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Weight Misperception and Health Risk Behaviors Among Early Adolescents

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Abstract

Objectives—To examine associations between weight misperception and youth health risk and protective factors.

Methods—Three thousand ten US seventh-graders (72.1% white, mean age: 12.7 years) self-reported height, weight, risk, and projective factors. Analyses were conducted to determine cross-sectional and longitudinal associations between weight overestimation and health risk and protective factors.

Results—Risk and protective factors had significant cross-sectional associations with weight overestimation. However, only depressive symptoms and reduced optimism predicted weight overestimation in eighth grade. Weight overestimation did not predict engagement in risky behaviors.

Conclusions—Weight overestimation and risk factors appear to co-occur, suggesting a constellation of risk that warrants further research.

Keywords

weight perception; risk and protective factors; substance use; depression

The prevalence of overweight and obesity among youth has risen to very high levels with 31.7% of youth in the United States identified as overweight or obese.¹ Other health-compromising behaviors such as smoking, substance use, and fighting continue to be problematic among adolescents as well. In 2008, 32.1% of eighth-graders reported using alcohol in the past year, 10.9% reported using marijuana in the past year, and 6.8% reported smoking cigarettes in the past month.² Among ninth-graders, 40.9% of students stated that they had been in a physical fight at least once in the past year.³ Previous research suggests

that health-compromising behaviors may co-occur,⁴⁻¹² and thus it is important to understand the patterning of these behaviors as well as their developmental progression. Despite minimal research to date, the role of potentially health-protective factors (eg, spirituality and optimism) is also important to consider, particularly given the high prevalence of health-compromising behaviors.

Although some research has explored the relationships among risk behaviors,^{8,9,12,13} the relationship between risk and protective factors and weight perception has been less thoroughly examined. Given the cultural ideal of thinness throughout many Western countries, the potential influence of perceived weight on risk behaviors is of particular importance. Adolescents express unhealthy weight concerns, experience substantial levels of body dissatisfaction,¹⁴⁻¹⁶ appear to be susceptible to cultural pressures, and may in fact be influenced by the ideal weight standards that have been portrayed by the media.^{16,17} Weight perception, particularly misperceptions, may therefore influence the type of health behaviors youth engage in, making this an important construct to study in regard to adolescent health.

Evidence suggests that actual weight and perception of weight are frequently not in alignment for both overweight and normal-weight youths. Overweight adolescents, however, may be more likely to underestimate their weight compared to normal-weight adolescents. In fact, despite nearly 48% of adolescents being classified as overweight in a recent study, only 22.3% of adolescents perceived themselves as such.¹⁸ Using data from the Youth Risk Behavior Survey from 1999–2007, approximately 30% of overweight adolescents did not perceive themselves to be overweight.¹⁹ On the other hand, Strauss (1999) found that 52% of girls and 25% of boys perceived themselves as overweight, despite being normal weight. In a national sample of youth, perceptions of overweight were not as prevalent, but similar differences were seen between girls and boys with 23.2% of girls and 7% of boys perceiving themselves as overweight regardless of their normal-weight status.²⁰ Although recognition of overweight status may help to motivate overweight adolescents to take action, inaccurately overestimating of weight status may have detrimental effects. In fact, normal-weight or underweight girls and boys are less accurate when estimating weight when compared with overweight and obese youth.²⁰

Perceiving oneself as overweight is of particular importance given the demonstrated association between overestimating one's weight and engaging in unhealthy weight-control behaviors. Research has shown that adolescents who inaccurately perceive themselves as overweight, regardless of actual weight, are more likely to engage in dieting and unhealthy weight-control behaviors.^{21,22} In addition, adolescents who have engaged in dieting and unhealthy weight-control behaviors paradoxically have been found to be at risk of weight gain over time^{23,24} and the onset of more severe disordered eating behaviors.^{23,25} Additionally, adolescents who perceive themselves to be overweight, but who are in fact normal weight, have been found to transition into an overweight status within less than 2 years.²⁶

Research has documented that several unhealthy behaviors may have important links to perceived weight status. Suicide ideation and attempts, along with depression and anxiety, have been associated with perceived overweight status among adolescents²⁷⁻³¹ Studies have also shown that adolescents' weight perceptions are significantly associated with suicidal behaviors, with the likelihood of suicide ideation and attempts higher among those who self-perceive themselves as very underweight or very overweight.^{29,30} In one study examining weight misperception, Al Mamun and colleagues found that individuals who perceived themselves as overweight at age 14, despite having a normal BMI, were more likely to have mental health problems at age 21, suggesting that a perception of being overweight during adolescence may be a significant risk factor for depression later in life.²⁷

Little research to date, however, has examined the association between misperceptions of one's weight status and various risk (eg, substance use and fighting) and protective factors (eg, optimism or spirituality). Understanding the relationships between weight misperception and these factors may help to establish a constellation of behaviors/risk factors that put youth at risk for negative health outcomes. Furthermore, much of the research to date that has examined individual risk and protective factors and weight status has been cross-sectional. However, in order to understand the relationship between multiple risk and protective factors and perceived overweight status, longitudinal research is needed. Thus, the purpose of this study was to examine if weight overestimation predicted engagement in risk behaviors and a reduction in protective factors or if engaging in risk behaviors and having reduced protective factors predicted later weight misperceptions. Using data from a large, longitudinal cohort of early adolescents, we examined 3 specific research questions: (1) Are weight overestimations and measures of risk and protective factors correlated at the same point in time? (2) Do weight overestimations in seventh grade predict increased levels of risk and protective factors in eighth grade? (3) Do increased levels of risk and protective factors in seventh grade predict weight overestimation in eighth grade?

METHODS

Study Design and Sample

Data for this study come from the Teens Eating for Energy and Nutrition at School (TEENS) intervention.³² TEENS consisted of a 2-year intervention study conducted in 16 middle schools in the Twin Cities, Minnesota, metropolitan area during 1997 to 2000. The primary goal of TEENS was to increase student's intakes of fruits/vegetables and lower fat foods. The intervention included classroom curricula, a family component, and school-level environmental changes.³³ Surveys were administered in the fall of seventh grade and the spring of eighth grade. Of 4050 eligible seventh-grade students, 3878 (95.8%) completed the baseline survey. At the end of eighth grade, 3010 (77.6%) of baseline participants completed the follow-up survey. The present study is a secondary data analysis of the data collected in the TEENS study.

Data for this study are limited to the cohort who completed both baseline and follow-up surveys. This resulted in a cohort of 3010 students (72.1% white, 27.9% nonwhite), with a baseline mean age of 12.7 years. Approximately 20% of students received free/reduced-price lunch and 51.1% were male. Students who did not complete the follow-up survey were more likely to be minority students, from single-parent households, enrolled in the free/reduced-price lunch program, less likely to have 2 parents working full-time, and less likely to have parents with higher educational attainment.³² The Institutional Review Board at the University of Minnesota approved all study methods.

Measures

Weight perceptions—Body mass index (BMI) was calculated using self-reported height and weight and transformed into age- and sex-specific BMI z-score percentiles derived from CDC/NCHS 2000 growth charts.³⁴ Based on previous research the BMI z-score percentile was then divided into 5 categories: underweight (5th percentile or below), slightly underweight (between the 5th and up to the 16th percentile), normal (16th to less than the 85th percentile), overweight (85th to less than the 95th percentile), and obese (95th percentile or above).²⁹ Students were asked the question "How do you think of yourself?" The response options for the question were "very underweight," "slightly underweight," "about the right weight," "slightly overweight," and "very overweight" (here after referred to as "perceived weight status"). Based on the BMI categories, individuals who reported

their perceived weight status at least one a category above their actual weight status (generated using BMI Z-scores) were treated as overestimators. Normal/underestimators were those students who were not defined as overestimators. The perception of weight was assessed at the baseline and follow-up time points using the same procedure. Given the negative outcomes associated with overestimating weight as discussed above, this study only explored weight misperception as an overestimate of weight. See Table 1 for the distribution of weight perceptions.

Overestimators were 74.4% white, 52.3% male, were on average 12.6 years old at baseline, and 19.3% received free or reduced-price lunch. Normal/underestimators were 69.2% white, 49.4% male, 12.7 years old at baseline, and 21.6% received free or reduced-price lunch. At baseline, there were statistically significant differences between overestimators and normal/underestimators by gender and race ($P<0.01$); the differences in free or reduced-price lunch were not statistically significant ($P=0.13$).

Risk factors—Seven risk factors were assessed: smoking; marijuana use; alcohol use; binge drinking; alcohol, tobacco, and other drug use; fighting; and depressive symptoms. Current smoking was assessed with one question asking the frequency of smoking cigarettes in the past 30 days. Seven response options ranged from not at all to 2 packs per day. Past-month marijuana use and alcohol use were independently assessed, with possible response items for each of the 2 questions ranging from zero to 40 or more times per month. Binge drinking was assessed with one item asking the students how many times they had 5 or more drinks in a row in the past 2 weeks. Seven response options ranged from none to 10 or more times. In addition to assessing alcohol, tobacco, and other drug use independently, an alcohol, tobacco, and other drug use (ATOD) scale was also created (using past-month alcohol, past-month marijuana, and current smoking items as well as an item assessing past-month inhalant use, with students being assigned a “1” for any use of each of the substances). This scale was used to determine if multisubstance use conferred additional risk beyond the use of each individual substance.

Fighting was measured with 5 items assessing how often the student participated in fighting behaviors in the past year (eg, “How many times did you hit or beat someone up?”). Response options ranged from never to 12 or more times, and the scale score ranged from 5 to 25. Depressive symptoms were measured with the Center for Epidemiologic Studies Depression Inventory (CES-D). This was a 20-item scale and ranged from zero to 60.^{35,36} A score of 16 is the recognized cut-point for depressive symptomology.^{36,37} A higher score on each of the risk factors indicates increased participation in the behavior.

Protective factors—Two protective factors were assessed, spirituality and optimism. Spirituality was measured with 6 items that assessed the extent to which spiritual/religious beliefs influenced the student’s decisions regarding drinking or using drugs, eating well, being active, choosing friends, and choosing how to spend free time. Response options were “not at all,” “somewhat,” and “a lot.” The scale ranged from zero to 12, and a higher score indicates more influence of spirituality or religiosity. Optimism was measured with 4 items that assessed how likely the student would live to age 35, get HIV or AIDS, be a parent by 18, and ever get in trouble with the police. The response options were “no chance,” “some chance,” “about 50/50,” “pretty likely,” and “it will happen.” This scale ranged from 4 to 20 with a higher score indicating lower optimism. Both scales have been used previously with good psycho-metric properties.³⁸

Analyses

Cross-sectional and longitudinal generalized and general mixed-effects regression analyses were conducted to assess the association between overestimate of weight and risk and protective factors. Mixed-effects regression models are appropriate for studies in which students are nested within schools.^{39,40} Schools were specified as the nested random effect in the model to account for the variability between schools. All of the risk and protective variables were standardized (transformed to mean=0 and standard deviation=1) prior to analysis, allowing for the direct comparison of the strength of association of each risk and protective factor.

Regression models were conducted to determine the association between the predictive value of risk and protective factors and overestimation of weight. First, a cross-sectional analysis was conducted between risk and protective factors and in the seventh grade and an overestimate of weight in the seventh grade. Second, a cross-sectional analysis was conducted between risk and protective factors in the eighth grade and an overestimate of weight in the eighth grade. Third, a longitudinal analysis was conducted to determine if risk and protective factors measured in the seventh grade predicted an overestimate of weight in the eighth grade. Fourth, a longitudinal analysis was conducted to determine if an overestimate of weight in the seventh grade predicted risk and protective factors in the eighth grade.

All analyses controlled for socioeconomic status (free/reduced lunch), gender, race/ethnicity, body mass index (BMI) percentile, treatment status (intervention or control), and baseline values of outcome (for longitudinal analyses). Of those completing the 2 surveys, missing data on individual survey items ranged from 0.003% (eighth-grade 30-day alcohol use) to 4.6% (seventh-grade spirituality). Missing data for self-reported height and weight were higher and ranged from 12.2 to 16.4%. Observations with missing data were excluded from models; thus although the total sample size was 3010, individual models vary in sample size.

RESULTS

The overall risk-behavior prevalence for this sample has been reported in a previous study⁹ (Table 2). When comparing overestimators and normal/underestimators, the prevalence of each risk factor (eg, smoking, alcohol use, depressive symptoms, fighting) among the overestimators in both seventh and eighth grade was higher than among the normal/underestimators, with the exception of fighting in seventh grade. In each group the risk-behavior prevalence increased from seventh to eighth grades. Overestimators were not more likely to be overweight than normal/underestimators in either seventh or eighth grade.

Cross-Sectional Associations

The cross-sectional generalized mixed-effects regression models found that seventh-graders with higher levels of alcohol, tobacco, drug use, binge drinking, depressive symptoms, and fighting were significantly more likely to overestimate their weight (Table 3). Odds ratios ranged from 1.14 (CI=1.01–1.26) to 1.45 (CI=1.30–1.62). In addition, seventh-graders who had higher levels of optimism were significantly less likely to overestimate their weight status (OR=0.82, CI=0.73–0.92). Similar to the seventh-grade cross-sectional associations, eighth-graders who engaged in higher levels of risk behaviors were significantly more likely to overestimate their weight status. Odds ratios ranged from 1.13 (CI=1.01–1.25) to 1.52 (CI=1.37–1.69). Eighth-graders with higher levels of optimism and spirituality were significantly less likely to overestimate their weight status (ORs=0.82, CI=0.74–0.91; 0.90,

CI=0.80–0.99 respectively). All cross-sectional models controlled for socioeconomic status, gender, race/ethnicity, BMI percentile, and treatment status.

Longitudinal Associations

Overestimate of weight predicting subsequent risk and protective factors—

The longitudinal general mixed-effects regression models in which seventh-grade overestimation of weight status predicted eighth-grade risk and protective factors found no statistically significant relationships (Table 4). All analyses controlled for socioeconomic status, gender, race/ethnicity, BMI percentile, treatment status, and baseline values of the risk or protective factor.

Risk and protective factors predicting subsequent overestimate of weight—

The longitudinal generalized mixed-effects regression models tested if seventh-grade risk and protective factors predicted eighth-grade overestimate of weight (Table 5). Higher levels of depressive symptoms (OR=1.24, CI=1.11–1.39) predicted weight overestimation in eighth grade. Lower levels of optimism in seventh grade predicted weight overestimation in eighth grade (OR=0.87, CI=0.77–0.98). Smoking, alcohol use, marijuana use, ATOD use, fighting, and spirituality did not significantly predict weight overestimation. However, fighting and binge drinking approached significance.

DISCUSSION

Adolescents who overestimate their weight status are at increased risk for a variety of factors that have negative consequences for health. Seventh-graders who overestimate their weight are likely to also report higher levels of substance use, depressive symptoms, fighting, and decreased levels of optimism. These cross-sectional relationships continue into eighth grade along with decreased levels of spirituality.

Increased levels of depressive symptoms and decreased levels of optimism in seventh grade predict weight overestimation in eighth grade. However, seventh-grade weight overestimation does not predict increased risk behaviors or decreased protective factors. This suggests increased depressive symptoms and reduced optimism put youth at risk for inaccurately perceiving their weight. It may be that youth who feel depressed develop a negative self-image. By eighth grade, this negative self-image may also predispose them to believe that they are more overweight than they actually are. Additionally, youth who are risk takers may be more likely to have a skewed perception of normative behavior, and this may also include weight status. These youth may also be less likely to engage regular physical activity and healthy eating and, therefore, may perceive themselves as less healthy overall, thus impacting their weight perception. Given that youth who overestimate their weight are more likely to engage in unhealthy weight-control behaviors,^{21,22} it is important to establish the factors that may increase the likelihood of weight misperception.

Although other studies, as well as this study, have found that overall weight perception is associated with engagement in risk behaviors,^{41,42} the present study found that in a longitudinal analysis, weight overestimation did not predict increased later engagement in risk behaviors. As the pattern of weight distribution in American youth grows heavier, it is possible that youth may also change their weight perception accordingly. Future studies should explore how continued time points may further illuminate how the relationship between risk factors and weight perception may continue to change over time.

As others have shown, there may be important interactions at play that are related to behaviors that put adolescents at risk for negative health outcomes. Research has established a smoking-depression association that plays a role in weight concerns;⁴³ the relationship

between sleep and adolescent risk behaviors;⁸ and the relationships between substance use, depressive symptoms and lack of optimism, and body mass index.⁹ As many of these behaviors are interrelated, theoretical models are needed to describe the nature and direction of these factors that may play in promoting or preventing adolescents from engaging in risk behaviors over time. Further studies are needed that continue to evaluate the constellation of risk behaviors, as well as how these behaviors covary over time, to continue to document these associations and their potential interactions.

This study has some limitations. Body mass index values were based on self-reported height and weight; although self-reported height and weight have been found to be highly correlated with measured height and weight,⁴⁴ these measures are subject to bias. Given that our data were exclusively drawn from self-reported measures (including height, weight, and perceived weight status), it is probable that reporting bias is correlated within individuals for all of these measures, thus attenuating our estimates of weight misperceptions in this population. However, the data are likely biased towards the null (adolescents underestimating their weight); therefore we may underestimate true associations. This reporting bias may also impact our measure of weight misperception. Future research should explore how weight misperception may influence self-reported weight data as well as use objective measures of height and weight. In the present study, we were not able to explore each category of weight misperception. Although some youth in the present study sample underestimated their weight (n=592), the primary focus of this study was on overestimation of weight; future research on underestimation of weight is warranted. Although there are limitations of the study, this study is strengthened by the large sample size and longitudinal exploration of the relationship between weight misperception and risk behaviors.

CONCLUSIONS

Engagement in risk behaviors, reduced optimism, and depressive symptomology may put youth at increased risk for misperceiving their weight status. These behavioral patterns and factors related to negative affect may be impacting youth's sense of self, leading them to believe that they are also heavier than they are. Weight overestimation and/or body dissatisfaction may also increase the likelihood of engagement in unhealthy weight-control behaviors that may actually lead to weight gain. Further, previous research has shown that engagement in risk behaviors has been shown to predict weight increases,⁹ which may result in sensitivity about weight change and overestimation of weight status. Although weight overestimation itself was not associated with later increases in risk factors in our research, the timing and engagement of risk behaviors are important in the establishment of health behaviors and a sense of self that have immediate and longer-term impact on the health status of adolescents.

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Table 1

Actual Versus Perceived Body Weight Status in TEENS Sample % (n)

	Perceived Underweight	Perceived Normal Weight	Perceived Overweight	Total
Seventh Grade				
Actual Underweight	32.5% (248)	45.2% (346)	22.3% (170)	100% (764)
Actual Normal	17.4% (297)	63.5% (1080)	19.1% (326)	100% (1703)
Actual Overweight	4.7% (23)	30.3% (149)	65.0 (319)	100% (491)
Eighth Grade				
Actual Underweight	29.1% (160)	40.5% (222)	30.4% (167)	100% (549)
Actual Normal	16.4% (302)	60.9% (1122)	22.7% (418)	100% (1842)
Actual Overweight	6.6% (38)	27.8% (160)	65.6% (377)	100% (575)

Table 2
Prevalence of Risk Factors Among Adolescents, Overall and by Weight Estimation Status (n=3010)

Risk Factors	Overall			Overestimators			Normal/Underestimators		
	Seventh Grade (n=3010)	Eighth Grade (n=3010)	Seventh Grade (n=3010)	Seventh Grade (n=974)	Eighth Grade (n=893)	Seventh Grade (n=1399)	Eighth Grade (n=1451)		
% Past-month smoking	6.3	14.9		7.7	19.0	5.8	13.7		
% Past-month alcohol use	13.2	29.7		14.2	31.5	12.5	28.6		
% Past-month marijuana use	3.3	12.0		3.7	13.9	2.8	10.6		
% Binge drinking (past 2 weeks)	3.5	10.7		5.6	13.3	2.6	10.0		
% Past-month ATOD use	18.1	35.3		19.1	37.4	16.9	33.5		
% Past-year ever fought	39.8	44.3		37.6	45.0	38.7	41.2		
% Depressed	31.0	34.0		38.3	46.3	26.8	27.8		
BMI									
% >=85 th percentile BMI-for-age z-score	19.6	21.8		3.2	4.8	14.8	16.5		
Mean percentile BMI-for-age z-score	56.0	58.9		44.4	52.7	59.0	58.2		
Mean BMI	19.6	21.0		18.2	19.9	20.8	20.7		

Table 3Cross-Sectional Associations Between Risk/Protective and Weight Overestimation^a(n=3010)^b

Risk/Protective Factor	Seventh-Grade Weight Overestimation Odds ratio (CI)	P-value	Eight Grade Weight Overestimation Odds ratio (CI)	P-value
Risk Factor				
Smoking	1.14 (1.02 – 1.26)	0.02	1.20 (1.09 – 1.33)	0.0003
Marijuana use	1.17 (1.03 – 1.32)	0.01	1.13 (1.01 – 1.25)	0.03
Alcohol use	1.16 (1.05 – 1.28)	0.003	1.19 (1.08 – 1.32)	0.0004
Bingedrinking	1.20 (1.08 – 1.33)	0.0007	1.16 (1.05 – 1.28)	0.005
ATOD	1.19 (1.07 – 1.33)	0.002	1.20 (1.08 – 1.32)	0.0005
Fighting	1.17 (1.05 – 1.30)	0.005	1.20 (1.07 – 1.35)	0.002
Depressive Symptoms	1.45 (1.30 – 1.62)	<0.0001	1.52 (1.37 – 1.69)	<0.0001
Protective Factor				
Spirituality	1.06 (0.95 – 1.17)	0.32	0.90 (0.80 – 0.99)	0.04
Optimism	0.82 (0.73 – 0.92)	0.0006	0.82 (0.74 – 0.91)	0.0003

Note.

^a Adjusted for socioeconomic status, number of parents in home, gender, race/ethnicity, BMI, and treatment.^b Sample size varies in individual models due to missing data.

Table 4

Weight Overestimation in Seventh Grade Predicting Self-reported Risk/Protective (R/P) Factors in Eighth Grade^a (n=3010)^b

Risk/Protective Factor	Eighth Grade R/P Estimate	SE	P-value
Risk Factor			
Smoking	0.07	0.05	0.15
Marijuana use	0.04	0.05	0.36
Alcohol use	-0.002	0.05	0.98
Binge drinking	0.01	0.05	0.82
ATOD	0.04	0.05	0.46
Fighting	-0.03	0.04	0.44
Depressive symptoms	0.03	0.05	0.48
Protective Factor			
Spirituality	-0.08	0.05	0.09
Optimism	0.02	0.05	0.70

Note.

^a Adjusted for socioeconomic status, number of parents in home, gender, race/ethnicity, baseline values of outcome (ie, risk and protective factors in seventh grade), BMI, and treatment.

^b Sample size varies in individual models due to missing data.

Table 5

Self-reported Risk/Protective Factors in Seventh Grade Predicting Weight Overestimation in Eighth Grade^a
(n=3010)^b

Risk/Protective Factor	Eighth Grade Weight Overestimation Odds Ratio (CI)	P-value
Risk Factor		
Smoking	1.00 (0.88 – 1.13)	0.97
Marijuana use	1.05 (0.91 – 1.21)	0.48
Alcohol use	1.05 (0.94 – 1.17)	0.37
Binge drinking	1.12 (1.00 – 1.26)	0.05
ATOD	1.03 (0.92 – 1.17)	0.59
Fighting	1.11 (0.99 – 1.25)	0.07
Depressive symptoms	1.24 (1.11 – 1.39)	0.0002
Protective Factor		
Spirituality	0.98 (0.88 – 1.10)	0.79
Optimism	0.87 (0.77 – 0.98)	0.02

Note.

^a Adjusted for socioeconomic status, number of parents in home, gender, race/ethnicity, baseline values of outcome (ie, Weight Estimation in seventh grade), BMI, and treatment.

^b Sample size varies in individual models due to missing data.