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Body Image as a Mediator of the Relationship Between Body Mass Index and Weight-Related Quality of Life in Black Women

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Abstract

Background: Body image (BI) may be important in understanding weight-related attitudes and behaviors in black women. Specifically, body dissatisfaction may mediate the relationship between body mass index (BMI) and weight-related quality of life (QOL) in black women. We examined the relationship between BMI and weight-related QOL in black women and tested for mediation by body dissatisfaction.
Methods: The sample included 149 black women recruited from Birmingham, Alabama, for a one-time clinic visit. BIs were self-reported using the Pulvers figure rating scale. Body discrepancy (BD), a surrogate measure of body dissatisfaction, was calculated as perceived current image minus ideal image. QOL was self-reported using the Impact of Weight on Quality of Life-Lite (IWQOL-Lite). Baron and Kenny's test for mediation was conducted where BMI was the predictor, IWQOL-Lite score was the outcome, and BD was the mediator under investigation.
Results: Mean age was 40.5 years, and mean BMI was 36.1 kg/m^2. The mean IWQOL-Lite score was 81.1 ± 15.8 out of 100. Participants had a BD score of 2.3, indicating a desire to be two figure sizes smaller than their current perceived body size. Tests for mediation revealed that BD partially mediated the relationship between BMI and IWQOL-Lite scores in this sample.
Conclusions: BD was in the pathway of the association between BMI and IWQOL-Lite scores. BI dissatisfaction may contribute to explaining more about black women's weight-related QOL beyond actual BMI alone. Additional research is needed to better understand black women's perception of weight and subsequent weight-related behaviors.

Introduction

The obesity epidemic in black women is well documented, but the impact of obesity on black women is less understood. There is evidence that excess weight has both physiologic and psychologic effects on black women that differ from those of white women. For example, despite a high prevalence of obesity-related diseases, findings from early research by Kumanyika et al.[1] indicated that the prevalence of several obesity-related diseases did not simply parallel the excess prevalence of obesity in black women. There was not a simple association between obesity-related diseases, such as diabetes mellitus, and the prevalence of obesity in black women, possibly as a result of different distributions of excess adipose tissue.[1] Later research further supported that the relationship between obesity and morbidity/mortality is weaker in blacks than whites and in women than in men.[2,3] Beyond the apparent differences between black and white women in the physiology of obesity and health, there is also evidence of different psychologic perspectives on obesity in these two groups. It is well documented that black women are more satisfied with their body size than are white women[4–7] and report less pressure to be thin, less dissatisfaction with their weight, and greater acceptance of being overweight than white women.[8] Additionally, black women report less impairment than white women in their weight-related quality of life (QOL).[9]

The interplay of psychologic factors related to obesity, such as QOL and body image (BI), warrant further study. There is

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a well-established relationship between weight and QOL in women. In general, as body mass index (BMI) increases, QOL decreases.[10,11] However, black women consistently report higher QOL compared to white women of similar BMIs,[12–14] and reasons for this difference in weight-related QOL are still unclear. There is evidence to support that self-perception of weight status may influence physical and mental aspects of QOL,[15] which might suggest that the positive self-BI of black women[16–18] may contribute to their weight-related QOL.

The purpose of this study was to examine BI among a sample of overweight and obese black women and to determine if BI dissatisfaction mediated the relationship between BMI and weight-related QOL in this sample.

Materials and Methods

Study population

Participants were community volunteers from the Birmingham, Alabama, metropolitan area. The study was announced via fliers, e-mails, and publication in the University of Alabama at Birmingham's clinical trials listings. A total of 194 individuals contacted us and completed a telephone screening for the study. Of those screened, 165 were eligible to participate. These individuals self-identified as female and black, were at least 19 years old, and had a self-reported BMI ≥ 25 kg/m^2. Of the eligible individuals, 149 females completed a one-time clinic visit for data collection. All participants provided informed consent, and this study was reviewed and approved by the University of Alabama at Birmingham Institutional Review Board to ensure protection of human subjects.

Measures

At the clinic visit, participants completed a demographics questionnaire, the Impact of Weight on Quality of Life-Lite survey (IWQOL-Lite)[19] and the Pulvers Figure Rating Scale.[20] Additionally, we measured height and weight using a standardized protocol.

Anthropometrics

A standardized protocol was implemented to collect height and weight. Height was measured using a SECA portable stadiometer model SECA 214 (Hanover, MD). Body weight was measured using a digital LifeSource MD Portable Precision scale model ProFIT UC-321(A& D Medical, Milpitas, CA). BMI was calculated from these measures of height and weight using the following formula:

$$(\text{weight in kilograms})/(\text{height in meters})^2$$

Body image/body satisfaction measure

BI was assessed using the Pulvers Figure Rating Scale (Fig. 1), a validated figural stimuli instrument that is culturally appropriate for blacks, with strong psychometric properties, including high interrater reliability ($\alpha = 0.95$).[20] Participants were shown a series of nine body figures (1, smallest to 9, largest) and asked to select which figure they thought most closely resembled their current body size ($BI_{current}$) and which figure they wanted to look like ideally (BI_{ideal}).

Body discrepancy (BD) was calculated from BI responses:

$$BD = BI_{current} - BI_{ideal}$$

This approach has been used in several previous studies examining BI and body satisfaction.[6,21] BD values could range from -8 to 8; $BD < 0$ indicated a desire to be larger than one's current perceived BI, and $BD > 0$ indicated a desire to be smaller than one's current perceived BI.[6,21]

Impact of Weight on Quality of Life—Lite

Weight-related QOL was assessed using the IWQOL-Lite survey. The original IWQOL was the first instrument specifically developed to assess the effects of obesity on the QOL of persons seeking treatment for obesity. The IWQOL-Lite was developed as a shorter version to be conveniently used to assess obesity-specific QOL in clinical trials. This survey has been validated and has demonstrated test-retest reliability (intraclass correlation coefficient [ICC] > 0.93).[19] Internal consistency reliability was assessed using Cronbach's[22] alpha. All scales have acceptable levels of internal consistency (alpha > 0.75), and all but one scale had excellent internal consistency (alpha > 0.90).

Administration of the IWQOL-Lite is easy, and respondents rarely report difficulty in completing the form. It is a 31-item survey, for which a score can range from 0 (worst) to

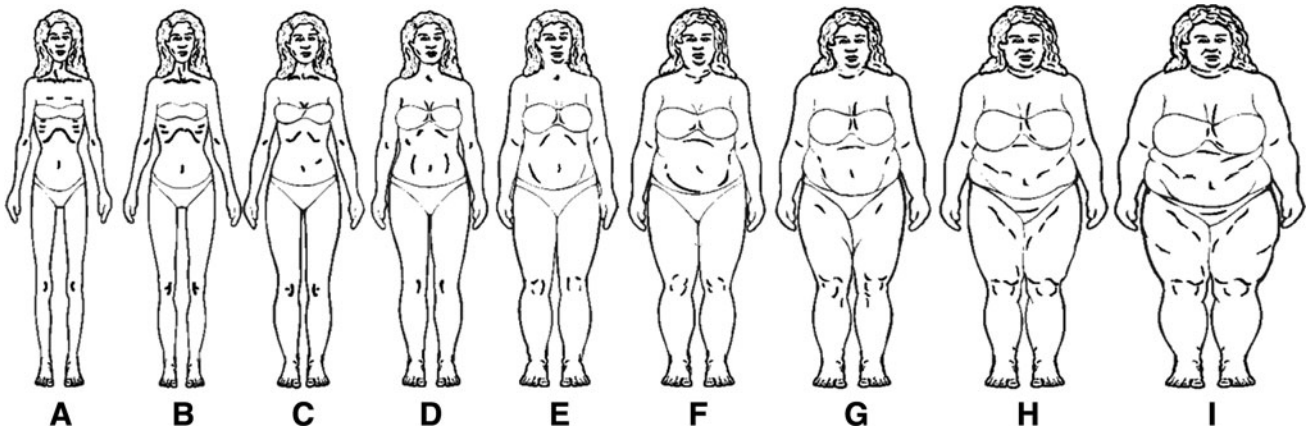


FIG. 1. Pulvers Figure Rating Scale. (Reprinted with permission of Dr. Kimberly Pulvers.)

100 (best), that looks at the effect of weight on physical function, self-esteem, sexual life, public distress, and work. An example of one question on the survey is: Because of my weight, I have trouble picking up objects. Each question has five response options: never true, rarely true, sometimes true, usually true, and always true.

Demographics

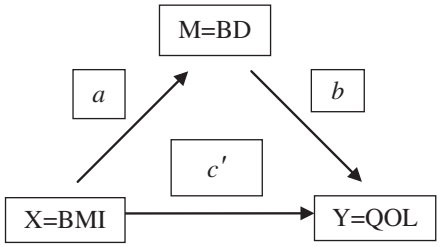
Age and income were assessed via a demographics questionnaire. Age was self-reported in years. Income was self-reported as annual household income. Other demographic variables, such as marital status (currently married, ever married, or never married) and years of education (number of years completed), were also self-reported.

Statistical analysis

Descriptive statistics were calculated and summarized as means ± standard deviation (SD) or medians. One-way analysis of variance (ANOVA) tests were used to examine the differences in BD by BMI category. *Post-hoc* comparisons were performed using Tukey's honestly significant difference (HSD) procedure.

We evaluated the proposed mediating effect of BD on the relationship of BMI to the IWQOL-Lite total and subscale scores using modifications of the Baron and Kenny approach.[23] Briefly, the intermediate variable *M* (BD) is considered to be a mediator if (1) the initial variable (*X*, BMI) is significantly associated with the outcome (*Y*, QOL), (2) the initial variable (*X*, BMI) is significantly associated with the mediator (*M*, BD), and (3) the mediator (*M*, BD) is significantly associated with the outcome (*Y*, QOL) after controlling for the effects of the initial variable (*X*, BMI). The satisfaction of these conditions indicates that there is an indirect (mediating) effect of *X* on *Y* through *M*. Baron and Kenny[23] discuss a fourth condition concerning reduction of the *X*-*Y* relationship for evidence of partial or complete mediation. Specifically, if a test for the partial relationship of *X* with *Y* (c' in Fig. 2) is nonsignificant, this is taken to suggest that *M* is a complete (or near-complete) mediator of the effect of *X* on *Y*. The disadvantage of the Baron and Kenny approach is that three separate regression models must be fit to estimate the effects of interest. MacKinnon[24] has provided multiple examples of using a path analytic approach to solve the mediation analysis models simultaneously. Figure 2 shows how the relationships between an initial variable, *X*, and the outcome, *Y*, are decomposed into direct and indirect (mediated) effects via path analysis. The amount of mediation (indirect effect) can be calculated in two ways: (1) the product of two regression coefficients (*ab*) or (2) the difference between two coefficients ($c - c'$), which are identical for path analyses with no missing data and continuous outcome variables.[25]

Currently, dozens of tests for mediation have been proposed, with no consensus on which is best.[26,27] Most of these methods differ on how to define standard errors (SE) and confidence intervals (CI). Bootstrapping has become a popular approach,[28] especially with small to moderate sample sizes. MacKinnon et al.[26,29] examined the performance of several methods for testing mediation to assess their Type I error rates and power and recommended bootstrapping the distribution of the product (*ab*) over the Sobel test or the Baron and Kenny causal steps approach. Therefore, we use a program that estimates the total, direct, and indirect effects of the initial variable *X* (BMI) on the outcome *Y* (QOL) through a proposed mediator, *M* (BD) simultaneously.[30] The program calculates the Sobel normal-theory test for the total and indirect effects and the bias-corrected bootstrap estimates and bias-corrected, accelerated bootstrap CI-for the indirect effects.[31] Preacher and Hayes[30] note that the sampling distribution of the indirect effect (*ab*) is skewed relative to a normal distribution, except under a complete null ($a = b = 0$), and, therefore, the confidence limits should not be equidistant from the point estimate. The bias-corrected, accelerated CIs employ a percentile bootstrap CI method[32] to adjust the percentile values of the sorted distribution of bootstrap estimates in order to improve the bounds of the CI. Further, they note that the bias-corrected estimate of the indirect (mediation) effect (ab'), because it is the mean of the product over multiple bootstrap resamples, will not necessarily equal the product (*ab*) or difference ($c - c'$) estimates of the indirect effects in the actual data. For a technical and detailed treatment justifying the bias-corrected estimates and bias-corrected, accelerated intervals, see Efron,[32] Efron and Tibshirani,[33] and Preacher and Hayes.[30] Because of some sparse missing data, we standardized each set variables (BMI, BD, IWQOL-Lite scale) separately for each mediation analysis and used 5000 bootstrap resamples to obtain the bias-corrected estimates. All models were statistically controlled for age, education, and marital status.



Legend

X: initial variable

Y: outcome variable

M: mediating variable

c': direct effect

a: X-M correlation

b: M-Y relationship, controlling for X

ab: Indirect (mediation) effect

Total Effect: $c = c' + ab$

FIG. 2. Diagram of Baron and Kenny[22] mediational model using specific variables being tested. BD, body discrepancy; BMI, body mass index; QOL, quality of life.

Table 1. Sample Characteristics ($n = 149$)

	Mean ± SD
Age (years)	40.5 ± 11.1
Weight (kg)	97.1 ± 22.1
BMI (kg/m^2)	36.1 ± 8.0
Education (years)	15.6 ± 2.5
IWQOL-Lite physical function	74.7 ± 21.0
IWQOL-Lite self-esteem	75.6 ± 23.3
IWQOL-Lite sexual life	88.8 ± 18.2
IWQOL-Lite public distress	88.5 ± 20.1
IWQOL-Lite work	91.5 ± 13.2
IWQOL-Lite total	81.1 ± 15.8
Yearly household income	%
$0–29,999	26.7
$30,000–59,999	45.3
≥ $60,000	26.0
Did not report	2.0
Obesity class	
Overweight (25.0–29.9)	25.3
Class I obesity (30.0–34.9)	28.0
Class II obesity (35.0–39.9)	16.7
Class III obesity (≥ 40.0)	30.0

BMI, body mass index; IWQOL, Impact of Weight in Quality of Life survey; SD, standard deviation.

Results

Characteristics of study participants are shown in Table 1. Participants were 149 black women with a mean BMI of 36.1 kg/m^2. On average, participants were 40 years of age and well educated. Table 1 also shows participants' IWQOL-Lite subscale and total mean scores with SDs. Cronbach alphas for the IWQOL total score and all subscales were acceptable, ranging from 0.76 to 0.95. Participants reported the greatest impairment of QOL in the physical function domain and the least impairment in the work domain.

Perceived BI is described in Table 2. On average, participants' current perception of BI was larger than their ideal BI ($BI_{current} = 6.0 \pm 1.4$ vs. $BI_{ideal} = 3.7 \pm 0.9$) (Fig. 1). Results from one-way ANOVA indicated a significant main effect of BMI category on $BI_{current}$ (F (3, 141) = 57.5, $p < 0.001$), BI_{ideal}(F (3, 140) = 32.9, $p < 0.001$), and BD (F (3, 140) = 16.1, $p < 0.001$). *Post-hoc* analyses using Tukey's HSD indicated that women in the 25–29.9 BMI category and 30–34.9 BMI category did not differ from one another in their perceived current BI or their ideal BI.

Table 3 shows that BD mediated the relationship between BMI on all but one of the IWQOL-Lite subscales and the total score. There were strong, statistically significant, unadjusted relationships between the BMI and IWQOL-Lite total score ($c = -0.4901$, $p < 0.0001$) and the physical function ($c = -0.5427$, $p < 0.0001$), public distress ($c = -0.5432$, $p < 0.0001$), and work ($c = -0.3143$, $p = 0.0002$) subscales. After controlling for BD, the magnitude of these associations decreased but remained statistically significant, indicating that BD partially mediated the relationship between BMI and these IWQOL-Lite scales (see c' column and p values in Table 3). Furthermore, the bias-corrected CIs for the indirect effects indicated that these partial mediation effects were statistically significant.

There was a significant inverse relationship between the BMI and IWQOL-Lite self-esteem subscale ($c = -0.2009$, $p = 0.0178$). However, after controlling for BD, the direction of the relationship changed and was no longer statistically significant ($c' = 0.0898$, $p = 0.3175$), indicating that BD completely mediated the relationship between BMI and the IWQOL-Lite self-esteem subscale. The bias-corrected CIs for the indirect effect also indicated that this mediation was statistically significant. Finally, BMI was not associated with the IWQOL-Lite sexual life subscale score, and, thus, the first criterion of the Baron and Kenny approach was not met; that is, there was no relationship to be mediated. However, the bias-corrected CIs indicate that there was a significant indirect effect of BMI on the sexual life subscale through BD, although the conditions for mediation were not met.

Discussion

This purpose of this study was to examine BI in black women and to determine if body dissatisfaction was a mediator in the BMI-QOL relationship. Participants reported an ideal BI that was smaller than their current perceived BI. This BD increased as BMI category increased. However, participants still reported relatively little impairment of weight-related QOL (81.1 ± 15.8). Tests for mediation revealed that the relationship between BMI and some IWQOL-Lite subscales (physical function, public distress, self-esteem, and work) and total scores was mediated by BD.

Our findings are consistent with the current literature, which shows that although there is desire to be thinner in both black and white women,[34] black women's QOL is not greatly impaired by excess weight.[10,11] Additionally, although there has been evidence to suggest that BD may impact weight-related QOL, this study is among the first to explicitly test BD as a mediator in the BMI-QOL relationship. These findings demonstrate that in black women, weight-related QOL is influenced by how far one is from her desired body size. The psychologic nature of several of the IWQOL-Lite subscales, such as self-esteem and public distress, may be heavily

Table 2. Description of Body Image Variables by Body Mass Index Category

	BMI category				
	25–30 (n = 38)	*30–35 (n = 43)*	*35–40 (n = 23)*	*40+ (n = 45)*	*Total (n = 149)*
$BI_{current}$	4.7 ± 0.8^a	5.3 ± 1.0^a	6.2 ± 1.2^b	7.4 ± 0.9^c	6.0 ± 1.4
BI_{ideal}	3.2 ± 0.5^a	3.2 ± 0.7^a	3.7 ± 0.6^b	4.5 ± 0.8^c	3.7 ± 0.9
BD	1.5 ± 0.7^a	2.1 ± 0.8^b	2.5 ± 1.2^{bc}	2.9 ± 1.0^c	2.3 ± 1.1

^{a,b,c}Means with common subscripts are not significantly different based on Tukey's honestly significant difference ($p \leq 0.05$).
BD, body discrepancy; $BI_{current}$, current body image; BI_{ideal}, ideal body image.

Table 3. Results for tests of Body Discrepancy Mediation of Body Mass Index-Quality of Life Relationship

	Model 1[a]		*Model 3*[a]				*Indirect effect*[b]	
IWQOL scales	*c*	*p*	*b*	*p*	*c′*	*p*	*ab*	*95% CI*
Total	−0.4901	<0.0001	−0.4127	<0.0001	−0.2633	0.0018	−0.2268	−0.3492
($n=146$)	(0.0752)		(0.0821)		(0.0828)		(0.0556)	−0.1285
Physical function	−0.5427	<0.0001	−0.2172	0.0086	−0.4233	<0.0001	−0.1194	−0.2196
($n=146$)	(0.0703)		(0.0814)		(0.0821)		(0.0463)	−0.0362
Self-esteem	−0.2009	0.0178	−0.5289	<0.0001	0.0898	0.3175	−0.2902	−0.4255
($n=146$)	(0.0838)		(0.0888)		(0.0895)		(0.0591)	−0.1892
Sexual life	−0.1235	0.1537	−0.2690	0.0085	0.0276	0.7860	−0.1512	−0.3018
($n=144$)	(0.0861)		(0.1007)		(0.1015)		(0.0634)	−0.0459
Public distress	−0.5432	<0.0001	−0.3303	0.0001	−0.3617	<0.0001	−0.1828	−0.2960
($n=146$)	(0.0716)		(0.0803)		(0.0809)		(0.0534)	−0.0844
Work	−0.3143	0.0002	−0.2678	0.0049	−0.1703	0.0752	−0.1441	−0.2648
($n=143$)	(0.0826)		(0.0937)		(0.0950)		(0.0564)	−0.0421

[a]Model 1 establishes the relationship to be mediated between BMI and QOL and estimates the total effect of BMI on QOL (*c*). Model 3 includes BMI and BD in the model and establishes the partial relationships of BMI (*c′*) and the mediator, BD (*b*), to QOL. The relationship of the initial variable (BMI) to the mediator (BD) remains constant across models and was estimated to be $a=0.5496$, $p<0.0001$ for analyses with no missing data ($n=146$). All models statistically control for age, education, and marital status.

[b]Bias-corrected estimate of indirect effects with bias-corrected, accelerated 95% confidence interval (CI) based on 5000 bootstrap resamples.

influenced by how one perceives her own body. Therefore, if a woman is less satisfied with her body, she may be more likely to experience impaired QOL in areas related to self-esteem and public distress. In fact, the relationship between BMI and the IWQOL-Lite self-esteem subscale was completely mediated by BD. This may be because self-esteem is an interpersonal psychologic trait rather than a physical action, feeling, or trait that one may experience.

Identifying BD as a mediator of weight-related QOL in black women helps to further elucidate the complex psychology of obesity in black women. It is often reported that black women are accepting of larger body sizes. However, the findings of this study indicate that there was a desire to be smaller in this sample of black women. Additionally, this desire to be smaller, that is, BI dissatisfaction, was in the pathway of the association between BMI and IWQOL-Lite scores. Thus, BI dissatisfaction may contribute to explaining more about black women's weight-related QOL beyond actual BMI alone. Other factors, such as education level or income, which have been shown to be associated with BI dissatisfaction,[35] must be considered as well. Participants in this study were well educated and reported higher than average annual household incomes. Therefore, the magnitude of the observed associations and mediations may be confounded by education or income level of the participants.

This study has strengths and limitations. Participants were a volunteer community sample and not seeking weight-loss treatment, increasing the generalizability of the results. However, this study sample generally had more years of education and relatively higher incomes than the median values for black women in Birmingham, where over half of black women >age 18 have no higher than a high school diploma. Therefore, our findings are limited to more educated women with higher household incomes than the general population. This study was also strengthened by the use of the Pulvers Figure Rating Scale, which is appropriate for assessing BI in black women. Previous BI research in black women admittedly has been potentially limited by use of a figure rating scale that may not be culturally sensitive in assessing BI in this unique population.[21] Additionally, the study is limited because key variables are based on self-report and, thus, are only as good as participant responses. However, questionnaires are the only way to elicit information about an individual's self-perceived QOL and BI.

In summary, black women reported experiencing BI dissatisfaction. Black women's body dissatisfaction mediated the relationship between BMI and weight-related QOL. This implies that BI is a psychologic factor that must be considered when studying the impact of obesity on black women. It is often reported that blacks are more accepting of larger body sizes and feel less pressure to be thin than whites. Our findings remind us, however, that although black women may be more accepting of larger body sizes, they may also have a desire to be smaller. The degree of the desire to be smaller can influence how BMI affects outcomes, such as weight-related QOL. We may also hypothesize that perceived QOL may also influence a woman's body dissatisfaction. Therefore, further cross-sectional and prospective exploration of the role of BI in black women may help to better understand their perception of weight and subsequent weight-related behaviors. Future research comparing weight-related QOL in black and white women with similar BI dissatisfaction may help to explain why black and white women experience weight-related QOL differently.

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Disclosure Statement

The authors have no conflicts of interest to report.

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