Published in final edited form as:

J Adolesc Health. 2020 February ; 66(2): 181–188. doi:10.1016/j.jadohealth.2019.08.012.

Disordered Eating Behaviors and 15-year Trajectories in Body Mass Index: Findings from Project EAT

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Abstract

Purpose—Disordered eating behaviors are prevalent among adolescents. Understanding how these behaviors link to BMI across different stages of development and over an extended time period may provide insight for designing interventions around eating and weight. This study had two objectives: (1) assess the distribution of disordered eating behaviors and develop a global score of disordered eating behaviors among adolescents, and (2) examine the association between the number of disordered eating behaviors in adolescence and BMI trajectory over 15 years.

Methods—Project EAT, a longitudinal study of weight-related health and behavior comprising four waves (EAT-I to EAT-IV), measured seven disordered eating behaviors (importance of weight and shape; frequent dieting; extreme unhealthy weight control behaviors; overeating; distress about overeating; loss of control while overeating; and frequency of overeating and loss of control) at baseline (N=1230, ages 11 to 18, 1998–1999). These behaviors were summed to create a disordered eating behavior score. BMI was self-reported at all four waves (up to age 27–33 at EAT-IV). Repeated measures with random slope and intercept examined the association between disordered eating behaviors and BMI trajectories over 15 years.

Results—At baseline, 50.7% and 33.7% of females and males endorsed disordered eating behaviors. Throughout 15 years of follow-up, sociodemographic-adjusted BMI was higher among adolescents who engaged in disordered eating behaviors. The association remained significant after further adjustment for baseline BMI ($p < 0.05$).

Conclusions—Among adolescents, regardless of the type of disordered eating behaviors, engagement in disordered eating behavior predicted higher BMI in a dose-response fashion.

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Keywords

Disordered Eating Behaviors; BMI trajectory; Adolescents; Longitudinal Study

Disordered eating behaviors, including overeating, dieting, and weight control behaviors, are highly prevalent among adolescents (1–2), and may range from a single disordered eating behavior to multiple comorbid behaviors. Research suggests that disordered eating behaviors and persistence of disordered eating behaviors over time tend to place young people at risk for eating disorders (3–4) and obesity (5–8).

A growing body of scientific literature suggests that preventing disordered eating behaviors is important for preventing eating disorders and obesity (3–8). While a focus on these eating behaviors is common in the field of eating disorders (4, 9), interventions aimed at preventing obesity tend to place less emphasis on reducing disordered eating behaviors (10–13). One reason may be that some behaviors, including those implemented with the goal of weight loss, are less appreciated as risk factors for weight gain. Thus, it is important to clarify the impact of individual and multiple disordered eating behaviors on Body Mass Index (BMI) over time.

Despite known associations between individual disordered eating behaviors and obesity (5–8), it is less clear how engaging in multiple disordered eating behaviors is associated with BMI. Understanding how the number of disordered eating behaviors is linked to BMI is particularly crucial given that many heterogeneous weight-related disordered eating behaviors and attitudes tend to interrelate, meaning that many people will engage in more than one behavior; these interrelated behaviors and attitudes include appearance concerns, unhealthy weight control behaviors, frequent dieting, and binge eating with different levels of impairment. Given this interconnectedness, creating a global score by counting the number of disordered eating behaviors and related attitudes may therefore serve as a useful proxy for the severity of disordered eating. In this study, we create such a global score, by replicating a composite score we developed in a different study, the Coronary Artery Risk Development in Young Adults (CARDIA), to assess eating behaviors in middle-aged adults (14). Using this score, we specifically aim to address the following two objectives. First, describe the extent of the disordered eating behaviors and assess their prevalence among adolescents. Second, building upon earlier studies reporting greater weight gain over time associated with individual disordered eating behaviors (5–8, 14–15), examine the association between our composite baseline disordered eating behavior scores and BMI trajectory over 15 years of follow-up. We speculate that engaging in one or more disordered eating behaviors will be associated with higher BMI trajectory over time, and that there will be a dose-response relationship between the number of disordered eating behaviors and BMI trajectory over time.

Methods

Study Design and Population

Project EAT, a population-based longitudinal study of weight-related health among adolescents, began as a cross-sectional survey in the Minneapolis-St. Paul metropolitan area of Minnesota in 1998–1999 (2). Given growing research interest in the eating and weight-related health of young people, a decision was made to follow up at five-year intervals with participants from the original sample who had provided sufficient contact information at EAT-I (N=3,672 of 4,746). Follow-up mailed/online assessments were conducted in 2003–2004 (EAT-II) and 2008–2009 (EAT-III), as participants progressed through adolescence and emerging adulthood (16–17). In 2015–2016, participants who previously responded to either EAT-II or EAT-III were contacted for a follow-up. Complete follow-up surveys were collected online, by mail, or by phone from 1,830 of the 2,270 participants that could be contacted (18–19). The University of Minnesota's Institutional Review Board Human Subjects Committee approved all protocols used in Project EAT.

The current analysis used data from participants who responded at all four time points (N=1455). Participants with missing BMI at any of the four time points were further excluded (n=225), resulting in an analytic sample of 1230 participants. Because attrition did not occur completely at random, and majority of the missing BMIs are due to loss to follow-up, inverse probability weighting was used to account for missing data and potential response bias (20). Weights were derived as the inverse of the estimated probability that an individual responded at all four time points based on several baseline covariates, including demographics, overweight status, parental living situation, and grade in school. After weighting, there were no significant differences between the analytic sample and the EAT sample on demographics and weight status ($P>0.20$). In the weighted analytic sample, the distribution of ethnicity/race of the participants was: 49.1% white, 19.0% African American, 5.3% Hispanic, 18.6% Asian, 0.7% Hawaiian or Pacific Islander, 3.2% American Indian or Native American, and 4.2% mixed race.

Creation of the original disordered eating behavior scale

The disordered eating behavior scale developed in Project EAT is replicated from the Coronary Artery Risk Development in Young Adults (CARDIA) study (14). In CARDIA, eight dimensions of disordered eating behaviors were assessed using measures from the Questionnaire on Eating and Weight Patterns-Revised (QEWP-R) (21). The eight dimensions include: concerns about weight or shape; extreme unhealthy weight control behaviors; frequent dieting; anxiety around eating or food; overeating in a relatively short period of time; and three additional symptoms related to overeating, including distress about overeating, loss of control when overeating, and distress about sense of loss of control (Appendix A). These eight dimensions were each dichotomized, closely following the Diagnostic and Statistical Manual of Mental Disorders-5 cut-off points for eating disorders (22). The problematic relationship to eating and food scale was created by counting the number of these variables that were 'positive' for each participant.

Replication of the disordered eating behavior scale in Project EAT

The disordered eating behavior scale developed in this study is a replication of the scale described above. In Project EAT, seven dimensions, described in detail below, were assessed. These included: (1) high importance placed on weight and shape; (2) extreme unhealthy weight control behaviors; (3) frequent dieting; and (4) episodic overeating. For those who endorsed episodic overeating, additional points were assigned for (5) distress about overeating and (6) experience of loss of control during overeating. For those who reported overeating with loss of control, an additional point was assigned for (7) frequent (more than once per month) overeating with loss of control. All seven dimensions of disordered eating behaviors were dichotomized as described below, following the cut-off points used by Diagnostic and Statistical Manual of Mental Disorders-5 (25) or previous Project EAT studies (2, 23) (Appendix A, Figure 1).

Dimensions of disordered eating behavior scale in Project EAT

Importance of weight and shape—Participants reporting that weight and shape were the main or most important things to them over the past six months were classified as being heavily influenced by weight and shape (Test-retest $r=.37$) (2) (Appendix A). The weight or shape concerns item in Project EAT was modified from the QEWP-R (21).

Extreme unhealthy weight control behaviors—Endorsement of any of the following five behaviors were used to define extreme unhealthy eating behaviors: ‘fasted’, ‘took diet pills’, ‘made myself vomit (throw up)’, ‘used laxatives’, and ‘used diuretics (water pills)’ (Appendix A). Although ‘fasting’ is not generally considered as an extreme unhealthy weight control behavior in Project EAT, we included it to match how unhealthy weight control behaviors were defined in CARDIA (14) (Test-retest percent $\kappa=.50$ to $.69$) (2, 24–26).

Frequent dieting—Frequent dieting was assessed from a question drawn from the Pound of Prevention Survey (24, 27), asking ‘how often have you gone on a diet during the last year? By ‘diet’, we mean changing the way you eat so you can lose weight. Available response options were ‘never’, ‘1–4 times’, ‘5–10 times’, ‘more than 10 times’, ‘I am always dieting’. Participants who had gone on diet for 5 or more times in the prior year were defined as a frequent dieter (Test-retest $r=.76$) (2) (Appendix A).

Episodic overeating and related dimensions—Overeating, sense of loss of control, frequency of overeating and loss of control, and distress about overeating were queried from questions adapted from QEWP-R. Overeating was ascertained from the question, ‘In the past year, have you ever eaten so much food in a short period of time that you would be embarrassed if others saw you (binge-eating)? (yes/no), (Test-retest $\kappa=.64$) (28). Among the subset of participants who confirmed overeating, three additional dimensions were assessed, including 1) distress about overeating 2) loss of control when overeating, and 3) frequency of overeating with loss of control. Distress about overeating was assessed from the question, ‘In general, how upset were you by overeating (eating more than you think is best for you)?’ (21) Available responses were ‘not at all’, ‘a little’, ‘some’, ‘a lot’ (Test-retest percent $\kappa=.58$) (28). A point was assigned when the response was ‘some’ or ‘a lot’. Sense of loss of

control was assessed from the question, ‘During the times when you ate this way, did you feel you couldn’t stop eating or control what or how much you were eating?’ (21) (yes, no) (Test-retest percent $\kappa = .58$) (28). The frequency of the overeating and loss of control was assessed from the question, ‘How often, on average, did you eat this way, that is, large amounts of food plus the feeling that your eating was out of control?’. Available options were nearly every day, a few times a week, a few times a month, less than once a month (21). A point was assigned if the response was at least a few times a month or more often. (Test-retest percent $\kappa = .62$) (28) (Appendix A).

To ensure that the seven items were appropriate to use in the development of the disordered eating behavior scale, a factor structure of the scale was tested with one-factor confirmatory factor analysis. The data fit the factor structure well [$\chi^2(2) = 4.60, p = .10, CFI = .99, TLI = .99, WRMR = .52$], and resulted strong standardized loadings across items (.55 – .77). Thus the results indicate that the seven behaviors may reflect one underlying latent construct, and support their use to create a global score.

Categories of disordered eating behavior scale

Throughout this paper, disordered eating behaviors, assessed with the disordered eating behavior scale, are presented in two ways: any versus none; and in three categories (0, 1, and 2 or more). To ensure adequate numbers of participants in each three disordered eating behavior categories, 2 to 7 points of disordered eating behaviors were collapsed to a single category.

Weight status

BMI was assessed using self-reported height and weight (Test-retest $r = 0.99$ and $r = .98$ and $r = .97$ for height and weight respectively at EAT-IV). At baseline (EAT-I), high correlations were found between measured and self-reported in the entire sample of male ($r = 0.88$) and female ($r = 0.85$) adolescents (29). Measurements were also completed at EAT-III for a subsample and had very high correlations between measured and self-reported BMI ($r = 0.95$ and 0.98 for males and females, respectively) (30).

Covariates

Age, ethnicity/race, and gender were self-reported. Ethnicity/race was assessed from the question “Do you think of yourself as (a) white, (b) black or African American, (c) Hispanic or Latino, (d) Asian American, (e) Hawaiian or Pacific Islander, (f) American Indian or Native American. To retain adequate cell sizes, ethnicity/race was dichotomized into either white or nonwhite for analysis.

Statistical Analysis

Participant characteristics are presented as mean $\pm$ SD or % frequency. The association of baseline disordered eating behaviors with BMI over three waves of follow-up was examined using repeated measures regression with random intercept and slope, and an unstructured correlation to account for the clustering within individuals over time. Models were adjusted for age, ethnicity/race, and socioeconomic status, then further adjusted for baseline BMI since heavier weight status predicts both disordered eating behavior and subsequent weight

gain. In addition, we examined the interaction between disordered eating behaviors and gender in predicting BMI, and presented stratified models where appropriate. All models were weighted by non-response propensity to reflect the original EAT sample population. Statistical tests were two-sided with a type 1 error rate of 0.05. Statistical analyses were conducted using SAS 9.4 (SAS Institute Inc., Cary, NC).

Results

Prevalence of disordered eating behaviors

Nearly 51% of the females and 34% of the males in the sample endorsed at least one disordered eating behavior at the study baseline. Engagement in two or more of the behaviors was more prominent among females compared to males (29.2% vs. 12.4%, respectively). The prevalence of disordered eating behaviors varied by ethnicity/race and gender. Among white female participants, 17.6% and 27.4% engaged in single and two or more disordered eating behaviors, respectively; among nonwhite female participants, 24.5% and 31.5% engaged in a single and two or more disordered eating behaviors, respectively. Among white males, 19.8% and 6.5% engaged in a single and two or disordered eating behaviors; 23.3% and 17.6% of the nonwhite males engaged in a single and two or more disordered eating behaviors, respectively (Table 1).

Among females, baseline (EAT-I) BMI was graded by the number of disordered eating behaviors reported at baseline (1998–1999): 21.2kg/m² with 0 disordered eating behaviors, 22.3 kg/m² for 1 behavior, and 22.8 kg/m² for 2 behaviors. Similar patterns were seen among males, where baseline BMI was 21.8kg/m² among those with 0 disordered eating behaviors, 22.6 kg/m² among those with 1 behavior, and 25.5 kg/m² among those with 2 behaviors (Table 1).

Association of Disordered eating behavior scale with BMI trajectories

Among females, in crude models, mean BMI was higher at each time point among those who had engaged in disordered eating behaviors at baseline compared to those without disordered eating behaviors, and was graded by the number of disordered eating behaviors. After further adjustment for sociodemographic variables, the mean BMI remained higher among participants with any disordered eating behavior compared to participants without disordered eating behaviors (BMI difference was 0.9 kg/m², 1.6 kg/m², 1.8 kg/m², 2.7 kg/m² at EAT-I, II, III, and IV respectively) (Figure 2 panel a), and graded by the number of disordered eating behaviors (Figure 3, panel a). When further adjusted for baseline BMI, these findings persisted (Figure 2 panel b and Figure 3 panel b).

Among males, as with females, the crude mean BMI was higher at each time point among participants engaged in any disordered eating behaviors compared to those without disordered eating behaviors, and was graded by the number of disordered eating behaviors. Findings remained significant after further adjustment of sociodemographics (BMI difference between any versus no disordered eating behavior was 1.5kg/m², 1.7kg/m², 1.7kg/m², and 1.3 kg/m², at EAT-I, II, III, and IV respectively) and graded by the number of disordered eating behaviors (Figure 2 panel c; Figure 3 panel c). Findings remained similar

and significant after further adjustment of baseline BMI (Figure 2 panel d; Figure 3 panel d). In contrast to the diverging mean BMI difference over time among females, the mean BMI difference converged over time among males.

Association between each individual eating behavior on BMI over time

Among males, throughout all four study waves, mean BMI difference ranged from -8.39 to 14.65 kg/m^2 , depending on the endorsement of the disordered eating behavior. At EAT-I and II, mean BMI was 10.32 and 14.81 kg/m^2 greater among males who experienced distress about overeating; at EAT-III and IV, mean BMI was 14.27 and 11.40 kg/m^2 greater among males who frequently experienced overeating with loss of control (Appendix B).

Among females, the mean BMI difference ranged from -1.18 to 1.90 kg/m^2 over the four study waves. At EAT-I, mean BMI was 1.02 kg/m^2 higher among participants who experienced distress about overeating compared to females without such experience. At EAT-II and III, the mean BMI was 2.12 and 1.73 kg/m^2 greater among females who frequently engaged in overeating with loss of control compared to females without such behaviors. At EAT-IV, the mean BMI was 1.89 kg/m^2 greater among females experienced of distress about overeating compared to females without experience of distress about overeating (Appendix B).

Discussion

In this population-based dataset of adolescents, we examined 1) the prevalence of disordered eating attitudes and behaviors, measured using a seven-point disordered eating behavior scale and 2) the association of baseline disordered eating behavior scores with BMI trajectories over 15 years. At baseline (age 11–18 yrs), approximately 21% of the male and female adolescents engaged in single disordered eating behaviors and 12% and 29% of male and female adolescents, respectively, engaged in two or more disordered eating behaviors. Disordered eating behaviors were more prevalent among nonwhite participants. Given that disordered eating behaviors vary by gender and ethnicity/race, it is difficult to directly compare our prevalence findings with those other studies that have a different mix of participants from a certain gender or ethnic/racial background. Nevertheless, the prevalence of 21% of females engaged in one disordered eating behavior in our study is consistent with other population-based studies reporting 16 to 33% female adolescents engaged in dieting and 9 to 22% engaged in binge eating (31). While several studies have reported that these disordered eating behaviors are more prevalent in nonwhite than white populations (32–33), other studies have reported the opposite (14, 34) or report no difference (31).

Throughout 15 years of follow-up, disordered eating behaviors in adolescence remained associated with higher BMI, even after adjusting for baseline BMI. This finding agrees with other studies reporting that individual and collective disordered eating behaviors are associated with higher BMI or greater increase in BMI (5–8, 14, 23, 35). In particular, our finding of greater BMI over time among adolescents engaged in disordered eating behavior is in agreement with an earlier study using Project EAT data, which examined BMI change in relation to the persistence of dieting and unhealthy eating behaviors over two time period (5). While we did not examine the persistence of the behaviors in our study, our finding adds

to the literature by suggesting that the total number of disordered eating behaviors in adolescence may affect BMI trajectory over time. In agreement with other studies showing a graded association between the number of disordered eating behaviors and BMI trajectories (14–15), we found a graded association between multiple disordered eating behaviors and BMI at EAT-III and IV among both male and female participants. Taken together, our findings suggest that, at the population level, the count of disordered eating behavior may be a simple yet adequate approach for examining the severity of disordered eating and its consequences.

Overall, physical, hormonal, and emotional changes that adolescents experience, coupled with peer pressure, bullying, weight-related teasing, and media exposure may influence adolescents to attempt weight loss, which may further lead to engagement in multiple disordered eating behaviors (36, 37). These behaviors are of concern because they may be markers of underlying distress and may lead to more severe psychiatric problems.

While engagement in disordered eating behaviors during adolescence may influence BMI, the reverse may also be true, evidenced by other longitudinal studies reporting higher BMI during childhood is associated with development of eating disorders or eating disorder traits during adolescence (38, 39). However, our results indicate that disordered eating behaviors predict subsequent BMI, independent of baseline BMI and suggest that reverse causation is not primarily responsible for our findings. Nevertheless, it is possible that BMI may have diverged prior to the assessment of eating behaviors in this study. Thus a feedback loop may exist between BMI and eating behaviors, where higher BMI during childhood leads to eating disorder traits further placing participants at risk for even greater BMI trajectories.

Overall, our study has several strengths. First, it was carried out using a large prospective study with inclusion of males and females, which allowed us to stratify the results by gender. Additionally, our study had substantial follow-up time, which allowed to track the BMI trajectory from adolescence (11–18 yrs) to young adulthood (27–33 yrs). Our study extends the follow-up period of an earlier Project EAT study that examined dieting and unhealthy weight control behaviors and the BMI difference over 10 years (5). With the additional 5 year of follow-up, our study tracks the BMI trajectory from adolescence to adulthood, and expands the analysis to include a broader spectrum of eating behaviors. Lastly, although BMI was self-reported, the measurement error is unlikely to be large, given validation studies confirming the high correlation between self-reported and measured height and weight in this cohort (29). Nonetheless, it is reported that obese patients with binge eating disorder accurately self-report their weight, height, and BMI (40). Thus, despite the self-reported and measured height and weight in Project EAT has been validated (29), the possible measurement error and variability of the self-reported weight, height, and BMI between subjects with disordered eating behaviors and subjects without disordered eating behaviors might have biased our results. In addition to the potential measurement error of the self-reported BMI, several other limitations of this study should also be noted. First, participants were restricted to Minnesota (at baseline), thus the findings may not be generalizable to other geographical regions. Second, the number of males engaged in multiple disordered eating behaviors was relatively small ($n=43$), limiting inference about their weight trajectories. Third, in this study, all nonwhites were merged into a single group

to maintain adequate cell sizes. Thus, the findings from males and nonwhites should be interpreted with caution. As in all epidemiological studies, our study is limited by potential residual confounding from unmeasured variables. Future studies should replicate the present study across different population groups (e.g., in different life course stages, different ethnic/racial populations, and across regions) and with a longer follow-up and a large group of males. Lastly, given that longitudinal studies report that disordered eating behaviors tend to persist from adolescence to adulthood (5, 16, 18), future work should also consider whether there is a difference between those who persist with disordered eating behaviors over time compared to those who engage for a time but quit, and those who have a later onset of these behaviors.

Conclusion

Disordered eating behaviors are highly prevalent among adolescents. Engagement in these behaviors during adolescence was prospectively associated with higher BMI into adulthood, even after adjustment for baseline BMI. Assuming a desire to lose or maintain weight played a role in the adolescents' motivation to engage in disordered eating, our study illustrates that these behaviors may be contrary to their goals in the long term. Furthermore, due to widespread weight stigma and the fact that thinness is frequently equated with health in US culture, dieting and weight/shape preoccupation among adolescents may be perceived by clinicians and patients as normative. Thus, clinicians working with adolescents should seek to understand (1) the role weight stigma plays in influencing the onset of disordered eating behaviors and (2) the broad range of risks associated with disordered eating behaviors, including the risk of elevated BMI demonstrated in this study. Healthcare practitioners who work with adolescents should consider sharing this paradoxical association with their adolescent patients during their conversations about the harms of disordered eating behaviors and offer alternative behaviors that can foster body appreciation and long-term health benefits. Adolescents may need to repeatedly hear that bodies come in different shapes and sizes and that they should engage in healthy eating and physical activity behaviors. Developmentally appropriate interventions are needed, which specifically encourage a balanced approach to healthy eating and physical activity among adolescents. Finally, public health efforts should address weight stigma in a broader context, including in healthcare settings, schools, workplaces, and various media outlets.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgement

All authors declare that they have no conflict of interest. Data collection for the study was supported by Grant Number R01HL116892 from the National Heart, Lung, and Blood Institute (PI: Dianne Neumark-Sztainer). The authors' time to conduct and describe the analysis reported within this manuscript was supported by Grant Number R35HL139853 from the National Heart, Lung, and Blood Institute (PI: Dianne Neumark-Sztainer) Cynthia Yoon wrote the first draft of the manuscript. Her time was supported by Award Number T32DK083250 from the National Institute of Diabetes and Digestive and Kidney Diseases. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Abbreviation

BMI	Body Mass Index
CARDIA	the Coronary Artery Risk Development in Young Adults Study
QEWPR	Questionnaire on Eating and Weight Patterns-Revised

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Implications and Contribution

Among adolescents, disordered eating behaviors, independent of baseline BMI, predicts greater BMI over time. Clinicians should be aware of the prevalent disordered eating behaviors among adolescents, and the long-lasting association of these behaviors with weight gain. Obesity prevention strategies and messages should not inadvertently promote engagement in disordered eating behaviors.

Figure 1. Disordered Eating Behaviors dimensions at EAT-I (1998–1999, N=1230)

Percents are weighted by non-response propensity to reflect the original EAT-I sample population, Ns are unweighted.

Figure 2. BMI Trajectory over 15 years of follow-up by Disordered Eating Behaviors (none vs. any) in 1998–1999 (N=1230)

*indicates significant BMI difference compared to 0 points (referent group)

Sociodemographic variables include: age, race, and parental socioeconomic status adjusted, stratified by gender

Male Disordered eating behaviors: 0 points 66.3% (n=411), 1 point or more: 33.7% (n=145)

Female Disordered eating behaviors: 0 points 49.3% (n=358), 1 point or more: 50.7% (n=316)

Figure 3. BMI Trajectory over 15 years of follow-up by Disordered Eating Behaviors Categories in 1998–1999 (N=1230)

*indicates significant BMI difference compared to 0 points (referent group)

Sociodemographic variables include: age, race, and parental socioeconomic status adjusted, stratified by gender

Male Disordered eating behaviors: 0 points 66.3% (n=411), 1 point 21.4% (n=102), 2 points 12.4% (n=43)

Female Disordered eating behaviors: 0 points 49.3% (n=358), 1 point 21.5% (n=133), 2 points 29.2% (n=183)

Table 1. Baseline characteristics and prevalence of Disordered Eating Behaviors Scale in EAT-I (N=1230)

Number of Disordered Eating Behaviors % (N)									
Column percent	Female			Male					
	0 points, 49.3% (n=358)	1 point, 21.5% (n=133)	2-7 points, 29.2% (n=183)	P value	0 points, 66.3% (n=411)	1 point, 21.4% (n=102)	2-7 points, 12.4% (n=43)	P value	Total N=1,230
Age (SD), years	14.7±1.6 ^a	15.0±1.7 ^{ab}	15.0±1.5 ^b	0.07	15.0±1.5 ^a	14.9±1.6 ^a	14.8±1.6 ^b	0.55	14.9±1.6
Ethnicity/race (row %)	<0.01				0.02				
White	55.0% (n=83)	17.6% (n=43)	27.4% (n=45)		73.8% (n=80)	19.8% (n=24)	6.5% (n=18)		888
Nonwhites	44.0% (n=275)	24.5% (n=90)	31.5% (n=138)		59.2% (n=331)	23.3% (n=78)	17.6% (n=25)		332
Grade level at baseline	<0.01				<0.01				
Middle school	33.0% (n=111)	30.5% (n=38)	28.4% (n=45)		28.9% (n=108)	35.1% (n=33)	36.4% (n=13)		348
High school	67.0% (n=246)	69.5% (n=94)	69.2% (n=138)		71.1% (n=302)	65.0% (n=69)	63.6% (n=30)		879
Socioeconomic Status	<0.01				<0.01				
Low	15.1% (n=29)	17.6% (n=16)	15.8% (n=18)		15.2% (n=26)	19.7% (n=11)	24.6% (n=7)		107
Medium-low	20.1% (n=52)	12.4% (n=14)	25.1% (n=33)		19.7% (n=59)	13.6% (n=10)	25.9% (n=4)		172
Medium	19.0% (n=68)	36.9% (n=40)	30.6% (n=55)		22.3% (n=78)	35.2% (n=28)	28.7% (n=14)		283
Medium-high	26.0% (n=110)	17.2% (n=35)	20.4% (n=51)		28.3% (n=154)	17.8% (n=25)	16.2% (n=11)		386
High	19.9% (n=96)	15.9% (n=26)	12.0% (n=23)		14.5% (n=90)	13.8% (n=24)	4.6% (n=5)		264
Baseline BMI (SD), kg/m ²	21.2±3.7 ^a	22.3±4.2 ^b	22.8±3.9 ^b	<0.01	21.8±3.8 ^a	22.6±4.1 ^a	25.5±6.4 ^b	<0.01	22.0±4.1

Note: nonwhites include Black or African American, Hispanics or Latino, Asian American, Hawaiian or Pacific Islander, or American Indian or Native American.
 Percents are weighted by non-response propensity to reflect the original EAT-I sample population, Ns are unweighted.