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Examination of the Relationship between Obesity and Suicidal Ideation

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Abstract

Objective—The relationship between obesity and suicidal ideation and behavior (suicidality) is not well-understood, and conventional suicide risk factors do not adequately explain the associations observed. Thus, the current study aimed to further examine the relationship between body mass index (BMI; kg/m²) and suicidal ideation as well as potential mechanisms of this relationship.

Methods—Two hundred seventy-one adults (n=151 undergraduates; n=120 obesity treatment participants) completed self-report questionnaires assessing relevant variables, including suicidal ideation, perceived burdensomeness, thwarted belongingness, and current height/weight used to calculate BMI.

Results—There was a significant, quadratic relationship between BMI and suicidal ideation ($b=.001$, $t=2.21$, $p=.03$, partial $r=.14$) and between BMI and perceived burdensomeness ($b=.003$, $t=2.50$, $p=.013$, partial $r=.16$), such that as BMI increased, these positive associations became more pronounced. Additionally, perceived burdensomeness partially mediated the relationship between BMI and suicidal ideation.

Conclusions—Individuals with a higher BMI demonstrated increased suicidal ideation as well as greater feelings of perceived burdensomeness. These results provide novel information regarding potential mechanisms explaining the obesity-suicidal ideation association.

Keywords

obesity; suicidal ideation; burdensomeness; belongingness; mediation

Introduction

The magnitude and direction of the relationship between obesity and suicidal ideation and behavior (suicidality) is not clear. Several large, epidemiological studies have reported an inverse relationship between body mass index (BMI; kg/m²) and completed suicide, such that individuals with a higher BMI have a lower risk of death by suicide as compared to

individuals with a lower BMI (1-3). In contrast, the majority of studies examining BMI and suicide attempts in obese individuals have shown positive associations between these factors (4). Few studies have examined the association between BMI and suicidal ideation, with two finding heavier body weight associated with increased ideation (5, 6), and others failing to observe any association (7, 8).

In addition to further examining the relationship between BMI and suicidal ideation, identifying factors that account for potential associations between weight status and suicidality has been cited as a research priority (9). Indeed, conventional risk factors for suicide (e.g., alcohol use, marital status, firearm ownership) do not adequately explain observed associations (10). Thus, other variables that may influence suicidal ideation and behavior in overweight individuals need to be examined. The interpersonal theory of suicidal behavior (11-13) posits that individuals with low social support (i.e., low belongingness) and feelings of being a burden to others (i.e., perceived burdensomeness) are more likely than others to experience a desire for suicide. Additionally, the theory posits that while these two psychological states increase risk for suicidal ideation, a third factor, an acquired sense of fearlessness about death and high pain tolerance (i.e., acquired capability for suicide), is necessary for individuals to *act* on suicidal thoughts (i.e., lethal or near-lethal suicide attempts). According to the theory, having the acquired capability for suicide does not necessarily mean that an individual wants to die by suicide, but rather that the individual is physically capable of dying by suicide should the desire develop.

There is robust empirical support for this explanatory model (14), which has been validated in clinical (15, 16) as well as non-clinical and community-based samples (16). Although this theory has not been applied to overweight/obese individuals, these constructs may provide some explanation for previous findings of positive associations between obesity and suicidal ideation and non-lethal attempts. In particular, it is possible that individuals with higher BMIs have increased levels of thwarted belongingness and perceived burdensomeness, which may increase risk of severe suicidal ideation. However, the association between obesity and completed suicide may be less clear, according to the theory. Although some obese individuals may have lower levels of acquired capability due to decreased physicality (e.g., exposure to routine hard exercise), other obese individuals may have relatively high levels of acquired capability due to painful and provocative experiences, such as exposure to surgical and other medical procedures or previous trauma. Consistent with this notion, research suggests obese individuals who have undergone bariatric surgery have increased rates of suicide compared to matched populations (17).

Given the limited and mixed findings on the association between BMI and suicidal ideation (1-8), the current study examined both a linear and quadratic relationship to determine the most appropriate model to describe the association between these constructs. To our knowledge, previous studies have not examined the quadratic relationship between BMI and suicidal ideation, which is an important step given the increased health and psychosocial consequences (including depressive symptoms) observed with more extreme levels of obesity in particular (18,19). Additionally, the current study aimed to explore potential mechanisms, including perceived burdensomeness and thwarted belongingness, of the relationship between weight status and suicidal ideation. It was hypothesized that individuals with a higher BMI would report: 1) increased levels of suicidal ideation, 2) increased levels of thwarted belongingness, and 3) increased levels of burdensomeness as compared to individuals with lower BMI. Given these predicted associations, it was also hypothesized that feelings of thwarted belongingness and perceived burdensomeness would mediate the relationship between BMI and suicidal ideation.

Subjects and Methods

Study Population

Participants were 271 males and females recruited from either a large southeastern university (n=151) or a community-based behavioral weight management clinic (n=120). Students were enrolled in psychology courses at the university and completed the study in exchange for course credit. Participants from the behavioral weight management clinic were members of a health maintenance organization (HMO) seeking treatment for weight loss through a program offered by the HMO.

Procedure

Students were recruited through a research participant pool that includes all students enrolled in psychology courses at the university. The current study was advertised to the participant pool and students volunteered to participate in exchange for course credit. HMO members were recruited during orientation group sessions outlining the weight management program. All participants signed a consent form prior to participation in any study procedures. Participants were told they would be filling out questionnaires regarding their general health, mood and eating symptoms. All procedures were approved by the university's Institutional Review Board.

Measures

Demographic variables including age, gender, race, ethnicity and income were assessed via self-report questions. Participants were also asked to indicate the presence (yes/no) of a variety of chronic medical conditions potentially associated with excess weight or cardio-metabolic dysfunction, including heart attack, diseases of the arteries, stroke, high blood pressure, diabetes, and kidney disease. For the current study, we created a composite variable of these cardio-metabolic conditions, which was used as a covariate. As such, scores for this variable could range from 0 to 6, with higher scores indicating a greater number of weight-related medical conditions.

Depressive Symptom Index- Suicidality Subscale (DSI-SS) (20)—The DSI-SS is a brief self-report measure of suicidal ideation, including thoughts, plans, and impulses for suicidal behavior. The measure consists of four items each scored on a four-point scale (0-3). Scores range from 0-12 with higher scores indicating greater severity of suicidal ideation. The DSI-SS has demonstrated good reliability and validity in previous studies (20) as well as in the current sample (Cronbach's $\alpha=.84$).

Previous Suicide Attempt—A history of a suicide attempt was assessed by a single self-report item that asked "have you ever made a suicide attempt?" This item was coded as a dichotomous variable (yes/no) and used as a covariate in analyses.¹

Interpersonal Needs Questionnaire (INQ) (21)—The INQ is a 15-item self-report questionnaire designed to measure participants' connection to others (i.e., belongingness) and the extent to which they feel like a burden on the people in their lives (i.e., perceived burdensomeness). The current study used a shorter 10-item version of this measure (22). The thwarted belongingness subscale consisted of five items, including "these days, I feel like I belong" (reversed) and "these days, I feel that there are people I can turn to in times of need" (reversed). The perceived burdensomeness subscale consisted of five items, including "these

¹Five percent (n=14) of the sample endorsed a lifetime suicide attempt based on this single self-report item (yes/no); we did not have sufficient power to examine the influence of BMI on self-reported suicide attempts.

days, I think I am a burden on society” and “these days, I make things worse for the people in my life.” All items were scored on a 7-point scale ranging from 1 (not at all true for me) to 7 (very true for me). As such, scores for the each subscale range from 5-35 with higher scores indicating greater feelings of perceived burdensomeness or thwarted (low) belongingness. The measure has demonstrated good internal consistency and evidence for construct validity in clinical and non-clinical samples (21, 22). Reliability in the current study was good (Cronbach’s $\alpha=.85$ for belongingness items; Cronbach’s $\alpha=.89$ for burdensomeness items).

Eating Disorders Inventory-Body Dissatisfaction Subscale (EDI-BD) (23)—The EDI-BD is one of eight subscales of the EDI, which is a widely used 64-item self-report measure of eating disorder symptoms. The EDI-BD subscale consists of nine items that assess attitudes and feelings about one’s body shape, including statements such as “I think my hips are too big” and “I feel satisfied with the shape of my body.” Each item is scored on a six-point scale ranging from 1 (never) to 6 (always). Scores range from 9-54 with higher scores indicating greater body dissatisfaction. This subscale was used as a covariate in analyses. It has demonstrated good reliability and validity in previous samples (23) as well as in the current sample (Cronbach’s $\alpha=.93$). The EDI has been used to assess body dissatisfaction in various samples, including community-based obese and non-obese groups (24-27).

Patient Health Questionnaire-9 (PHQ-9) (28)—The PHQ is a 9-item measure used to assess symptoms of depression, which served as a covariate in analyses. Each item is rated on a 4-point scale ranging from 0 (not at all) to 3 (nearly every day). Scores range from 0-27 with higher scores indicating greater severity of depressive symptoms. Reliability in the current sample was good (Cronbach’s $\alpha=.84$).

Weight and Height—Participants reported their current height (in feet and inches) and weight (in lbs). Self-reported weight has been shown to be a valid and reliable approach that corresponds closely with objective, documented measurements (29, 30). Height and weight were used to calculate body mass index (BMI; kg/m^2) for each participant.

Statistical Analysis

Due to potential influences of eating disordered symptoms on weight and suicidal ideation (31), individuals who were underweight (BMI < 18.5) were excluded from analyses, which represented only 10 individuals.² Independent t-tests and chi-square analyses were conducted to examine differences in demographic and psychological variables between the two samples (i.e., college students and weight management patients). Expected differences were found between the college and weight management groups in terms of age (19 ± 1 vs. 48 ± 11 years, $p < .001$) and BMI (23.2 ± 3.7 vs. $38.7 \pm 9.7 \text{ kg}/\text{m}^2$, $p < .001$). Additionally, the weight management group had a significantly higher percentage of female participants compared to the student group (88% vs. 79%, $p = .05$). As such, subsequent analyses controlled for these group differences to increase power and variability, rather than conduct separate analyses for each location.³

²When these individuals are included in analyses, similar results are observed for the relationship between BMI and perceived burdensomeness, BMI and thwarted belongingness, and burdensomeness and suicidality; as expected, the relationship between BMI and suicidality ($p = 0.08$) is less clear, given the likelihood of increased eating pathology and suicidality among some, but not all, low-weight individuals.

³Additional analyses were conducted to determine whether the predictor (i.e., BMI²) significantly interacted with group location. There were no significant BMI² X group interactions; thus, only pooled analyses are presented.

Linear regression analyses were first used to examine the relationships between BMI and suicidal ideation as well as BMI and perceived burdensomeness and thwarted belongingness. Polynomial regression was used to examine quadratic relationships. As indicated in polynomial analyses (32), the linear predictor (i.e., BMI) was centered and the higher order predictor was formed from this centered variable. Analyses were first conducted controlling for age and gender and then conducted controlling for additional covariates likely to influence the hypothesized relationships, including depression, weight-related medical conditions, body dissatisfaction, and past suicide attempt. Lastly, given the cross-sectional nature of the data, exploratory regression analyses were conducted to examine potential mediators of the relationship between BMI and suicidal ideation as has been done in previous studies (33-36).

Results

Sample Characteristics

Demographic information and sample characteristics appear in Table 1. Mean age of the overall sample was 32 ± 17 years (range 18-75), and mean BMI was 30.1 ± 10.4 kg/m² (range 18.8-79.7). Racial composition of the sample was as follows: 67% White/Caucasian, 22% Black/African-American, 1% Asian or Hawaiian/Pacific Islander, 8% Other.

Association between BMI and Suicidal Ideation

Controlling for age and gender, there was no significant linear relationship between BMI and suicidal ideation ($b=.009$, $t=1.59$, $p>.11$, partial $r=.10$). However, there was a significant quadratic relationship between BMI and suicidal ideation such that as BMI increases, the relationship between BMI and suicidal ideation becomes stronger ($b=.001$, $t=2.21$, $p=.03$, partial $r=.14$) (Table 2, Model 1). Furthermore, this relationship remained significant even while controlling for important covariates, including depression, medical conditions, body dissatisfaction, and past suicide attempts ($b=.001$, $t=2.18$, $p=.03$, partial $r=.15$) (Table 2, Model 2).

Associations between BMI, Burdensomeness and Belongingness

Controlling for age and gender, there was no significant linear ($b=.03$, $t=.68$, $p=.50$, partial $r=.04$) or quadratic relationship between BMI and thwarted belongingness ($b=.002$, $t=.88$, $p=.38$, partial $r=.06$). Additionally, there was no significant linear association between BMI and perceived burdensomeness ($b=.04$, $t=1.56$, $p=.12$, partial $r=.10$). However, there was a quadratic relationship such that as BMI increases, the positive association between BMI and perceived burdensomeness is more pronounced ($b=.003$, $t=2.50$, $p=.013$, partial $r=.16$) (Table 3, Model 1). Furthermore, this relationship remained significant while controlling for depressive symptoms, body dissatisfaction, medical conditions, and past suicide attempt ($b=.003$, $t=2.65$, $p=.01$, partial $r=.18$) (Table 3, Model 2).

Exploratory Analyses: Burdensomeness as a Mediator of the BMI-Suicidal Ideation Association

Given the initial association between BMI and suicidal ideation, mechanisms of this relationship were explored. In particular, perceived burdensomeness was significantly associated with both suicidal ideation ($b=.15$, $t=12.01$, $p<.001$) and BMI. As such, it was examined as a potential mediator of the relationship between BMI and suicidal ideation based on the mediation approach described by Baron and Kenny (37).⁴ Indeed, when

⁴As expected, thwarted belongingness was also significantly associated with suicidality in the current sample ($p<.001$); however, it was not explored as a potential mediator given its lack of association with BMI.

burdensomeness was added to the regression model examining the quadratic relationship between BMI and suicidal ideation, BMI was no longer significant, suggesting partial mediation. A Sobel test (37) confirmed that the association found between BMI and suicidal ideation was accounted for by levels of perceived burdensomeness ($z=2.91$, $p<.002$) (Figure 1). The significance of the mediation effect was also verified using the PRODCLIN program (38), which computes confidence limits based on the distribution of the product of the unstandardized path coefficients divided by the pooled standard error of the path coefficients rather than the normal distribution. The 95% confidence interval [.0002, .0007] did not include zero, indicating significant mediation at $p<.05$.

Discussion

In the current study, individuals with a higher BMI demonstrated increased suicidal ideation as well as greater feelings of perceived burdensomeness as compared to individuals with lower BMI. Both of these relationships were non-linear, such that the associations with suicidal ideation and perceived burdensomeness were more pronounced among individuals with more severe levels of obesity. Importantly, the significant non-linear association between BMI and suicidal ideation remained even after controlling for strong covariates, including depression, past suicide attempt, body dissatisfaction, and chronic medical conditions. Consistent with the interpersonal theory of suicidal behavior, perceived burdensomeness mediated the association between BMI and suicidal ideation in the current sample.

These findings provide valuable and novel information on the association between obesity and suicidal ideation, which has previously received limited research attention and is not a well-understood relationship. Prior research has indicated that obesity is associated with a lower risk of completed suicide (1-3), although the relationship between obesity and suicidal ideation has been less consistent. The current findings indicate that the BMI-suicidal ideation association is best conceptualized as a quadratic, rather than a linear relationship, which may help explain some of the mixed results obtained in previous research.

Indeed, findings from the current study were consistent with the interpersonal theory of suicidal behavior (11) as perceived burdensomeness was an important predictor of suicidal ideation in this sample. Furthermore, perceived burdensomeness also accounted for the positive non-linear association between BMI and suicidal ideation. We also found that thwarted belongingness (i.e., low social support) was associated with suicidal ideation; however, it was not associated with BMI. This finding suggests that overweight/obese individuals may not report diminished levels of social support, and thus social support may not be a large factor driving the association between BMI and suicidal ideation, specifically.

In terms of clinical relevance, current recommendations indicate the importance of evaluating suicidal ideation and behavior as part of clinical assessments (39). The current findings suggest that such evaluation may be particularly warranted for clients with more severe levels of obesity. While obesity may be a significant risk factor for suicidal ideation, one's sense of being a burden to others may be another relevant construct to evaluate, given perceived burdensomeness partially mediated the relationship between BMI and suicidal ideation. Even in clinical cases in which an individual denies suicidal ideation, it may be worthwhile to assess perceived burdensomeness, as the presence of this state may increase the risk of future suicidality (12). Furthermore, individuals who have received bariatric surgery may be at particular risk of suicidal behavior (17). As such, targeting levels of perceived burdensomeness with obese clients during weight-loss treatment and/or post-bariatric surgery may be important in decreasing suicidal ideation and future risk of suicide.

There are several limitations to the current study that should be noted. First, the sample was mostly women (which is common to treatment-seeking samples), so these results may not generalize to males or participants not seeking treatment. This community-based group may not be representative of a “typical” obese sample, given that they are seeking weight-management treatment as part of their health insurance. Second, although observed differences between the two samples were accounted for in pooled analyses, there are likely other differences between the groups (e.g., motivation for participation) that may not have been taken into account. Third, although some important covariates of depression, body dissatisfaction, past suicide attempts, and weight-related medical conditions were included in analyses, other covariates that were not assessed (e.g., other psychiatric comorbidities, treatment for depression) may impact the relationship between obesity and suicidal ideation. Furthermore, we do not have information regarding the severity or treatment history of the specific medical conditions, which may also influence the relationship between obesity and suicidal ideation and be important factors to examine in future studies. Similarly, only the EDI body dissatisfaction subscale was included in the current study and examination of other aspects of eating pathology (e.g., binge eating) may be important in this population. The current investigation also relied upon self-report measures of constructs, and the potential for inaccuracies and bias are inherent in this type of assessment. Finally, this study used a cross-sectional design, thus the temporal relationship between BMI, burdensomeness and suicidal ideation cannot be confirmed.

Despite these limitations, the current study has several strengths, and findings point to several areas of future investigation. Strengths include use of a large sample representing both clinical and non-clinical settings, which increases generalizability. Additionally, to our knowledge, this was the first study to apply the interpersonal theory of suicidal behavior to a clinical sample of overweight individuals and specifically examine perceived burdensomeness as a potential mediator of the relationship between BMI and suicidal ideation. Areas of future investigation include extending outcomes to assess suicide attempts and suicide mortality in addition to suicidal ideation as well as examination of the third facet of the interpersonal theory of suicide, acquired capability for suicide. Additionally, future research should test the predictive value of this model in other samples, including patients who are seeking or who have received bariatric surgery. This may be particularly worthwhile since the observed associations appear to be most pronounced among those on the higher end of the BMI spectrum. Importantly, future research should also use longitudinal designs to examine the temporal relationship between BMI, burdensomeness and suicidal ideation.

In summary, findings from this study support previous research indicating that obesity is associated with increased risk of suicidal ideation. By applying constructs from the interpersonal theory of suicidal behavior (i.e., perceived burdensomeness and thwarted belongingness), this investigation provides novel information on potential mechanisms explaining the relationship between weight status and suicidal ideation. Results indicated that perceived burdensomeness (i.e., feeling that one is a burden to significant others around them) was positively associated with BMI and suicidal ideation, and perceived burdensomeness partially mediated this observed relationship.

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Note: *** $p < .001$, ** $p < .01$, * $p < .05$, ns=non-significant ($p > .05$). Age and gender were included as covariates in all analyses. BMI= body mass index.

Figure 1.
Relationship between BMI, Perceived Burdensomeness and Suicidal Ideation.

Table 1

Demographic Information and Sample Characteristics

	Overall Sample		College Students		Weight Management		t	df	p
	M	SD	M	SD	M	SD			
Age	32.04	16.60	18.89	1.39	48.47	11.43	28.17	122	<.001
BMI*	30.06	10.41	23.20	3.65	38.70	9.71	16.58	146	<.001
Suicidal Ideation	0.20	0.73	0.23	0.72	0.15	0.75	-0.98	265	0.33
Depression	6.41	5.07	6.26	5.27	6.60	4.82	0.50	227	0.62
Perceived Burdensomeness	6.16	3.00	6.20	2.94	6.10	3.09	-0.26	260	0.80
Thwarted Belongingness	11.20	6.32	11.63	6.22	10.64	6.43	-1.27	263	0.21
Medical complications	2.98	2.88	2.02	1.91	4.18	3.40	6.20	176	<.001
Body Dissatisfaction	34.25	9.73	30.08	9.39	39.61	7.23	9.34	263	<.001

* Note: BMI ranges were 18.8-25.8 for the college students and 22.7-49.8 for the weight management participants, N=12 of the college students had a BMI $\geq 25.0 \text{ kg/m}^2$, and thus met criteria for overweight. Additionally, n=2 of the weight management participants had a BMI $\geq 25.0 \text{ kg/m}^2$, and thus met criteria for normal weight.

Table 2

Quadratic Relationship between BMI and Suicidality

<u>Model 1</u>	B	St. Error	t	Partial r	p
(Constant)	0.28	0.26	1.04		0.30
BMI centered	−0.004	0.008	−0.50	−0.03	0.62
BMI centered squared	0.001	<0.001	2.21	0.14	0.03
Age	−0.002	0.004	−0.58	−0.04	0.56
Gender	−0.05	0.12	−0.43	−.03	0.67
<u>Model 2</u>	B	St. Error	t	Partial r	p
(Constant)	−0.02	0.32	−0.05		0.96
BMI centered	−0.01	0.01	−0.80	−0.06	0.42
BMI centered squared	.001	<.001	2.18	0.15	0.03
Age	−0.001	0.004	0.18	0.13	0.86
Gender	−0.24	0.15	−1.57	−0.11	0.12
Depressive Symptoms	0.07	.011	5.89	0.38	<.001
Body Dissatisfaction	0.01	0.007	0.76	0.05	0.45
Medical Conditions	−0.18	0.09	−1.92	−0.13	0.06
Suicide Attempt	0.46	0.25	1.82	0.13	0.07

Table 3

Quadratic Relationship between BMI and Perceived Burdensomeness

<u>Model 1</u>	B	St. Error	t	Partial r	p
(Constant)	5.65	1.11	5.11		<.001
BMI centered	-.03	.03	-.75	-.05	.45
BMI centered squared	.003	.001	2.50	.16	.01
Age	-.003	.02	-.16	-.01	.87
Gender	.14	.51	.27	.02	.79
<u>Model 2</u>	B	St. Error	t	Partial r	p
(Constant)	4.44	1.25	3.57		<.001
BMI centered	-.05	.04	-1.16	-.08	.25
BMI centered squared	.003	.001	2.65	.18	.01
Age	.008	.02	.477	.03	.63
Gender	-.90	.59	-1.52	-.11	.13
Depressive Symptoms	.29	.04	6.66	.42	<.001
Body Dissatisfaction	.04	.03	1.30	.09	.19
Medical Conditions	-.80	.36	-2.25	-.16	.03
Suicide Attempt	.38	.93	.41	.03	.68