The Role of Overweight Perception and Depressive Symptoms in Child and Adolescent Unhealthy Weight Control Behaviors: A Mediation Model

Bridget Armstrong, MS, Sarah C. Westen, BS, and David M. Janicke, PhD
Department of Clinical and Health Psychology, University of Florida

All correspondence concerning this article should be addressed to Bridget Armstrong, MS, Department of Clinical and Health Psychology, University of Florida, PO Box 100165, Gainesville, FL 32610, USA. E-mail: barmstrong@phhp.ufl.edu

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Objective Children who are overweight or obese are at risk for depression and development of unhealthy weight control behaviors (UWCBs), including using diet pills, purging, or fasting. Explications of pathways leading to UWCBs are needed to prevent the associated negative health outcomes. Methods Participants were 106 children/adolescents 8–17 years of age at a pediatric clinic. Measures included child body mass index, the Child Depression Inventory–Short Form, and questionnaires assessing perception of overweight and UWCBs used in the past year. Depression was hypothesized to mediate the relationship between perception of overweight and UWCBs. Results A bootstrapped mediation model revealed that depressive symptoms mediated the relationship between youth perception of overweight and UWCBs accounting for youth body mass index z-score. The total model explained 24% of the variance in UWCBs. Discussion This study presents a potential mechanism by which youth perception of overweight may influence UWCBs. Longitudinal research is needed to further elucidate the directionality of these relationships.

Key words depression; unhealthy weight control behaviors; weight concern; youth.

Research suggests many children who are overweight or obese have impaired psychological health (i.e., depression, self-esteem, and quality of life) compared with nonoverweight youth (De Niet & Naiman, 2011). Recent data indicate nearly one in three youth are overweight or obese (Ogden, Carroll, Kit, & Flegal, 2012); however, not all children who are overweight or obese experience negative psychological outcomes (Friedman & Brownell, 1995). Furthermore, links between childhood weight and psychological outcomes have not been consistently supported (Erickson, Robinson, Haydel, & Killen, 2000; Flodmark, 2005), which highlights the need to address mechanisms by which obesity and psychological outcomes are related.

Of particular concern is the use of unhealthy weight control behaviors (UWCBs) by youth. UWCBs are strategies aimed at controlling weight, which include skipped meals, use of diet pills, purging, fasting, use of laxatives or diuretics, and cigarette smoking. Children and adolescents who use such unhealthy weight control methods are at greater risk for the development of a variety of negative outcomes (Boutelle, Neumark-Sztainer, Story, & Resnick, 2002), including inadequate nutrition intake, abnormal psychosocial development (Neumark-Sztainer & Hannan, 2000), the development of eating disorders (Austin, 2011; Goldschmidt et al., 2011), stunted physical growth, and delayed puberty (Swenne & Thurfjell, 2003). Use of these behaviors in prepubescent children is of special concern due to issues of growth and onset of menarche in girls (Mallick, 1983). Weight control behaviors have been found in children as young as those in elementary and middle school years (O’Dea & Caputi, 2001), potentially exacerbating known potential risk factors associated with UWCB use. For older children, population-based studies
of adolescents indicate up to 40% are trying to lose weight (Kann et al., 1995) and between 3 and 9% of adolescents report using extreme weight loss strategies such as vomiting, diet pills, or laxatives (Story, Neumark-Sztainer, Sherwood, Stang, & Murray, 1998). Further, overweight youth appear to be at greater risk for utilizing UWCBs compared with normal-weight peers (Boutelle et al., 2002; Goldschmidt, Aspen, Sinton, Tanofsky-Kraff, & Willfley, 2008; Vander Wal & Mitchell, 2011). For example, Neumark-Sztainer, Hamman, Story, and Perry (2002) found 76% of overweight girls and 55% of overweight boys reported UWCBs, such as skipping meals, smoking, fasting, and eating very little food. An alarming proportion of this sample (e.g., nearly one-fifth of overweight girls) reported using extreme weight loss strategies. The high occurrence of obesity and UWCBs in youth has resulted in a call for research to focus on explicating the developmental pathways of these conditions to slow the trajectory of weight gain and prevent the use of UWCBs along with their unfortunate sequela (Goldschmidt et al., 2008).

One factor that may help explain which children engage in UWCBs is the child’s own perception of being overweight. Research suggests that a child’s perception that he or she is overweight is often a better predictor of child psychosocial difficulty than actual weight status (Gray, Crawford, Follansbee-Junger, Dumont-Driscoll, & Janicke, 2012). Many overweight or obese youth underestimate their weight (Gray et al., 2012; Maximova et al., 2008), which may act as a buffer against many psychosocial complications of obesity, but may limit engagement in lifestyle changes aimed at promoting a healthier weight. However, accurate weight perception in overweight or obese youth has been shown to be associated with feeling sad or depressed (Khambalia, Hardy, & Bauman, 2012), and these youth report more symptoms of psychological distress than overweight youth who do not perceive themselves as overweight (Xie et al., 2011) and are more likely to engage in UWCBs (Park, 2011). Together, these data suggest that perception of overweight or obese status may better explain the development of psychosocial problems compared with actual weight status. Failure to account for perception of weight status may explain the literature’s inconsistent findings regarding psychosocial functioning in overweight and obese children (Gray et al., 2012).

Depressive symptoms may also be an important contributor to the use of UWCBs. Depressive symptoms have been linked to the use of UWCBs in both overweight and healthy weight youth (Goldfield et al., 2010). Overweight youth may be more at risk for UWCBs, given research that suggests overweight or obese youth have higher rates of depression and depressive symptoms (Melnk et al., 2006), are more likely to complain about depression (Bell et al., 2011), and are more likely to experience psychological distress during adolescence (Kubzansky, Gilthorpe, & Goodman, 2012) than nonoverweight youth. Therefore, the finding that children who are overweight or obese appear to be at-risk to engage in more UWCBs than healthy-weight youth (Goldschmidt et al., 2008) may be explained by increases in depressive symptoms. However, it is not clear if depression and UWCBs function mechanistically, or if depression and UWCBs are independently related to weight status (Martyen-Nemeth, Penckofer, Gulanick, Velsor-Friedrich, & Bryant, 2009), or perhaps, more saliently, perception of overweight.

Although research suggests that perception of overweight and depression symptomology may play roles in the development of UWCBs in youth, to our knowledge, there is no research examining these variables together in one predictive model. Understanding the mechanisms that may contribute to the use of UWCBs may help guide prevention and treatment efforts. The current study aims to examine the relationship between youth overweight, youth perception of overweight, depressive symptoms, and use of UWCBs. We hypothesize that after controlling for objective child weight, a child’s perception that he or she is overweight will be positively associated with his or her engagement in UWCBs, and that this relationship will be mediated by depressive symptoms.

**Method**

**Participants**

Participants were 106 children/adolescents between the ages of 8–17 years and a parent/legal guardian attending a regularly scheduled acute care or annual check-up appointment at a pediatric primary care clinic. Families were excluded if: (1) the child was not accompanied to the appointment by a parent/legal guardian, (2) the parent or child had mental retardation or a psychotic disorder that interfered with their ability to complete study measures, and (3) the child or parent could not read or speak English.

**Procedure**

Potential participants were approached by a member of the research team while waiting in a private patient room before being seen by their physician. Informed consent was obtained from the parent or legal guardian and assent was obtained from the child before data collection. The child and parent then independently completed separate questionnaires. A member of the research team was present to
answer any questions. On average, questionnaire packets were completed within 15 minutes. Each family was compensated $5 on completion of the study questionnaires. Of the 123 families approached, six qualified families declined to participate and indicated lack of time or interest and/or feeling uncomfortable completing questionnaires as their primary reason for refusal. Eleven participants were excluded due to missing at least one critical variable of investigation. The study protocol was approved by the governing institutional review board. Data were collected between 2009 and 2010.

**Measures**

The questionnaires included in the current study were youth or parent self-report measures and were part of a larger study examining physiological and psychosocial functioning in overweight and nonoverweight youth.

**Anthropometrics**

Child height (cm) and weight (kg) were obtained by the medical team at the primary care visit when consent and data collection occurred. Child body mass index (BMI) z-score was calculated using age and gender norms published by the Kuczmarski et al., 2002.

**Demographics**

Parents completed a brief questionnaire designed for this study to collect information on child age, race/ethnicity, and gender, as well as parent/legal guardian gender, marital status, and family income. Children in the sample had a mean age of 11.74 (standard deviation [SD] = 2.58) years. There was a roughly equal mix of genders, with 52.1% female. Children were primarily African American (49.1%) and Caucasian (32.1%), with a smaller percentage identifying as Hispanic (3.8%), biracial (14.1%), or Asian (9%). A majority of parents or guardians were female (90.4%), and 60% of the sample reported having an annual income between $10,000 and $39,999.

**Youth Perception of Overweight**

Youth perception of overweight was assessed by asking child participants if they perceived themselves as underweight, a little underweight, normal weight, a little overweight, or overweight. Responses were then dichotomized between youth who perceived themselves to be either a little overweight or very overweight versus those who perceived themselves as underweight and normal weight. Similar one-item questions have been used to assess weight perception in previous studies (Seo & Lee, 2012) and have been shown to be predictive of suicidal ideation, as well as intention to lose weight or prevent weight gain (Ezendam, Oenema, & Brug, 2012; Seo & Lee, 2012).

**Unhealthy Weight Control Behaviors**

To assess use of UWCBs, youth were asked “Have you done any of the following things to lose weight or keep from gaining weight during the past year?” (a) Skipped meals, (b) ate very little food, (c) took diet pills, (d) made myself vomit, (e) fasted, (f) used a laxative, (g) smoked more cigarettes, (h) used a food substitute (powder or a special drink), (i) used diuretics, and (j) skipped breakfast. Responses to each item were rated either “yes” or “no.” The number of UWCBs used was calculated from the sum of the positively endorsed items. Similar scales have been used to assess UWCBs in youth as young as grade 4 (Haines, Neumark-Sztainer, Perry, Hannan, & Levine, 2006) and have shown good internal consistency ($\alpha = .70–.80$) (Keery, Eisenberg, Boutelle, Neumark-Sztainer, & Story, 2006). Internal consistency in the current sample was adequate (Cronbach’s $\alpha = .76$).

**Depressive Symptoms**

The Child Depression Inventory–Short Form (CDI-S) was used to measure youth depressive symptoms (Kovacs, 1992). The CDI-S consists of 10 items to indicate the degree of depressive symptoms experienced in the past 2 weeks on a 3-point Likert scale ranging from 0 to 2 (total scores range from 0 to 20). The CDI-S has good internal consistency (Gray et al., 2012) and has been shown to have a sound factor structure (Gomez, Vance, & Gomez, 2012). Internal consistency in the current study was adequate (Cronbach’s $\alpha = .80$).

**Data Analytic Plan**

Data were analyzed using IBM SPSS Statistics Developer Version 20. Mediation analysis was conducted using the SPSS macro PROCESS (Preacher, Rucker, & Hayes, 2007). First, bivariate correlations were conducted to examine relationships among the variables of interest and demographic variables. Minority status was dummy coded in reference to Caucasian versus non-Caucasian, and gender was dummy coded in reference to females. Demographic variables that were significantly related to any of the outcome or predictor variables were controlled for as covariates in the subsequent models. Given research indicating possible moderation effects of minority status (Story, French, Resnick, & Blum, 1995), gender (Neumark-Sztainer, Wall, Story, & Perry, 2003), and age (Ter Bogt et al., 2006), all were examined as possible moderators. To test for mediation effects, we conducted mediation analyses using bootstrapping. Bootstrapping is a statistical estimation method that involves resampling with replacement from the original sample to estimate the sampling distribution of a statistic.
method that involves drawing repeated samples from the
data with replacement to gain multiple estimates of the
indirect effect (Preacher & Hayes, 2008). Using this
method, we generated 5,000 bootstrapped samples, as rec-
commended and used by Preacher and Hayes (2008).
Advantages to using this statistical approach to testing me-
diation over Baron and Kenny’s approach (Baron & Kenny,
1986) are that it does not make the often erroneous as-
sumption of normality for the direct effects. Additionally,
type II error is reduced because fewer inferential tests are
required (Preacher & Hayes, 2008). Bootstrapping bases
significant results on finding that the 95% confidence
interval does not contain zero.

Results

Characteristics of the Sample
Fifty-five percent of the children in the sample had a BMI
between the 5th and 85th percentile for age and gender, 10.4% of the sample were overweight (BMI between the
85th and 95th percentile for age and gender), and 33.0% of
the sample were obese (BMI above the 95th percentile for
age and gender). One percent of the sample had a BMI
below the 5th percentile for age and gender. Thirty-two
percent of the sample perceived themselves to be at least
some degree of overweight. Youth reported similar rates of
UWCBs as seen in previous studies (Neumark-Sztainer
et al., 2003). The number of youth endorsing at least
one UWCB is comparable with rates observed in studies
with younger samples (Haines et al., 2006) as well as
older samples (Neumark-Sztainer et al., 2003). The most
common weight control behaviors included skipping
breakfast (42% endorsed), skipping other meals (33% en-
dorsed), and eating very little food (31% endorsed).
Overall, youth reported a relatively low number of depres-
sive symptoms, similar to rates observed in previous
samples of younger children (Allgaier et al., 2012) as well
as older youth (Cotton et al., 2009).

Correlational and Moderator Analyses
Bivariate Pearson correlations and descriptive data are
shown in Table I. Child minority status was correlated
with UWCBs. A t-test revealed that non-Caucasians
(M = 1.88, SD = 2.03) reported engagement in a signifi-
cantly greater number of UWCBs than Caucasians
(M = .88, SD = 1.36), t(104) = 2.62, p = 01. To investigate
the effects of gender age and minority status on UWCBs,
all were examined as potential moderators in preliminary
mediation models. Results indicated that gender, age, or
minority status did not moderate any direct or indirect
effects between relevant study variables. Therefore, given
that age and gender were not related to any variables of
interest, they were not included in the final model for the
sake of parsimony. Because of the significant main effect
of minority status on UWCBs, all relevant models still con-
trolled for minority status as a covariate. Correlation anal-
ysis also showed that child BMI z-score was positively
associated with the number of different UWCBs used in
the past year. To examine the effects of perception of over-
weight above and beyond objective weight status, child
BMI z-score was included as a covariate in all subsequent
models.

Mediation Predicting UWCBs
The overall effect of youth perception of overweight on
UWCBs through depressive symptoms was tested control-
ling for youth BMI z-score using a bootstrapped mediation
model. A bootstrapping method advocated by Preacher and
Hayes (2008) was used to estimate the indirect effects of
perception of overweight on UWCBs through the mediator
of youth depressive symptoms. Figure 1 shows the medi-
ation model and identifies the bootstrapped estimates of

Table I. Correlations Among Study Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. BMI z-score</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.03</td>
<td>1.12</td>
<td>–1.77 to 3.27</td>
</tr>
<tr>
<td>2. Child age</td>
<td>.021</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11.74</td>
<td>2.58</td>
<td>8 to 17</td>
</tr>
<tr>
<td>3. Child gender</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11.74</td>
<td>2.58</td>
<td>8 to 17</td>
</tr>
<tr>
<td>4. Minority status</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11.74</td>
<td>2.58</td>
<td>8 to 17</td>
</tr>
<tr>
<td>5. Depressive symptoms</td>
<td>.035</td>
<td>.118</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
<td>1.81</td>
<td>2.6</td>
<td>0 to 12</td>
</tr>
<tr>
<td>6. Perception of overweight</td>
<td>.711**</td>
<td>.054</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
<td>1.81</td>
<td>2.6</td>
<td>0 to 12</td>
</tr>
<tr>
<td>7. Unhealthy weight control behaviors</td>
<td>.298**</td>
<td>.117</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
<td>1.57</td>
<td>1.9</td>
<td>0 to 9</td>
</tr>
</tbody>
</table>

Note. *Minority status dummy coded in reference to Caucasian versus non-Caucasian.

*Gender dummy coded in reference to boys.

*p < 05, **p < 01.
the indirect effect as well as the unstandardized B weights for the path coefficients.

After accounting for youth BMI as well as minority status, youth perception of overweight was positively related to child depressive symptoms, which in turn were related to increased use of UWCBs. The relationship between child perception of overweight and UWCBs was mediated by youth depressive symptoms, evidenced by the confidence interval that did not contain zero (see Figure 1). The model accounted for 24% of the variance in UWCBs.

Discussion

The purpose of the current study was to examine possible mechanism by which child perception of overweight is related to UWCBs, namely, through the mediating variable of depressive symptoms. This addresses a call for such path analysis put forth by Goldschmidt and colleagues (2008). Results indicate that depressive symptoms may have a contributory role in the prediction of UWCBs and account for a portion of the variance in the relationship between child perception of overweight and use of UWCBs.

Results from the current study are consistent with literature that has identified perception of overweight as a better predictor of negative psychosocial outcomes relative to objective measures of weight status (Fisher, Lange, Young-Cureton, & Canham, 2005; Middleman, Vazquez, & Durant, 1998; Park, 2011; Saxton, Hill, Chadwick, & Wardle, 2009; Xie et al., 2011). For example, Ter Bogt et al. (2006) showed that overweight youth who perceived themselves as overweight were more likely to have higher symptoms of depression. Similarly, the current study did not identify a statistically significant direct relationship between BMI and depressive symptoms, whereas perception of overweight and depressive symptoms were significantly correlated. Additionally, our findings indicating a relationship between perception of overweight and increased use of UWCBs also is consistent with previous literature (Khambalia et al., 2012; Middleman et al., 1998; Park, 2011; Ter Bogt et al., 2006). The current study extends the literature by showing that even after controlling for objective weight status, the perception of overweight is related to the use of a greater variety of UWCBs and this relationship may be explained by increased depressive symptoms. Further, in a hypothesis generating-effort in line with recommendations by Frazier, Tix, and Barron (2004), we examined alternative models including potential moderators of the relationship between weight perception, depression, and UWCBs to rule out models that may fit the data equally as well. Results indicated that minority status, age, or gender did not moderate any relationships examined.

Although the cross-sectional nature of this study does not allow us to conclude a causal relationship between these variables, we can speculate on how these factors could be connected. It is possible that both depressive symptoms and UWCBs may be related to a third variable in youth, such as teasing. Indeed, youth who experience weight-related teasing are more likely to experience increased depressive symptoms as well as UWCBs (Madowitz, Knatz, Maginot, Crow, & Boutelle, 2012). Future research should investigate the directionality of peer interactions and their influence on behavioral and psychological outcomes (Stunkard, Faith, & Allison, 2003). Additionally, youth may engage in UWCBs to gain a sense of control in their lives, above and beyond their use as a method of weight loss. Indeed, research has shown a link between depressive mood, poor coping strategies, and unhealthy eating behavior in nonoverweight (Fryer, Waller, & Kroese, 1997) and overweight (Martyn-Nemeth et al., 2009) youth. However, these relationships are complex and involve other domains such as self-esteem (Ackard, Neumark-Sztainer, Story, & Perry, 2003), concurrent life stressors (Cartwright et al., 2003), and quality of social support (Brissette, Scheier, & Carver, 2002). However, such pathways are purely speculative and necessitate further exploration of the pathways among coping and the development of UWCBs using both longitudinal and experimental data.

It is also important to note the likelihood that the relationship between depressive symptoms and UWCBs is multidirectional. It has been suggested that healthy weight management behaviors require a healthy state of mind. Effective weight loss efforts often require planning, such as packing a healthy lunch, making time for exercise, or waking up early enough for breakfast (Kruger, Blanck, & Gillespie, 2006). Unfortunately, increased depressive symptoms may impair planning abilities in youth (Vergara-Lopez, Lopez-Vergara, & Colder, 2013). Therefore, youth with increased depressive symptoms may resort to quick and unhealthy behaviors aimed at
weight loss. However, given the ineffective nature of these behaviors, this may further reinforce feelings of inadequacy and inability to control appearance. This cycle may continue as depressive symptoms lead to increasingly maladaptive dieting behaviors, as youth become both more desperate to lose weight and more psychologically unfit to make healthy choices (Gillen, Markey, & Markey, 2012). Ultimately, UWCBs appear to be associated not only with depression but with diagnosable eating disorders as well (Austin, 2011; Goldschmidt et al., 2011); this suggests the need for health care professionals to reduce UWCBs in youth before they become more complex long-term mental health problems. Notably, the current study found that the most frequently endorsed UWCBs were those considered less “extreme” (i.e., fasting). However, skipping meals and fasting have been suggested as optimal “red flag” questions indicative of poor mental well-being and further UWCBs, which indicates that these behaviors warrant discussion in clinical assessment (Utter, Denny, Robinson, Ameratunga, & Crengle, 2012).

Although youth perception of overweight appears to be a risk factor for UWCBs, it is not clear that targeting and encouraging overweight youth to view themselves as normal weight would be helpful for weight management or long-term health. Indeed, our results indicate that depressive symptoms (even subclinical) may help explain this relationship, and thus be a point of intervention. In light of the current results, practitioners might be encouraged to screen youth for depressive symptoms using a similar abbreviated depression measure used in the current study to assess for not only clinical depression, but also subclinical symptoms that may be an indicator of further negative consequences such as UWCBs. Additionally, weight management programs can aim to address or prevent depression within weight management treatment, as it appears to be a risk and possible mechanism contributing to UWCBs in youth. Indeed, such treatments may complement each other; for example, increased physical activity would be beneficial both for weight management as well as preventing and decreasing depressive symptoms (Collins & Fitterling, 2009).

Several limitations should be considered when interpreting results from the current study. Both the correlational and the cross-sectional nature of the study limit our ability to imply causality within these constructs. Future research should examine these factors longitudinally to better elucidate the nature of these relationships. Additionally, data on depressive symptoms and UWCBs in the current study were self-reported. The use of self-reported depressive symptoms may have resulted in underreporting of depressive symptoms compared with symptomology elucidated by parent-report measures. Indeed, the low level of depressive symptoms, although similar to previous samples (Allgaier et al., 2012), may have limited our abilities to detect significant associations, given the restricted range of symptoms reported. Additionally, adolescents may distort the frequency of weight control behaviors symptoms due to the sensitive nature of the questions. Further, measurement of UWCBs in the current study assessed the variety, but not frequency, of weight control behaviors used. Future research should include assessment of both the methods by which and frequency with which youth are using such weight control strategies. However, the use of objectively measured BMI is a study strength; previous work has used self-reported weight (Neumark-Sztainer et al., 2002), which has been shown to be an underestimated measure of BMI (Himes, Hannan, Wall, & Neumark-Sztainer, 2005). Finally, the small sample size, and thus relatively small number of overweight or obese children in the sample, may have limited our abilities to detect significant relationships.

Results from the current study highlight the importance of screening youth for weight perception and subsequent depressive symptoms, as these may be risk factors for the development of UWCBs, above and beyond weight status. Identification of such risk factors indicates a possible point of intervention wherein cognitive components related to weight and depressive symptoms could be addressed to help avoid the negative outcomes associated with the use of UWCBs. Additionally, clinicians need to be aware that overweight youth are at risk for UWCBs, and that both weight perception as well as depressive symptoms are possible mechanisms by which this association occurs.

In summary, this study found that depressive symptoms mediated the relationship between child perception of overweight and engagement in greater UWCBs. This suggests that child perception of overweight status and depressive symptoms may be significant factors that contribute to child engagement in more UWCBs, further highlighting the important role that child perception of weight may play in less-than-optimal psychosocial outcomes and health behaviors.

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