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Are Body Dissatisfaction, Eating Disturbance and Body Mass Index Predictors of Suicidal Behavior in Adolescents? A Longitudinal Study

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Abstract

Disordered eating, body dissatisfaction, and obesity have been associated cross-sectionally with suicidal behavior in adolescents. This study examined these relationships in a longitudinal design, in order to determine the extent to which these variables predicted suicidal ideation and attempts. The study population included 2,516 older adolescents and young adults who completed surveys for Project EAT- II (Time 2), a five year follow-up study of adolescents who took part in Project EAT (Time 1). Multiple logistic regression was used to estimate odds ratios for suicidal behaviors at Time 2. Predictor variables included Time 1 extreme and unhealthy weight control behaviors (EWCB and UWCB), body dissatisfaction, and BMI percentile. Suicidal ideation was reported by 15.2% of males and 21.6% of females and suicide attempts were reported by 3.5% males and 8.7% females. For females, suicidal ideation at Time 2 was predicted by Time 1 EWCB. The odds ratio (OR) for suicide attempts was similarly elevated in females reporting EWCB at Time 1. These OR for both suicidal ideation and suicide attempts remained elevated even after controlling for Time 2 depressive symptoms. In males, EWCB was not associated with suicidal ideation or suicide attempts five years later. BMI and body dissatisfaction did not predict suicidal ideation or suicide attempts in males or females. These results emphasize the importance of extreme weight control behaviors.

Keywords

suicide; obesity; body dissatisfaction; eating disorders

Introduction

Suicide is a leading cause of death in adolescents (Goldsmith, 1986) and suicidal ideation and suicide attempts are common. In reviewing the published literature on suicidal behaviors during adolescence Evans and colleagues (Evans *et al.*, 2005) found mean lifetime rates of suicidal ideation of 29.9%, with suicide attempts reported by 9.7%. It appears that the frequency of suicidal behavior is typically underestimated by families (Breton *et al.*, 2002; Klimes-Dougan, 1998) and might also be by clinicians. Suicidal behavior results in substantial utilization of emergency care and hospitalization (Olfson *et al.*, 2005).

Numerous correlates of suicidal behavior during adolescence have been identified. These include family history of suicidal behavior (Brent & Mann, 2005) substance use disorders, early childhood maltreatment (Bridge *et al.*, 2006), and psychiatric disorders (Andrews & Lewinsohn, 1992; Brent *et al.*, 1988; Fergusson *et al.*, 2003; Kessler *et al.*, 1999). The psychiatric disorders implicated include, most prominently, mood disorders and eating disorders, but also anxiety disorders and psychotic disorders. Among these, it appears that eating disorders may carry the highest suicide risk of any psychiatric disorder (Franko & Keel, 2006; Harris & Barraclough, 1994).

While the link between diagnosable eating disorders and suicidal behavior has been recognized for some time, recent evidence also suggests a correlation between suicidal behavior and body dissatisfaction, as well as disordered eating behaviors that fall short of the threshold for eating disorder, not otherwise specified (EDNOS) diagnosis (Ackard *et al.*, 2003; Crow *et al.*, 2008; Rafiroiu *et al.*, 2003). For example, in a school-based study of 13-year olds, higher levels of body dissatisfaction predicted suicidal attempts over two year follow-up (Rodriguez-Cano *et al.*, 2006). Similarly, Crow et al. (2008) reported that unhealthy weight control behaviors and body dissatisfaction both correlated cross-sectionally with suicidal behavior in adolescents. In a sample of high school age adolescents, body image and particularly body attitudes and feelings predicted suicidal ideation (Brausch & Muehlenkamp, 2007).

Whether overweight and obesity are correlated with suicidal behavior has been unclear; some studies have found such a correlation (Carpenter *et al.*, 2000; Falkner *et al.*, 2001; Moore *et al.*, 1962) but others have not (Crow et al., 2008; Hallstrom & Noppa, 1981; Kittel *et al.*, 1978; Neumark-Sztainer *et al.*, 1997a). If obesity and suicidal behavior were associated in adolescents, this would represent a significant public health concern, given the marked increases in obesity prevalence among adolescents.

While cross-sectional relationships have been repeatedly described, the extent to which body dissatisfaction, disordered eating, or obesity are predictive of the occurrence of suicidal behaviors over time is not known. Identifying factors that are predictive of suicide risk is essential for treatment and prevention. In this study, we examined the longitudinal relationships between body dissatisfaction, weight control behaviors, weight status, and self-reported suicidal behavior using a non-clinical sample of adolescents and young adults. To expand on previous work, the study examined a larger group of both male and female adolescents over a longer period of time at multiple ages. We hypothesized that body dissatisfaction, weight control behaviors, and obesity would be positively associated with self-reported suicidal ideation and suicide attempts at five-year follow-up.

Method

Participants

Data for this analysis came from Project EAT-II (Neumark-Sztainer *et al.*, 2006a; Neumark-Sztainer *et al.*, 2006b). Project EAT-II was a follow-up study of adolescents who participated

in Project EAT (Neumark-Sztainer *et al.*, 2002a; Neumark-Sztainer *et al.*, 2002b), which examined dietary intake, weight status, eating behaviors, and socio-environmental and demographic correlates in a large, ethnically diverse study population. Project EAT involved 4,746 Minnesota middle and high school students who were initially surveyed during 1998-1999. Project EAT-II aimed to re-contact all of the original participants five years after the initial study. A total of 1,074 (22.6%) of the original cohort was lost to follow-up, mainly due to having no address found at follow-up (N = 591), or missing contact information at Time 1 (N = 411). A total of 3,672 participants were contacted by mail in 2003-2004 and 2,516 (68.4% of those contacted, 1,386 females and 1,130 males) completed the Project EAT-II survey. The follow-up sample was more likely to be white and at higher SES, likely due to higher mobility in the lower SES and non-while groups, who were heavily represented in the original EAT sample. Population weights reflecting the original sample were used in all analyses to address this shortcoming. The high school aged cohort represented about one-third of the sample (mean age = 17.2) while two-thirds were in the young adult group (mean age = 20.4). The sample was ethnically diverse, with Asian Americans comprising 19.2% of the total, African Americans 18.7%, Hispanics/Latinos 5.8%, Native American 3.6%, mixed race 4.3%; the remainder (48.4%) were Caucasian. A wide socioeconomic distribution was seen, with most participants falling in the lower middle, middle, or upper middle SES categories; 17.4% were of low SES and 13.8% were of high SES. Further details of Project EAT-II are available elsewhere (Neumark-Sztainer et al., 2006a; Neumark-Sztainer et al., 2006b). All study procedures were approved by the University of Minnesota's Human Subject Committee for both Project EAT and Project EAT-II.

Measures

Weight Status—At Time 1, weight and height were measured by trained Project EAT staff in school settings. Weight was measured in light clothing and height was measured without shoes. Body mass index (weight (kg)/height $(m)^2$) was calculated and participants were classified as being underweight (less than 15^{th} BMI percentile), average weight (15^{th} to 85^{th} BMI percentile), moderately overweight (85^{th} to 95^{th} BMI percentile), or very overweight ($\geq 95^{th}$ BMI percentile) according to gender- and age-based cutpoints recommended by the Centers for Disease Control and Prevention (Kuczmarski et al., 2000).

Body Satisfaction—Subjects completed a 10-item scale on which satisfaction with separate body parts and characteristics was rated from one (“very dissatisfied”) to five (“very satisfied”). For example, the scale asks “How satisfied are you with your stomach?” A score was created ranging from 10 to 50, with greater scores indicating greater levels of body satisfaction (Pingitore *et al.*, 1997). Cronbach's alpha at Time 2 was 0.92 for females and 0.93 for males for the composite score. In this study, test-retest reliability was also acceptable with Pearson correlations of .68 to .77 in a racially diverse subgroup of 252 7^{th} and 10^{th} grade participants. The median score was 35; the top quartile cutoff was 41, and the lowest quartile cutoff was 28. In the current analyses, the lowest quartile was considered to have “body dissatisfaction.”

Suicidal Thoughts and Behaviors—Students reported on both suicide attempts and suicidal ideation. The survey questions used included “have you ever thought about killing yourself?” and “have you ever tried to kill yourself?” Response options included “no”, “yes, in the past year”, and “yes, more than a year ago”.

Those reporting past year suicidal ideation or attempts at Time 2 were categorized as cases regardless of Time 1 suicidal status. Those reporting suicidal ideation or attempts “more than a year ago” at Time 2 but *no* suicidal reports at Time 1 were also categorized as cases. All others were considered to have no suicidal thoughts or behaviors at Time 2. In this way we were able to identify suicidal ideation and attempts occurring after the assessment of Time 1

predictor variables. Two week test-retest Spearman correlations at Time 1 were 0.78 (ideations) and 0.80 (attempts).

Unhealthy Weight Control Behaviors—The unhealthy weight control behaviors assessed included: 1) taking diet pills, 2) "making myself vomit", 3) using laxatives, 4) using diuretics, 5) fasting, 6) eating very little food, 7) using a food substitute (powder/special drink), 8) skipping meals, 9) smoking more cigarettes. Subjects were asked for each of these to answer 'yes' or 'no' to "Have you done any of the following things in order to lose weight or keep from gaining weight during the past year?". Subjects endorsing any of items 1-4 were classified as using extreme weight control behaviors (EWCB); those endorsing any of items 5-9 were considered to have unhealthy weight control behaviors (UWCB).

Depressive Symptoms—A six item scale was used to assess depressive symptoms (Kandel & Davies, 1982). At Time 2, the scale had a Cronbach's alpha of .80 for males and .81 for females. For the current analyses, those scoring in the highest quartile were considered to have high levels of depressive symptoms.

Demographic Variables—Socioeconomic status (SES) was categorized into five levels using an algorithm based on highest educational level completed by either parent plus eligibility for free or reduced lunch, eligibility for public assistance, and parental employment status (Neumark-Sztainer et al., 2002a). Race/ethnicity was assessed by asking "Do you think of yourself as 1) white, 2) black or African American, 3) Hispanic or Latino, 4) Asian American, 5) Hawaiian or Pacific Islander, or 6) American Indian or Native American, 7) other race?" Participants were asked to check all that apply. For purposes of this analysis, all non-whites were grouped together. Analyses were adjusted for race/ethnicity based on this grouping.

Data Analysis

Data were weighted to adjust for differential response rates using the response propensity method (Little, 1986), where the inverse of the estimated probability that an individual responded at Time 2 was used as the weight. Estimates are therefore generalizable to the population represented by the original Time 1 Project EAT sample.

Multiple logistic regression analysis was used to estimate odds ratios for Time 2 suicidal ideation and attempts separately. In unadjusted analyses, four Time 1 weight-related variables (weight status, body dissatisfaction, EWCB, and UWCB) were entered simultaneously. A second model adjusted for race, SES and age group. This model was further adjusted for high depressive symptoms at Time 2, given that depression has been associated with suicidal behavior.

Results

Weight distribution, frequencies EWCB and UWCB at Time 1, suicidal behavior at Time 2, and participant characteristics are shown in Table 1. UWCB were endorsed by the majority of the females (57.0%) and a large percentage of the males (31.1%). Extreme weight control behaviors were less common (12.9% of females and 3.9% of males). Suicidal ideation was reported by 21.6% of females (12.6% in the past year, 8.9% more than one year ago) and 15.2% of males (8.3% in the past year,7.0% more than one year ago) at Time 2, while suicide attempts were reported by 8.7% of females and 3.5% of males at Time 2.

The unadjusted and adjusted relationships between Time 1 weight-related variables (weight status, body dissatisfaction, EWCB and UWCB), and Time 2 suicidal ideation are shown in Table 2. For females, EWCB were predictive of later suicidal ideation (OR 1.98, 95% CI 1.34 – 2.93). These odds ratios remained elevated even after adjusting for demographic variables

and Time 2 depressive symptoms (OR 1.79, 95% CI 1.19 – 2.71). In contrast, among males the relationship between EWCB and suicidal ideation was not statistically significant. Furthermore, neither UWCB, body dissatisfaction, nor weight status at baseline predicted suicidal ideation at follow-up for males or females.

Table 3 shows the relationship between Time 1 weight status, body dissatisfaction, weight control behaviors, and Time 2 reported suicide attempts. Similarly, EWCB in females was associated with a significantly elevated odds ratio for suicide attempts (OR 2.53, 95% CI 1.53 – 4.18). These odds ratios remained elevated after adjusting for demographic variables and Time 2 depressive symptoms (OR 2.41; 95% CI 1.43 – 4.07). In males, no association between suicide attempts and EWCB was found. As with suicidal ideation, UWCB, body dissatisfaction, and weight status were not significantly associated with suicide attempts in either males or females over five-year follow-up.

Discussion

The results of this study show that in females but not in males, EWCB at baseline were predictive of suicidal ideation and suicide attempts at five-year follow-up independent of depressive symptoms. Contrary to our hypotheses, body dissatisfaction, UWCB, and weight status were not predictive of suicidal behavior five years later in males or females.

These findings are consistent with the results of several previous studies that have shown an association between both syndromal eating disorders (Harris & Barraclough, 1994) and limited eating disorder symptoms and suicidal behaviors (Crow et al., 2008; Miotto *et al.*, 2003). Previous studies were cross-sectional, however, and the current study indicates that EWCB are predictive of suicidal ideation and suicide attempts over time, suggesting that EWCB might be a risk factor or risk marker for later suicidality. While the rates of suicidal ideation and attempts endorsed by subjects were high, they were in the range of those reported in other community-based studies (CDC, 2000; Kessler et al., 1999).

Differential associations between EWCB and suicidal thoughts and behaviors were found between males and females. The smaller sample size of males endorsing EWCB (as well as suicidal behaviors) and resulting limited power to detect such efforts may explain this, given that the O.R. observed were similar in males and females (but confidence intervals were larger in males). An alternative explanation may be that differing societal attitudes regarding the importance of weight and shape make EWCB more emotionally salient for females. If this were the case, EWCB might have more psychopathological consequences for females than males.

Results from the current study differ from previous cross-sectional work which has found an association between body dissatisfaction and suicidal behavior in adolescents (Crow et al., 2008; Miotto et al., 2003). The reasons for these divergent findings are unclear. Perhaps body dissatisfaction is associated with psychosocial distress which might have short-term but not long-term links to suicidal behavior. The nature of this study, with reassessment after five years, did not examine short-term relationships between these variables. Alternatively, body dissatisfaction and UWCB may be so common among young women at present as to be considered normative; perhaps only more severe psychopathology (for example, weight control behaviors defined as “extreme”: purging, laxative use, and diuretic use) is predictive of suicidal behavior. This relationship might operate at the personality trait level. For example, underlying impulsivity has been associated with both disordered eating and with suicidal behavior. Recent work has suggested that altered serotonin function may be correlated with the co-occurrence of self-harm, impulsivity, and bulimic symptoms (Steiger *et al.*, 2001).

The results of this study further our understanding of the relationship between body weight and suicidal behavior. The finding that weight was unrelated to suicidal behavior is consistent with some prior work in this area (Crow et al., 2008; Hallstrom & Noppa, 1981; Kittel et al., 1978; Mukamal *et al.*, 2007; Neumark-Sztainer *et al.*, 1997b) but contradicts others (Carpenter et al., 2000; Falkner et al., 2001; Neumark-Sztainer et al., 1997b). It is noteworthy that while the cross-sectional prior studies have been mixed, the two prospective studies examining this question (Mukamal et al. 2007, and the current study) have not found higher BMI to be predictive of suicide.

There are a number of strengths and some limitations to the current project. The sample size is large and diverse, in terms of gender, ethnicity and socioeconomic status. In addition, the use of a prospective design with five-year follow-up broadens our understanding of the relationship between EWCB and later suicidal behavior. Limitations include the lack of extensive detail regarding suicidal ideation and suicide attempts. It would be helpful to have more information in this regard, particularly the timing, frequency, and severity of suicidal behaviors over the five-year period. There is evidence that varying the method of suicide assessment leads to variation in the reported rate of suicidal behavior (Prinstein *et al.*, 2001). Similarly, more detailed measures of body dissatisfaction and disordered eating behaviors/attitudes would have been helpful and might have yielded different findings. Attrition at five-year reassessment is another limitation. Finally, while this design is prospective, it nonetheless entails some degree of retrospective recall at the five-year reassessment point.

These findings have important implications for future research and practice. They help clarify the link between disordered eating and suicidal behavior. These findings further emphasize the importance of screening for EWCB. Levels of disordered eating that may fall short of diagnostic thresholds have been viewed as less serious, but such disordered eating is tied to psychosocial and physical morbidity and, this study suggests, is associated with an increased risk of suicidal behavior. It is unclear from the current study if EWCB lead to suicidal thoughts/behaviors through some underlying mechanism or rather are a sign of more global distress and a risk marker for suicide risk. In either case, the use of EWCB by an adolescent suggest a need for careful monitoring of the adolescent's mental health. Future research should examine this issue over even longer periods of observation. In addition, it would be of interest to know whether the risk for adolescent suicidal behavior conferred by EWCB carries over into adulthood. If the link between EWCB and suicidal behavior is confirmed, efforts directed at preventing the onset of disordered eating might also diminish the risk of subsequent suicidal behavior.

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Table 1

Demographics and Key Variables by Gender

	Total		Male		Female	
	%	(n)	%	(n)	%	(n)
Gender	100	(2,516)	44.9	(1,130)	55.1	(1,386)
Age cohort (Time 2)						
High School	32.1	(807)	32.5	(367)	31.8	(441)
Young Adult	67.9	(1,709)	67.5	(763)	68.2	(946)
Weight Status (Time 1)						
>15%ile	5.1	(124)	5.5	(61)	4.8	(64)
15-85%ile	64.0	(1,562)	64.4	(711)	63.6	(851)
85-95%ile	15.6	(380)	12.6	(139)	18.0	(241)
≥ 95%ile	15.4	(375)	17.5	(193)	13.6	(182)
EWCB (Time 1)	8.9	(220)	3.9	(44)	12.9	(176)
Diet Pills	3.8	(95)	1.3	(14)	5.9	(81)
Self-induced vomiting	4.5	(111)	1.6	(18)	6.8	(93)
Laxatives	1.0	(25)	0.5	(6)	1.4	(19)
Diuretics	1.1	(28)	0.7	(8)	1.5	(20)
UWCB (Time 1)	45.3	(1,125)	31.1	(347)	57.0	(778)
Fasting	14.1	(349)	9.8	(109)	17.7	(240)
Eating very little	32.3	(805)	17.5	(196)	44.3	(609)
Food substitutes	8.0	(200)	5.5	(62)	10.1	(138)
Skipping meals	32.0	(802)	16.6	(186)	44.9	(616)
Cigarettes for weight control	7.0	(174)	4.0	(45)	9.4	(129)
Suicidal Ideation (Time 2)	18.7	(463)	15.2	(168)	21.6	(295)
Suicidal Attempts (Time 2)	6.4	(157)	3.5	(38)	8.7	(119)

EWCB: extreme weight control behaviors

UWCB: unhealthy weight control behaviors

Table 2

Weight Status, Body Dissatisfaction, and Weight Control Behaviors at Time 1, and Suicidal Ideation at Time 2

	Unadjusted [1] OR (95% CI)	Adjusted for Demographic Variables [2] OR (95% CI)	Adjusted for Demographic Variables and Time 2 Depression OR (95% CI)
Weight Status			
Males	0.97 (0.78-1.21)	0.94 (0.75-1.19)	0.95 (0.74-1.22)
Females	1.06 (0.88-1.26)	1.02 (0.85-1.23)	1.02 (0.85-1.23)
Body Dissatisfaction			
Males	0.88 (0.50-1.54)	0.99 (0.56-1.75)	0.67 (0.36-1.24)
Females	1.06 (0.77-1.46)	1.02 (0.74-1.42)	0.93 (0.67-1.30)
UWCB			
Males	0.81 (0.54-1.24)	0.77 (0.50-1.19)	0.62 (0.39-1.00)
Females	0.89 (0.65-1.21)	0.93 (0.68-1.27)	0.82 (0.59-1.13)
EWCB			
Males	1.36 (0.55-3.36)	1.73 (0.69-4.37)	1.66 (0.62-4.43)
Females	1.98 (1.34-2.93)	2.00 (1.34-2.99)	1.79 (1.19-2.71)

[1] 4 weight related variables entered simultaneously

[2] Adjusted for race, Socioeconomic and age group

OR: Odds Ratio

CI: Confidence Interval

Table 3

Weight Status, Body Dissatisfaction, and Weight Control Behaviors at Time 1, and Suicide Attempts at Time 2

	Unadjusted [1] O.R. (95% CI)	Adjusted for Demographic Variables [2] O.R. (95% CI)	Adjusted for Demographic Variables and Time 2 Depression O.R. (95% CI)
Weight Status			
Males	1.18 (0.80-1.76)	1.16 (0.78-1.74)	1.19 (0.78-1.81)
Females	1.28 (1.00-1.64)	1.18 (0.92-1.53)	1.17 (0.91-1.51)
Body Dissatisfaction			
Males	1.70 (0.72-4.01)	1.76 (0.74-4.20)	1.14 (0.45-2.89)
Females	1.05 (0.67-1.66)	1.05 (0.66-1.67)	1.02 (0.64-1.62)
UWCB			
Males	1.10 (0.51-2.39)	1.09 (0.50-2.38)	0.95 (0.42-2.12)
Females	1.23 (0.77-1.98)	1.26 (0.78-2.03)	1.14 (0.71-1.86)
EWCB			
Males	3.19 (1.01-10.13)	3.15 (0.97-10.22)	2.95 (0.86-10.07)
Females	2.53 (1.53-4.18)	2.70 (1.62-4.51)	2.41 (1.43-4.07)

[1] 4 weight related variables entered simultaneously

[2] Adjusted for race, SES and age group

OR: Odds Ratio

CI: Confidence Interval