with feeling "too fat" (OR 1.11, 95% CI 1.03, 1.20) as well as "too thin" (OR 1.13, 95% CI 1.03, 1.22).

As shown in Table 4, all mediation paths (Figure 1) were significant. Based on these results and the results presented in Table 2, self-perceived body weight was confirmed as a mediator in the relationship between weight status and mental well-being.

Discussion

The findings of this study suggest that the associations between overweight or obesity and mental well-being can be explained by self-perceived body weight. Perceiving one's own body weight as "too thin" or "too fat" was associated with poorer mental well-being, regardless of weight status and with gender, SES, and cross-country differences.

Weight status, self-perceived body weight, and mental well-being

Adolescents living with overweight or obesity reported poorer mental well-being than their counterparts with normal weight. Self-perceived body weight was confirmed as a mediator in this relationship, which suggests that the psychological perception of being "too fat" explains the observed associations between overweight or obesity and mental well-being. The findings complement those of other studies in which high BMI was linked to lower levels of mental well-being [27–30], although these earlier studies did not adjust for self-perceived body weight. Our results are consistent with an earlier observation of one study [11] that found that the association between overweight or obesity and life satisfaction disappeared after adjusting for self-perceived weight. Similarly, our findings are also consistent with the conclusions of a systematic review of overweight, self-perceived weight, and depressive symptoms that found that overweight was no longer associated with depressive symptoms after adding weight perception to the predictive model [2]. The present results add to the literature, suggesting that self-perceived weight is a predictor of mental health outcomes [2,3,16,31]. Of note, the present study used HBSC-SHC, which may have both psychological and somatic origins, as an indicator of mental well-being. Additional analysis based on only psychological complaints (feeling low, irritability or in a bad mood, feeling nervous, and sleeping difficulties) was performed (data not shown), but this did not substantively change the results or their interpretation.

It is conceivable that self-perceived body weight may lie on the causal pathway between weight status and mental well-being and may play a mediating role. However, the present study is based on cross-sectional data, which limits the ability to make interference about causal relationships, and reverse causation cannot be discounted. Poor mental well-being may be a consequence of perceived overweight but may also be a predictor of weight gain [32]. Moreover, the present study is based on self-reported data, and the mediation effect may, to some extent, be explained by shared variance caused by responding bias; for example, adolescents who rate their well-being lower may also rate their body weight more critically. Reverse causality may also play a role if adolescents who report lower well-being judge their weight more critically. Other potential confounding variables should be considered. For example, given that perceived weight discrimination is associated with higher odds of self-perceived overweight and poorer mental well-being [2]. Symptoms of depression may explain the link between perceived weight and well-being scores or perceived weight discrimination

Table 1
Sample characteristics and descriptive statistics (N = 64,559)

Country	Sample size	Girls (%)	Median age	Weight status				Self-perceived body weight			Mental well-being	
				% Thinness	% Normal weight	% Overweight	% Obesity	% Feeling "too thin"	% Feeling "about right size"	% Feeling "too fat"	Median life satisfaction[a]	Median subj. health complaints[b]
Albania	710	54	14.9	8	76	14	2	16	62	22	8	4.1
Armenia	1,180	56	15.4	17	70	11	2	21	64	15	8	4.1
Austria	1,303	54	15.2	11	73	14	3	17	46	37	8	4.0
Azerbaijan	1,324	57	15.3	21	70	7	2	21	69	9	8	4.6
Belgium (Flemish region)	1,263	51	15.5	14	74	10	2	14	50	36	8	4.0
Belgium (Walloon region)	828	51	15.5	11	72	14	3	17	49	35	8	3.8
Bulgaria	1,409	56	15.7	15	69	14	2	15	59	26	8	3.8
Canada	3,092	52	15.4	8	68	17	7	15	55	30	7	3.9
Croatia	2,068	50	15.6	8	77	14	1	17	58	24	8	4.1
Czech Republic	3,559	50	15.3	9	73	15	3	24	51	25	8	4.0
Denmark	711	49	15.8	10	75	12	2	14	51	34	8	4.1
England	320	49	15.5	14	72	12	2	14	54	32	7	3.8
Estonia	1,437	51	15.8	10	73	13	4	20	46	34	8	3.9
Finland	1,016	50	15.8	7	77	13	3	12	59	29	8	3.8
France	1,954	51	15.2	15	72	10	2	15	59	26	8	3.9
Georgia	1,069	51	15.7	15	72	10	3	22	54	24	8	4.1
Germany	1,389	57	15.3	10	72	15	3	16	46	38	8	4.0
Greece	1,265	50	15.8	7	74	16	4	23	49	29	7	3.8
Greenland	155	48	15.2	3	71	22	5	12	52	36	8	4.0
Hungary	1,065	56	15.6	10	71	14	5	16	54	31	7	3.6
Iceland	1,852	51	15.7	7	75	14	4	13	63	24	8	3.9
Ireland	401	43	15.5	15	73	8	3	22	49	29	7	3.9
Israel	2,442	57	15.5	12	71	14	3	20	53	27	8	3.5
Italy	1,201	55	15.8	9	74	14	2	11	60	29	7	3.5
Kazakhstan	1,464	51	15.3	20	75	5	1	17	69	15	9	4.5
Latvia	1,319	51	15.6	10	77	11	3	17	50	33	7	3.9
Lithuania	1,095	53	15.8	9	78	11	3	18	52	30	8	4.0
Luxembourg	1,183	51	15.5	11	70	14	5	16	50	34	8	3.8
Macedonia	1,370	51	15.6	9	68	18	5	*NA*	*NA*	*NA*	8	*NA*
Malta	500	55	15.7	10	58	23	10	14	62	24	7	3.4
Netherlands	1,175	53	15.4	16	75	8	1	13	52	35	7	4.1
Norway	585	51	15.6	12	73	12	3	*NA*	*NA*	*NA*	8	4.0
Poland	1,675	52	15.6	12	75	11	2	19	40	41	7	3.8
Portugal	1,342	54	15.5	10	70	16	3	17	52	31	8	4.1
Republic of Moldova	1,528	51	15.6	17	75	7	2	19	63	18	8	4
Romania	1,265	52	15.1	11	70	16	3	19	56	26	8	3.8
Russia	1,740	53	15.5	14	73	11	2	20	52	28	7	4
Scotland	542	46	15.7	15	66	15	3	17	51	32	7	3.8
Serbia	1,522	51	15.8	9	72	16	3	56	37	7	8	4.1
Slovakia	1,092	47	15.3	11	73	14	2	23	55	22	8	3.9
Slovenia	1,656	47	15.7	7	75	15	4	17	51	32	8	4.1
Spain	1,441	51	15.5	10	74	13	3	19	51	30	8	4.2
Sweden	1,405	51	15.4	8	78	12	2	19	52	29	7	3.6
Switzerland	2,251	49	15.3	10	75	12	2	18	48	34	8	4
Turkey	1,483	51	15.8	13	70	14	3	18	64	17	6	3.4
Ukraine	1,912	49	15.4	15	74	8	2	14	62	24	7	3.9
Wales	1,671	42	15.7	11	71	14	4	16	51	33	8	3.9
Total	**64,229**	**51**	**15.5**	**11**	**73**	**13**	**3**	**18**	**54**	**28**	**8**	**3.9**

Bold values indicates statistical significance ($p < .05$).
[a] Life satisfaction: 0 = worst possible life at the moment, 10 = best possible life at the moment.
[b] Subjective health complaints: 1 = all symptoms frequently, 5 = all symptoms never or rarely.

Table 2
Mixed linear regression analysis of the associations between mental well-being, weight status, and self-perceived weight

Independent variables	Dependent fixed variables	Model 1			Model 2		
		Coefficient (β)	95% CI	*p* value	Coefficient (β)	95% CI	*p* value
Life satisfaction[a]	Intercept	8.04	[7.93, 8.15]		8.19	[8.08, 8.30]	
	Thinness	−0.03	[−0.08, 0.01]	.132	−0.02	[−0.07, 0.03]	.364
	Overweight	−0.18	[−0.22, −0.13]	**<.001**	0.08	[0.04, 0.13]	**<.001**
	Obesity	−0.47	[−0.55, −0.38]	**<.001**	−0.07	[−0.16, 0.02]	.132
	Girls	−0.45	[−0.48, −0.42]	**<.001**	−0.37	[−0.40, −0.34]	**<.001**
	SES interm. 60%	−0.36	[−0.40, −0.33]	**<.001**	−0.35	[−0.38, −0.31]	**<.001**
	SES lower 20%	−0.80	[−0.85, −0.76]	**<.001**	−0.77	[−0.82, −0.72]	**<.001**
	Too thin				−0.36	[−0.40, −0.32]	**<.001**
	Too fat				−0.73	[−0.76, −0.69]	**<.001**
Subjective health complaints[b]	Intercept	4.05	[3.99, 4.11]		4.14	[4.07, 4.2]	
	Thinness	−0.02	[−0.04, 0.00]	.117	−0.01	[−0.03, 0.02]	.568
	Overweight	−0.09	[−0.11, −0.07]	**<.001**	0.03	[0.01, 0.05]	**.004**
	Obesity	−0.16	[−0.2, −0.12]	**<.001**	0.02	[−0.02, 0.06]	.232
	Girls	−0.49	[−0.5, −0.47]	**<.001**	−0.45	[−0.47, −0.44]	**<.001**
	SES interm. 60%	0.01	[−0.01, 0.02]	.562	0.01	[−0.01, 0.03]	.283
	SES lower 20%	−0.05	[−0.07, −0.03]	**<.001**	−0.04	[−0.06, −0.02]	**<.001**
	Too thin				−0.19	[−0.21, −0.17]	**<.001**
	Too fat				−0.34	[−0.35, −0.32]	**<.001**

Bold values indicates statistical significance (p value < .05).
Base levels: "normal weight" = base level in weight status, boys = base level in gender, highest 20% = base level in SES, "about the right size" = as base level in weight perception.
CI = confidence interval; SES = socioeconomic status.
[a] Life satisfaction: 0 = worst possible, 10 = best possible.
[b] Subjective health complaints: 1 = all symptoms frequently, 5 = all symptoms never or rarely.

may explain the link between self-perceived weight and mental well-being scores.

Perceiving one's own body weight as "too thin" or "too fat" was associated with poorer mental well-being regardless of weight status, with the lowest scores were found among those who perceived themselves as "too fat." This finding corresponds with those of other studies [2,11,33]. The relationship between self-perceived weight and mental well-being may be viewed in light of developmental changes, including the onset of puberty, which may demand a constant restructuring of adolescents' perception of their body and is important in the development of one's self-concept, self-esteem, and interpersonal relationships with peers [34]. Feeling "too thin" or "too fat" may result in a myriad of psychological and emotional effects, which may influence mental well-being. Feeling "too fat" may also trigger concerns about social rejection because internalization of weight stigma may lead to physiological distress [2] and poorer mental well-being.

Girls seem to be vulnerable to processes related to body weight and mental well-being, possible because of strong external pressures about their body. The observed gender differences in self-perceived weight may suggest that girls tend to internalize a thin body ideal, whereas boys' ideals are geared more toward muscularity [35]. For boys, it is likely that both

Table 3
Logistic regression analysis of aspects of self-perceived body weight dissatisfaction as independent binary variables and weight status, gender, and SES as fixed dependent variables

Model 3					
Independent variable	Dependent fixed variable	Coef. (β)	OR	95% CI	*p* value
Feeling too fat	Intercept	−2.06	0.12		
	Thinness	−1.51	0.22	[0.19, 0.25]	**<.000**
	Overweight	2.20	9.06	[8.44, 9.73]	**<.000**
	Obesity	3.49	32.64	[27.55, 38.68]	**<.000**
	Girls	1.15	3.16	[3.02, 3.31]	**<.000**
	SES intermediate 60%	0.06	1.06	[1.00, 1.13]	**.026**
	SES lower 20%	0.11	1.11	[1.03, 1.20]	**.002**
Feeling too thin	Intercept	−1.32	0.27		
	Thinness	1.90	6.69	[6.23, 7.19]	**<.000**
	Overweight	−2.05	0.13	[0.11, 0.15]	**<.000**
	Obesity	−2.23	0.11	[0.08, 0.15]	**<.000**
	Girls	−0.97	0.38	[0.36, 0.40]	**<.000**
	SES intermediate 60%	0.02	1.02	[1.00, 1.10]	.429
	SES lower 20%	0.12	1.13	[1.03, 1.22]	**.002**

Bold values indicates statistical significance (p value < .05).
Base levels: "normal weight" = base level in weight status, boys = base level in gender, highest 20% = base level in SES, "about the right size" = as base level in weight perception.
CI = confidence interval; SES = socioeconomic status.

Table 4
Formal mediation test with categorical independent variables

Mediation path			Estimated effects from models 1–3 (standard error)				Mediation test	
Dependent variable (Y)	Independent variable (X)	Mediator (M)	c	c′	b	a	$z_{Mediation}$	*p* value[a]
Life satisfaction	Thinness	Too thin	−0.03 (0.02)	−0.02 (0.02)	−0.36 (0.02)	1.90 (0.03)	−16.73	**<.001**
	Overweight	Too fat	−0.18 (0.02)	0.08 (0.02)	−0.73 (0.02)	2.20 (0.03)	−34.37	**<.001**
	Obesity	Too fat	−0.47 (0.04)	−0.07 (0.04)	−0.73 (0.02)	3.49 (0.07)	−30.37	**<.001**
Subjective health complaints	Thinness	Too thin	−0.02 (0.01)	−0.01 (0.01)	−0.19 (0.01)	1.90 (0.03)	−19.22	**<.001**
	Overweight	Too fat	−0.09 (0.01)	0.03 (0.01)	−0.34 (0.01)	2.20 (0.03)	−35.15	**<.001**
	Obesity	Too fat	−0.16 (0.02)	0.02 (0.02)	−0.34 (0.01)	3.49 (0.07)	−30.90	**<.001**

Bold values indicates statistical significance (p value $< .05$).
Y, X, and M refer to the mediation models presented in Figure 1.
[a] Bonferroni correction for multiple testing: $\alpha = 0.017$.

obesity and lack of muscularity are important to how they perceive their weight. This perception of boys should be followed up in future studies because an increasing number of boys are engaging in weight reduction behaviors [6]. However, feeling "too thin" or "too fat" may also be a sign of mental illness (e.g., the presence of an eating disorder), which should be followed up in future studies. Low SES was a significant covariate in the present analysis and may indicate that socioeconomic resources play a role in both weight perception as well as in fostering mental health in the younger population. This perspective should be further investigated.

Differences between countries

Differences between countries in the associations between weight status, self-perceived body weight, and mental well-being suggest that both sociocultural influences (e.g., social media, family, and peers) and social weight comparisons play roles in weight perceptions and its influence on mental well-being. Overall, stronger associations between self-perceived weight and mental well-being were observed in countries with high prevalence of adolescents feeling "too fat" or "too thin." A high prevalence of feeling "too fat" may reflect a strong sociocultural focus and external pressure for a thin body ideal that is accompanied by negative stereotyping of overweight and obesity. The differences between countries may reflect the importance of relative comparisons. Moreover, in countries with a high prevalence of overweight or obesity, higher weight may be perceived as the normal weight in terms of social body weight comparisons. These perspectives may be followed up with qualitative studies.

Implications

The finding that one in two adolescents perceived themselves as "too thin" or "too fat" is of public health concern. Although this percentage has been relatively stable in recent years, the associations between self-perceived body weight and mental well-being have changed. Adolescents who in the past perceived themselves as "too fat" have become increasingly likely to report poorer mental well-being relative to those perceiving their body weight as "about the right size" [36]. Mental well-being has worsened in many countries in recent years [5] possibly because of changes in the associations between self-perceived weight and mental well-being [36].

Reducing overweight and obesity are stated as key public health priorities. However, the use of BMI as an indicator of normal or healthy weight is associated with challenges. Although public health professionals at present are concerned about the obesogenic environment, health psychologists and health promoters worry about the societal pressure for thinness. Concerns have been raised about the potential negative psychological effects created by interventions addressing weight loss that focus largely on body shape and size and of the extensive media coverage targeting measures of obesity at the individual. Alternatively, fostering appreciation of the body in relation to its functionality as opposed to its appearance may encourage adolescents to feel positive about their body and, at the same time, engage in healthy behaviors. These implications are relevant for clinicians working with adolescents of all body weight and sizes and correspond with Golding's work [37], in which is suggested that clinicians should assess weight perceptions more consistently and should recognize that feeling "too thin" or "too fat" to be risk factors for poor mental well-being.

Social media are important to the development of young people's perception about body weight and size. Social media campaigns should consider image-related content to avoid increasing body weight dissatisfaction. Advertisements for products promising weight loss and larger muscles are commonly targeted at adolescents through social media, as are advertisements for cosmetic and plastic surgery. These perspectives are important when developing policy actions aiming to regulate external pressure related to body weight.

Strengths and limitations

The strengths of the present study are the large data set based on nationally representative sampling and the use of standardized measurements in all countries. The limitations include the use of self-reported height and weight, which may result in misclassification of BMI. However, the included items have been validated for use in population studies [18]. Another possible limitation is that the perception of one's body weight may change considerably during adolescence, and associations between BMI, self-perceived body weight, and mental well-being might differ between age groups. Including another age group may have produced different results. Finally, race and ethnicity could potentially be important covariates. Unfortunately, these perspectives could not be assessed in the present study because of lack of adequate data within the study.

Conclusion

The findings of the present study suggest that associations between mental well-being and overweight or obesity can be

explained by self-perceived body weight. Perceiving one's own body weight as "too fat" was significantly associated with gender, SES, and country, all of which contributed to explaining the variance in the mental well-being of adolescents included in this study. Further research is needed to understand these relationships better and to develop effective intervention strategies.

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Supplementary Data

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