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Body Dissatisfaction Mediates the Association between Body Mass Index and Risky Weight Control Behaviors among White and Native American Adolescent Girls

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Abstract

The developmental path leading to eating disorders among adolescent girls often proceeds from increasing body size, to increasing body dissatisfaction, to increasing ED risk. To determine whether body dissatisfaction (BD) mediates the association between body size and risky weight control behaviors, we examined data from White ($n = 709$) and Native American ($n = 253$) girls, who differ substantially in terms of average body mass and reported weight control behaviors. Measures of BD included weight, shape, and appearance concerns. Measures of ED-risk included dieting, exercising to control weight, binge eating, and vomiting. Results showed body dissatisfaction was a highly significant mediator of the relationship between BMI and ED risk for both ethnic groups; although BD did not mediate the association between BMI and binge eating for either group. BD is apparently an important mediator of the association between body size and some, but not all, risky weight control behaviors.

Keywords

Adolescent girls; Native American; BMI; Body dissatisfaction; Weight control behaviors; Eating disorder risk; Mediation

Introduction

Over the past decade various theories have suggested how cognitive and environmental variables may interact to increase the risk for developing eating disorders (EDs). Many of these theories, expressed in the form of causal models (e.g., Williamson, Netemeyer, Jackman, Anderson, & et al., 1995; Huon et al., 2002; Stice, Presnell, & Spangler, 2002; Neumark-Sztainer, Wall, Story, & Perry, 2003), provide data demonstrating significant positive associations between body mass index (BMI), body dissatisfaction (BD), and one or more ED risk behaviors (e.g., dieting, binge eating, purging, or excessive exercising to control weight).

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In support of the BMI-BD association, recent prospective studies have shown that increases in BMI over periods up to a year, significantly predict BD increases over that same period (Stice and Whitenton, 2002; Presnell, Bearman, & Stice, 2004; Field et al., 2001). In a year-long study of adolescents, for instance, Field et al. (2001) found that BMI at T₁ predicted increases in weight concerns from T₁ to T₂ and that *increases* in BMI from T₁ to T₂ predicted *increases* in weight concerns, even after adjustment for age and weight concerns at T₁. In other recent studies, including at least one prospective study (Stice et al., 2002), BD has been shown to be positively associated with ED risk (e.g., Shaw, Ramirez, Trost, Randall, & Stice, 2004; Croll, Neumark-Sztainer, Story, & Ireland, 2002), although Stice (2002) has pointed out that effect sizes for BD-ED risk associations in many of these studies are quite small.

Few studies have examined associations between BMI and BD or between BD and ED risk among non-White ethnic groups. In one such study, Yates, Edman, & Aruguete (2004) found that while the BMI-BD association was common to White, Black, Japanese, Filipino, Chinese, Hawaiian, and multiethnic groups, the strength of the relationship varied substantially. For example among females, Filipinas were the most dissatisfied with their bodies, despite having among the lowest BMIs.

Similarly, some studies have suggested that ethnic differences in BD may account for differences in ED risk among adolescent girls (e.g., Taylor et al., 2003; Caradas, Lambert, & Charlton, 2001). On the other hand, Shaw et al. (2004) assessed White, Black, Asian, and Hispanic females (11 to 26 yo) but found no significant differences in BD, ED symptoms (e.g., binge eating, fear of fat, or weight and shape concerns), or the strength of associations among these.

Based on the above evidence that BMI is positively associated with BD among adolescents and that BD has been associated with increased ED risk in several studies, we predicted that BD would significantly mediate the association between BMI and behaviors presumed to increase ED risk. Given the rather limited and somewhat ambiguous literature concerning the role of BD among non-White ethnic groups, the current study tested the hypothesis that BD is a significant mediator of the association between BMI and risky weight control behaviors for both White and Native American adolescent girls. These two ethnic groups differ substantially both in terms of average BMI scores and in terms of the most commonly reported types of weight control behaviors (Lynch, Heil, Wagner, & Havens, 2007). To test this prediction, we created a structural equation model (SEM) representing the proposed relationships among BMI, BD, and ED risk behaviors and evaluated the mediational role of BD using regression estimates derived from this model for each ethnic group.

Method

Participants

Students in grades 5-10 from 13 Montana schools, selected for their historically high Native American (NA) enrollments, participated ($n = 2558$). Ethnic group and gender distributions of the full sample were: 59.4% White, 19.1% Native American with two NA biological parents, 7.7% Native American with one NA parent, 7.3% Hispanic, and 6.5% other or mixed ethnicity. Of these 48.0% were female. For purposes of the present study, only data from the largest female groups were included: White ($n = 709$) and Native American with two NA parents ($n = 253$). Mean ages of these groups were 13.7 ± 1.6 years (White) and 13.6 ± 1.8 years (Native American).

Instruments and Procedure

The following instruments were completed in Health Enhancement classes during two class periods. Parental approval was obtained using a passive consent method. Procedures were approved by the Institutional Review Board at MSU-Bozeman and by individual schools or school districts.

Demographic—Age, gender, ethnicity, and number of biological parents in household were self-reported.

McKnight Risk Factor Survey—This self-report questionnaire was originally designed to assess ED risk among pre- and post-adolescents girls. The MRFS-III was psychometrically validated (Shisslak et al., 1999). For the current study the revised MRFS-IV designed for grades 6-12 was used. Items from selected risk domains were rated on 5-point Likert scales.¹ The current study focuses only on MRFS items directly related to BD and ED risk behaviors.

Figure Rating Scale—The FRS (Stunkard, Sorenson, & Schulsinger, 1983) was used to assess shape concern. Participants circled one of nine gender-specific figures perceived to look “most similar” to them selves and another figure judged “most preferred.” Difference scores indicated the degree of “shape concern.”

BMI—Height (m) and weight (kg) were derived from electronic photographs taken while participants stood barefoot on a digital balance. Each photo included a meter stick later used to calculate each participant's height using ImageJ software (<http://rsb.info.nih.gov/ij/>). Weight was read directly from the Tanita BWB-800S balance. BMI was calculated as kg/m^2 . This photographic method was employed in order to facilitate the rapid, non-subjective data collection required for collecting large amounts of data within the very limited time schedule of the participating schools.² For the purpose of group comparisons, raw BMI scores were transformed to age-specific *z*-scores according to the CDC's BMI-for-age growth charts (Centers for Disease Control, 2006).

BD indicators—A structural equation model (SEM) representing the hypothesized relationships among three endogenous variables (BMI, BD, and ED risk) was evaluated using AMOS Graphics software (v.5, Arbuckle, 2003). Model variables were either directly measured or estimated (latent). The latent variable “Body Dissatisfaction” was estimated from three composite indicators referred to as weight concern (Wt_Con), appearance concern (App_Con), and shape concern (Shp_Con). Wt_Con was the mean of four items from the “Overconcern with Weight and Shape” domain of the MRFS and App_Con was the mean of two items from the “Appearance Concern” domain of the MRFS.¹ Shape concern (Shp_Con) was taken as the FRS difference score.

ED Risk indicators—Four MRFS items were selected as potential indicators of ED risk based on their similarity to items used in previous ED risk studies (e.g., Croll et al., 2002). Two items were selected from the “Weight Control Behavior” domain of the MRFS (dieting and exercising), one from the “Binge Eating” domain, and one from the “Purging” domain (vomiting).¹

¹Items from the MRFS-IV (grades 6-12) can be seen in the “scoring guide” available at the Laboratory for the Study of Behavioral Medicine website: <http://bml.stanford.edu/mcknight/>.

²An unpublished manuscript describing the validation procedures for the photographic methods and comparing the results to standard anthropometric methods is available upon request.

Reliability of BD and ED Risk indicators—Internal reliability of the three indicators of BD and four indicators of ED Risk were assessed for each ethnic group and for the two groups combined. Cronbach's Alphas for BD were: White girls ($\alpha = .788$), NA girls ($\alpha = .684$), combined ($\alpha = .754$). Results for ED Risk were: White girls ($\alpha = .552$), NA girls ($\alpha = .524$), and combined ($\alpha = .544$). Subsequent removal of the binge eating indicator (see below) improved these values: White girls ($\alpha = .630$), NA ($\alpha = .620$), and combined ($\alpha = .627$).

Results

Model

In the proposed structural model the latent variable Body Dissatisfaction (indicated by the three composite variables described above) was hypothesized to mediate the association between the latent variables Body Size and ED Risk (indicated by the four risk behaviors noted above). Body size was indicated by BMI z-scores. Because the BMI-BD relationship deviated slightly from linearity, five extremely low scores ($\text{BMI-z} < -2.0$) were removed from the data set, prior to mediation analyses, in order to improve linearity of this relationship.

Measurement models for BD and ED Risk

Measurement models for endogenous BD and ED Risk variables were assessed by confirmatory factor analyses using data from each ethnic group. Standardized regression weights for all associations between latent and indicator variables were highly significant ($p < .001$), except for Binge Eating, which was the weakest ED Risk indicator for both groups and was non-significant for the NA group. Vomiting, the next weakest indicator, remained significant ($p < .001$) for both groups.

Mediation analyses

The percent mediation by each of the three BD indicators was initially assessed using an SPSS macro graciously provided by William N. Dudley of the University of Utah (Dudley, 2004). This program estimates the percentage of the total effect mediated and the ratio of the indirect to direct effects using the Sobel test. For this set of analyses, BMI z-scores served as the independent variable (IV), each of the four ED Risk indicators served as a dependent variable (DV), and each of the three BD indicators served as a presumed mediator (MV). These initial analyses employed the combined data from both groups, since the goal was merely to determine which BD indicators were significant partial mediators of the BMI-ED risk relationship. Significant partial mediation was shown for each MV and each DV, except Binge Eating (BE). Since none of the regression analyses involving BE were significant, a key requirement for mediation analysis was not satisfied (Baron & Kenny, 1986). In all other cases, the effect of the IV on the DV was significantly reduced in the presence of the MV, indicating significant partial mediation. Percent mediation for each of the significant associations is shown in Table 1.

Having determined which BD indicator variables were significant partial mediators of specific risk behaviors, and the percent mediation in each case, we used AMOS to examine these same associations among the latent variables of the SEM. Based on the above results, BE was not included in these latent variable analyses. For these analyses, Sobel tests were carried out using the online calculator provided by Preacher & Leodarnelli (2001). Unstandardized regression coefficients (path coefficients) and their standard errors (SEs) for associations among the three latent variables for each group (derived from AMOS) were entered into this calculator. Results demonstrated highly significant mediation by the endogenous BD variable for both White ($z = 8.128, p < .0001$) and NA ($z = 3.862, p < .0001$) groups.

Discussion

The present study confirms that body dissatisfaction significantly mediates the BMI-ED risk relationship for both White and Native American girls. Weight and shape concerns were the strongest mediators, while appearance concern was a significant but weaker mediator (Table 1). Mediation was highly significant for both ethnic groups when assessed using the latent variable associations derived from the SEM.

Given previous evidence, the strong mediational role of BD in such diverse ethnic groups is somewhat surprising. As noted above, Yates and colleagues (2004) found that high BMI scores were associated with greater BD among some ethnic groups than others and Caradas et al. (2001) reported that the association between BD (assessed by figure ratings) and EAT-26 scores was significant for groups of White and mixed-race girls but not for Black South African girls. By contrast, the current results suggest broad similarities between White and Native American girls, despite some notable differences. For instance, exercising to control weight is apparently a slightly stronger ED risk indicator for Native American girls, whereas dieting is a stronger indicator of ED risk among White girls. Despite these differences, both groups appear to be responding in a generally similar manner to body dissatisfaction.

Binge eating was not a reliable indicator of ED Risk and associations between BMI and BE were not significantly mediated by BD for either ethnic. This may suggest that BE follows a developmental trajectory independent of mediation by BD, although this interpretation is somewhat surprising given previous results suggesting significant associations between BD and BE (e.g., Ghaderi, 2003; Stice & Shaw, 2002). It should be noted, however, that differences among studies in the method of measuring BE may account, at least in part, for difference in its associations with BMI and/or ED risk.

Strengths and limitations

A major strength of this study is the size of the Native American sample. On the other hand, the lower internal reliability of the BD measure for the NA group suggests that this particular method of assessment may not be entirely appropriate for this ethnic group. This fact illustrates the need for development of better measures of BD and ED risk specifically validated for use with Native Americans (and other ethnic groups). Another limitation of this study is the fact that although the proposed structural model implies a “causal” relationship among variables, the data available in the present study are cross-sectional and, therefore, cannot show causality. Future longitudinal or experimental studies will be needed to test for causal associations. Another limitation is the small number of items used to assess a wide range of ED risk variables. Additional studies will be needed to establish the validity of items such as those used in the present study; although two previous prospective studies (Field et al., 2001; Taylor et al., 2003) have shown MRFS items to be useful predictors of ED risk among adolescents.

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Table 1

Mediation results based on associations between BMI-z scores, each of the three hypothesized mediators (Wt_Con, App_Con, and Shp_Con) and each of the four presumed ED risk behaviors (Dieting, Binge Eating, Exercising, and Vomiting).

IV	Mediator	DV	Sobel z-score	p <	Percent Mediation
BMI-z	Wt_Con	Dieting	9.16	.000001	66.3
BMI-z	Wt_Con	Binge Eating		n.s.	
BMI-z	Wt_Con	Exercising	8.51	.000001	55.0
BMI-z	Wt_Con	Vomiting	6.60	.000001	77.3
BMI-z	App_Con	Dieting	6.30	.000001	30.6
BMI-z	App_Con	Binge Eating		n.s.	
BMI-z	App_Con	Exercising	5.69	.000001	24.4
BMI-z	App_Con	Vomiting	5.16	.000001	47.2
BMI-z	Shp_Con	Dieting	7.91	.000001	62.2
BMI-z	Shp_Con	Binge Eating		n.s.	
BMI-z	Shp_Con	Exercising	5.80	.000001	41.3
BMI-z	Shp_Con	Vomiting	4.59	.000004	93.1