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Examining the association between body mass index and weight related quality of life in black and white women

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EXAMINING THE ASSOCIATION BETWEEN BODY MASS INDEX AND WEIGHT RELATED QUALITY OF LIFE IN BLACK AND WHITE WOMEN

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EPIDEMIOLOGY

ABSTRACT

Obesity not only increases risk for morbidity/mortality, but also impacts the quality of life of obese individuals. In the United States, black women have the highest prevalence of obesity of any other group with approximately 80% of black women over age 20 having a body mass index (BMI) $\geq$ 25 kg/m^2. We aimed to examine the association between weight and quality of life in this high risk population and compare it to weight-related quality of life in white women using the Impact of Weight on Quality of Life (IWQOL)-Lite questionnaire.

Data for 343 women were analyzed (172 black, 171 white). The mean age and BMI of participants was 40 years and 35.6 kg/m^2, respectively. The mean IWQOL-Lite total score was 74.3; black and white women had IWQOL-Lite scores of 81.6 and 66.9, respectively. Hierarchical linear regression models revealed a significant BMI-by-race interaction indicating that the relationship between BMI and IWQOL-Lite score was modified by race.

Subgroup analyses were conducted on 150 black women to examine the role of body image in the relationship between BMI and IWQOL-Lite scores. Using the Pulvers Figure Rating Scale, participants were shown a series of nine body figures (1=smallest)

and asked to select which figure most closely resembled her current body size ($BI_{current}$) and which figure reflected her ideal body size (BI_{ideal}). Body discrepancy (BD), a surrogate measure of body image dissatisfaction, was calculated from BI responses (BD = $BI_{current}$-BI_{ideal}). Participants' current perception of body image was larger than their ideal body image ($BI_{current}$= 6.0 ± 1.4 vs. BI_{ideal}= 3.7 ± 0.9). Tests for mediation indicated that BD partially mediated the relationship between BMI and IWQOL-Lite scores in this sample.

This study supports the hypothesis that obesity is associated with reduced quality of life in women. Our findings also suggest notable psychological differences regarding weight in black and white women. Differences in the mentality of black women regarding weight suggest the need for different approaches to promote seeking and maintaining a healthy body size. Additional research is needed to understand how to incorporate the weight perspectives of black women into weight management messages and interventions.

Key words: quality of life, body image, black, women, weight, obesity

DEDICATION

In loving memory of the following:

My Great-grandmother

Mrs. Ida Mae Benford

1917 – 2007

My Grandfather

Mr. Elroy Cox, Sr.

1917 – 2003

My Yorkie

Dominique "Tink" Cox

1996 – 2010

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I thank everyone who played a role in getting me here today. Though this path may not have initially been in my plans, it was clearly in God's plan and I am eternally thankful that He placed people in my life that encouraged me and assisted me in achieving this goal.

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LIST OF ABBREVIATIONS

BD	body discrepancy
BI	body image
BMI	body mass index
IWQOL	Impact of Weight on Quality of Life
NHANES	National Health and Nutrition Examination Survey
SES	socioeconomic status
QOL	quality of life

INTRODUCTION

Introduction and objective

Health is recognized as a state of complete physical, mental and social well-being, and not merely the absence of disease or sickness (1). This definition speaks directly to an emerging health related assessment known as quality of life, which includes the physical, psychological, and social domains of health (2). Quality of life is an individual's subjective evaluation and reaction to a current state of being that is influenced by that person's experiences, beliefs, expectations and perceptions (2, 3).

The dramatic rise in the prevalence of obesity over the past two decades has stimulated interest in the health and quality of life outcomes resulting from the obesity epidemic (4). With the increased prevalence of overweight and obesity in the United States, weight-related quality of life is a worthwhile area of interest in order to begin to understand the multifaceted impact of the obesity epidemic on our society. The role of obesity in chronic conditions such as heart disease, cancer, and diabetes is well documented (5-7). However, investigating weight as a specific factor that may affect an individual's quality of life is a new area of obesity research in need of more data to inform public health research and practice. The majority of the current literature specifically examining the impact of weight on quality of life has been collected for clinical purposes in mostly white women (8, 9). However, there is no substantial literature on the impact of weight on the quality of life in black women, who may display

a unique relationship between weight and quality of life due to cultural differences that make them more accepting of larger body sizes and less dissatisfied with their bodies than their white counterparts (10). When considering that quality of life is composed of not only physical but also psychosocial components, body image dissatisfaction, defined as how far a woman perceives herself to be from her ideal body size (11, 12), may mediate the relationship between body mass index (BMI) and quality of life in black women.

Obesity in the United States

Over the past two decades, the prevalence of overweight and obesity in the United States population has continued to increase. According to 2007-2008 NHANES data, an estimated 68 percent of adults over age 20 living in the United States are clinically overweight (BMI 25.0 kg/m^2-29.9 kg/m^2) or obese (BMI $\geq$ 30.0 kg/m^2), an increase of 10% since 1988 (13). This fact creates a point of great concern in our society for several reasons. The health ramifications of overweight and obesity for the general population are well documented for a variety of medical conditions including heart disease, diabetes, cancer, and hypertension (5, 6). Furthermore, obesity has implications that reach beyond standard medical consequences such as economics and quality of life (14). The true role of obesity, as measured by BMI, in impacting or predicting outcomes such as quality of life may differ greatly depending on the age, race, gender, SES, heredity, or numerous other characteristics of the overweight/obese individual. Therefore, it is worthwhile to explore the role of BMI on health outcomes in unique subgroups.

Comparing the prevalence of obesity in black and white women

National Center for Health Statistics data for 2007-2008 indicated that black women were significantly more likely to be obese than white women (15). Currently, approximately 80% of black women over age 20 have a BMI > 25 kg/m^2 (16). However, it still remains unclear exactly how this obesity prevalence translates into health implications due to evidence suggesting that the relationship between obesity and morbidity/mortality have been found to be weaker in blacks than whites and in women than in men (7). Though there is a high prevalence of obesity-related diseases in blacks, findings from early research by Kumanyika et al indicated that the prevalence of several obesity-related diseases did not simply parallel the excess prevalence of obesity in black women (17). For example, there was not a simple association between obesity-related diseases such as diabetes mellitus and the prevalence of obesity in black women (17). The reasons for this difference in association are not completely clear. Research suggests it may be due to several factors including differences in physiology (18), body composition , e.g., differences in distribution of excess adipose tissue (17,19), or cultural acceptance of a larger body size (20).

BMI and quality of life

Quality of life is an individual's subjective evaluation and reaction to a current state of being that is influenced by that person's experiences, beliefs, expectations and perceptions (2, 3). Quality of life has been shown to be associated with weight status in various dimensions. Specifically, weight-related quality of life is reported to be lower by

those with higher BMIs (3). Furthermore, this impairment is present whether or not the person is attempting to lose weight and may be impacted by sociodemographics and medical variables (3).

Body image

Body image has historically been simply defined as "the picture of our own body which we form in our mind" (21). However, body image is a complex, multidimensional construct that is influenced by several factors. Body image is influenced by physical characteristics, interpersonal experiences, cultural socialization, internal dialogues, appearance-schematic processing, body image emotions, and self-regulatory strategies and behaviors (11). Given the numerous factors that may influence an individual's body image, attitudes about body image may differ greatly for individuals from different social or cultural groups.

There is a body of literature showing that blacks are more satisfied with their body size than whites (22-24). Generally, black women report less pressure to be thin, less dissatisfaction with their weight and greater acceptance of being overweight than white women (25). Williamson et al. used figural stimuli to measure perception of body weight and found that black women did not perceive themselves to be overweight as did the BMI-matched white women (26). Furthermore, black women report having a weight problem at a significantly higher BMI than white women (25). There is evidence that the relationship between BMI and disease risk may be different for black women compared to women of other race/ethnic groups (17). This difference in disease risk is

hypothesized to be due to different distributions of adipose tissue in black and white women. We suspect the relationship of other domains of health such as weight-related quality of life may also be different for black women partially as a function of culturally driven body image perceptions.

The relationship between BMI and quality of life may be moderated by self-perceptions of body image. This is especially true in black women where a slightly larger body size is preferred (27). Few studies have examined the relationship between self-image, weight, and quality of life in black women. Therefore, we wanted to examine the impact of weight on quality of life in black women and whether body image mediates the relationship.

Development and use of IWQOL-Lite

The Impact of Weight on Quality of Life-Lite (IWQOL-Lite) is a survey designed specifically to measure reported impairment due to weight. It was adapted from the original IWQOL, the first instrument specifically developed to assess the effects of obesity on the quality of life of persons who were seeking treatment for obesity (4). The IWQOL-Lite was developed as a shorter version to be conveniently used to assess obesity-specific quality of life in clinical trials. The IWQOL-Lite was developed and validated in a heterogeneous population (28). This survey has demonstrated test-retest reliability (ICC>.93) (29). Reliability of the instrument was also high based on the following Cronbach α coefficients for subscales and total instrument: physical function, 0.94; self-esteem, 0.93; sexual life, 0.91; public distress, 0.90; work, 0.90; total, 0.96

(29). According to data from the IWQOL-Lite, females generally showed greater impairment than males (4). Therefore, we seek to extend the generalizability by conducting further analyses in a sample of black women, whose cultural experience may suggest a different perception of weight-related quality of life.

Summary

In general, obesity is associated with increased risk for morbid conditions such as heart disease, diabetes, cancer and hypertension. The obesity epidemic among black women is of great public health concern due to the disproportionate number of obese black women compared to white women. Given the difference in the relationship between BMI and disease risk for black and white women, we suspect that the relationship of other domains of health such as weight-related quality of life may also be different for black women partially as a function of culturally driven body image perceptions. The IWQOL-Lite is a validated measure that has demonstrated great usefulness in measuring quality of life in the context of body weight. However, there is very limited data on black women using the IWQOL-Lite. This study will contribute key knowledge to the literature by assessing the association between weight and quality of life in a sample of black women and determining the race effect when comparing this association between black and white women. We will also test whether body image dissatisfaction is a mediator between body mass index and weight-related quality of life in this sample of black women.

EXAMINING THE ASSOCIATION BETWEEN BODY MASS INDEX AND WEIGHT RELATED QUALITY OF LIFE IN BLACK AND WHITE WOMEN

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Introduction

With the well documented increase in the prevalence of obesity in the United States (1-3), researchers are currently examining the widespread impact of the obesity epidemic (4, 5). The health ramifications of overweight and obesity include a variety of medical conditions including heart disease, diabetes, cancer, and hypertension (6, 7). However, obesity has implications that reach beyond clinical outcomes. One such emerging area of interest is quality of life, which refers to the 'physical, psychological, and social domains of health, seen as distinct areas that are influenced by a person's experiences, beliefs, expectations and perceptions (8).

Early research showed that obesity impaired an obese individual's ability to live a full and active life (9). Subsequent reports further supported that obesity impaired quality of life (10). However, early studies often focused only on individuals seeking treatment for obesity, who may differ from the general obese population, limiting the generalizability of the results. Additionally, many of these studies assessed quality of life using generic quality of life instruments rather than obesity-specific quality of life instruments. Finally, much of the literature regarding weight and quality of life does not examine unique subgroups whose quality of life may be impacted differently by weight due to features unique to that subgroup.

One subgroup of interest in the area of obesity research is black women who have a significantly higher prevalence of overweight and obesity than their white counterparts (11, 12). Flegal et al report that approximately 80% of Black women over age 20 have a BMI $\geq$ 25 kg/m^2 (3). It remains unclear exactly how this obesity rate translates into health implications. There is evidence to suggest that the relationship between obesity

and morbidity/mortality is weaker in blacks than whites and in women than in men (13). It is also unclear how obesity impacts quality of life in black women. Specifically, if black women are more accepting of a larger body size because of experiences, beliefs, expectations and perceptions that are associated with being a black woman, that acceptance may subsequently affect the relationship between quality of life and weight in this group. Given the high prevalence of overweight and obesity in black women, it is important to understand how quality of life is affected by weight in this group in order to better understand the breadth of the obesity epidemic beyond traditional clinical outcomes. We can then begin to examine how to improve quality of life in these individuals either by encouraging them to seek healthier body sizes or by addressing other societal factors, e.g., public accommodations or removal of stigma that may be leading to reduced quality of life for obese individuals. Therefore, we assessed quality of life in a sample of overweight or obese black and white women using the Impact of Weight on Quality of Life – Lite (IWQOL-Lite), an obesity-specific quality of life instrument (Cronbach $\alpha = 0.96$). Few studies have examined the relationship between weight and quality of life in a group of non-treatment seeking women using an obesity-specific measurement tool. We suspect that the relationship between BMI weight-related quality of life may be different for black women. Therefore, the primary aim of this study was to use the IWQOL-Lite to examine the association between weight and quality of life in women and determine whether this association differs by race.

Methods

Study population

Data for this study were derived from 2 sources. One-half of the sample data (n=176) was collected from community volunteers in Birmingham, Alabama (150 black, 26 white). The study was announced via flyers, emails, 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, 190 were eligible to participate. These individuals self-identified as female, black or white, were at least 19 years old, and had a self-reported BMI $\geq$ 25 kg/m^2. Of the eligible individuals, 176 females completed a one-time clinic visit for data collection. The Birmingham participants were then matched based on BMI and age to data of 175 individuals of the opposite race group in a normative database of IWQOL-Lite respondents (26 black, 149 white) to construct the complete dataset used for this study. The database contains data on over 10,000 participants collected at Duke Medical Center from various settings including the general community, severely obese individuals, weight loss clinical trials, various weight loss programs, obese with type 2 diabetes, and obese with hyperlipidemia. The vast majority of these participants are white with a mean age of 46.1 years. The mean BMI for participants included in the database is 37.5 kg/m^2. For this study, only participants from the general community sample (n=711) were used for matching in order to make the sample as similar to the Birmingham sample as possible.

After calculating BMI from measured height and weight, we determined that 4 of the Birmingham participants did not meet inclusion criteria due to having a BMI < 25 kg/m^2. Subsequently, 4 individuals that they were matched to in the normative database also did not meet the BMI inclusion criteria. Thus, these 8 participants were not included in this analysis. For this study, cross-sectional data for 343 women were analyzed (172 black, 171 white).

All participants provided informed consent and this study was reviewed and approved by the University of Alabama at Birmingham Institutional Review Board to ensure the protection of human subjects.

Measures

Anthropometrics

A standardized protocol was implemented to collect height and weight for the Birmingham participants. 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: ((weight in pounds * 703)/(height in inches)^2). Height and weight data for participants in the normative database was self reported.

Impact of Weight on Quality of Life – Lite

The original IWQOL was the first instrument specifically developed to assess the effects of obesity on the quality of life in persons who were seeking treatment for obesity. The IWQOL-Lite was later developed in a heterogeneous sample as a shorter version to be conveniently used to assess obesity-specific quality of life in clinical trials. This survey has been validated and has demonstrated test-retest reliability (ICC>.93) (14).

Administration of the IWQOL-Lite is simple 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 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 5 response options which are "*never true*," "*rarely true*," "*sometimes true*," "*usually true*," and "*always true*."

Key Covariates

Age, income, and race were assessed via a demographics questionnaire. Age was self-reported in years. Income was attained by self-report of annual household income. Race was self-identified by participants.

Statistical Analysis

Descriptive statistics were calculated and summarized as means ± SD or medians. One-way analysis of variance (ANOVA) tests were used to examine the differences in IWQOL-Lite scores by BMI category. Post-hoc comparisons were performed using

Tukey's honestly significant difference procedure (HSD). Hierarchical linear regression models were used to predict IWQOL-Lite scores. Based on existing literature and the study hypothesis, BMI was entered as the independent variable in Step 1. Other potential predictors were added in step 2 to determine which variables were appropriate for creating the most parsimonious model. For all analyses, a p value of <0.05 was considered statistically significant.

Results

Participant characteristics are described in table 1. Participants had a mean age of 40.5 years and a mean BMI of 35.6 kg/m^2. On average, participants reported 15 years of education and nearly half reported a median annual household income between $30,000-$59,999. The mean IWQOL-Lite total score was 74.3 out of 100; when stratified by race, black and white women had IWQOL-Lite scores of 81.6 and 66.9, respectively.

Table 2 presents IWQOL-Lite scores—subscales and total—by race and BMI classification. Based on results of one-way ANOVA, there was a significant main effect of BMI on IWQOL-Lite total and subscale scores except for the sexual life subscale (physical function: F (3, 336) = 46.6 p<0.001; self-esteem: F (3, 337) = 10.1 p<0.001; sexual life: F (3, 318) = 2.3 p=0.08; public distress: F (3, 337) = 55.8 p<0.001; work: F (3, 333) = 12.6 p<0.001) and total score F (3, 337) = 34.8 p<0.001). Tukey's HSD post-hoc comparisons of differences across BMI groups indicated that the physical function subscale score significantly declined with each increase in BMI group. In all other IWQOL-Lite subscales and total score, the 25-29.9 BMI group was not significantly different from the 30-34.9 BMI group.

Hierarchical linear regression modeling also displayed a significant inverse association between BMI and IWQOL-Lite total score and all five subscales (Table 3). All models were statistically significant (physical function: F (4, 336) = 64.2 $p<0.001$; self-esteem: F (4, 337) = 43.5 $p<0.001$; sexual life: F (4, 318) = 10.6 $p<0.001$; public distress: F (4, 337) = 80.4 $p<0.001$; work: F (4, 333) = 23.8 $p<0.001$) and total score F (4, 337) = 61.4 $p<0.001$). Figure 1 presents graphs illustrating the relationship between BMI and IWQOL-Lite scores stratified by race. As shown in table 3, when controlling for age and race, a significant BMI-by-race interaction persisted for models predicting physical function ($p=0.01$), self-esteem ($p<0.001$), sexual life ($p<0.001$), public distress ($p<0.001$), work ($p<0.001$) and total ($p<0.001$) IWQOL-Lite scores. These results indicate that the relationship between BMI and quality of life score is modified by race. Age was also a significant predictor of physical function and self-esteem scores.

Discussion

Our study sought to examine the association between weight and quality of life in a community sample of women and whether this association is modified by race. In this sample, the mean IWQOL-Lite score was 74.3 on a 100 point scale. Additionally, there was a strong inverse correlation between BMI and the 5 IWQOL-Lite subscale and total scores. Further analysis revealed that race modified the relationship between BMI and IWQOL-Lite scores. At similar BMIs, black women consistently reported higher scores for all IWQOL-Lite subscales than their white counterparts. The greatest difference in IWQOL-Lite scores between black and white women was seen in the self-esteem subscale. This is consistent with previous literature showing that obesity is associated with low self-esteem in whites, but not blacks (15). Black women scored lowest on the

physical function subscale. This finding is similar to that of previous studies (16) which suggested that despite different cultural acceptance for body sizes in blacks that may attenuate the effect of weight on psychosocial aspects of weight-related quality of life, physical function is a more palpable aspect of weight-related quality of life that is experienced more similarly across racial groups. Even still, despite the more palpable and subjective nature of the physical function subscale, black women in this sample reported significantly higher physical functioning quality of life than white women in this sample.

To date, a large majority of the current weight-specific quality of life literature has been focused specifically on clinical populations or treatment-seeking individuals. Our findings in the general population are similar to that of clinical populations or those seeking treatment, although the strength of association may differ according to subgroup or quality of life domain. In general, as BMI increases, quality of life decreases for both black and white women. This generalizability is of note because there is evidence to support that obese persons seeking treatment may have more psychological disturbances than those not seeking treatment (17), which could potentially play a role in one's perceived quality of life. However, our findings suggest that weight-related quality of life reported in the general population is similar to previous findings regarding individuals seeking weight loss treatment. Additionally, our findings provide evidence that association between weight and quality of life is modified by race such that quality of life is less impaired with increased BMI in black women than in white women. One may purport that this is because of the well-documented cultural acceptance and/or preference for larger body sizes (18-20). Therefore, quality of life as measured by the IWQOL-Lite, which is largely composed of questions that may be socially influenced or based on self-

perception, would not be as impaired in black women since they do not face the same social or cultural expectations of body size as white women. The implications of the relationship between weight and quality of life in black women remain unclear. While the highest quality of life is desirable as an indicator of overall well-being, black women's perception of experiencing a high quality of life despite having a high BMI may also dampen motivation for attempting weight reduction.

There are strengths and limitations associated with this study. The major strengths of this study are the sources of data and the composition of the sample. Participants are from the community and intended to represent the general population extending generalizability beyond clinical populations or those seeking weight loss treatment. Additionally, this study sample is comprised of 50% blacks, which adds to the literature that currently contains numerous studies of majority white populations. This study also has limitations. One limitation is the source of data for half of the study sample. Data were collected for 172 and matched to 171 additional participants from the normative database, which contained data collected at a different time and location than participants who provided original data for this study. This could potentially introduce bias related to the source of data. However, statistical testing for potential effects of data source were not significant suggesting that data source did significantly impact our findings. Another potential limitation is the self-reported height and weight data of participants in the normative database. However, Kolotkin et al report that the prevalence of overweight and obesity in a sample from the normative database is similar to data from the National Center for Chronic Disease Prevention and Health Promotion. Also, previous studies using this data are comparable to other studies where height and weight are measured

suggesting that the potential bias of self-report is minimal and does not substantially affect the association between weight and IWQOL-Lite scores (21).

In conclusion, higher BMI is associated with reduced weight-related quality of life in women. The relationship between BMI and weight-related quality of life is modified by race such that black women report higher quality of life than white women at the same BMI. Additionally, for black women, the psychosocial aspects of obesity seem to be less affected by BMI compared to the mechanical/physical functioning aspects of obesity. Further research is needed to further understand how quality of life may affect weight-related behaviors in black and white women.

Table 1. Characteristics of study participants and mean IWQOL-Lite scores

	Total (n=343)	Black (n=172)	White (n=171)
Age (years)[a]	40.5 ± 11.2	40.5 ± 11.2	40.4 ± 11.3
BMI (kg/m^2)	35.6 ± 7.7	35.7 ± 7.8	35.5 ± 7.7
Education (years)[b]	15.7 ± 2.5	15.7 ± 2.5	15.9 ± 2.7
IWQOL-Lite Scores			
Physical Function[a]	71.2 ± 22.9	75.7 ± 20.9	66.6 ± 24.0*
Self-esteem	62.3 ± 29.6	76.1 ± 24.2	48.5 ± 28.1*
Sexual life[c]	81.7 ± 24.2	88.1 ± 19.6	74.7 ± 26.7*
Public distress	84.0 ± 22.9	89.3 ± 19.2	78.6 ± 25.0*
Work[d]	84.9 ± 19.1	92.0 ± 12.7	79.7 ± 22.2*
Total	74.3 ± 20.1	81.6 ± 15.9	66.9 ± 21.3*

Mean ± SD. a-missing data for 1, b-data provided for Birmingham sample only, c-missing data for 19, d-missing for 4. *T-test indicates statistical difference at $p<0.05$.

Table 2. IWQOL-Lite scores by BMI and race

	(BMI kg/m^2)			
	25-29.9	30-34.9	35-39.9	40+
Physical Function				
Black	86.9 ± 13.5 (48)	79.2 ± 18.9 (47)	74.5 ± 16.6 (28)	62.2 ± 23.8 (47)
White	84.1 ± 16.0 (50)	73.9 ± 16.4 (38)	62.4 ± 20.6 (32)	46.1 ± 21.5 (50)
Total	85.5 ± 14.8[a] (98)	76.8 ± 17.9[b] (85)	68.1 ± 19.7[c] (60)	53.9 ± 23.9[d] (97)
Self-esteem				
Black	83.1 ±20.0 (48)	75.9 ± 23.9 (47)	74.9 ± 25.6 (28)	70.7 ± 26.4 (47)
White	62.6 ± 26.4 (50)	53.9 ± 26.1 (39)	45.0 ± 27.3 (32)	32.4 ± 23.5 (50)
Total	72.6 ± 25.6[a] (98)	65.9 ± 27.1[ab] (86)	58.9 ± 30.3[b] (60)	51.0 ± 31.4[c] (97)
Sexual life				
Black	89.6 ± 18.7 (48)	86.0 ± 23.5 (46)	90.6 ± 13.8 (28)	87.0 ± 20.1 (46)
White	81.4 ± 25.0 (48)	78.5 ± 23.2 (36)	73.1 ± 27.4 (27)	65.0 ± 28.8 (43)
Total	85.5 ± 22.3[a] (96)	82.7 ± 23.5[a] (82)	82.0 ± 23.1[a] (55)	76.3 ± 26.9[a] (89)
Public distress				
Black	98.0 ± 5.0 (48)	93.7 ± 14.1 (47)	90.9 ± 14.9 (28)	75.6 ± 26.8 (47)
White	96.4 ± 8.1 (50)	91.3 ± 11.3 (39)	72.7 ± 23.8 (32)	54.8 ± 24.2 (50)
Total	97.2 ± 6.8[a] (98)	92.6 ± 12.9[a] (86)	81.2 ± 22.0[b] (60)	64.9 ± 27.4[c] (97)
Work				
Black	95.3 ± 7.9 (48)	92.6 ± 13.2 (47)	94.2 ± 9.3 (27)	88.1 ± 15.4 (45)
White	90.4 ± 15.8 (49)	86.1 ± 16.8 (39)	72.3 ± 24.1 (32)	69.1 ± 24.0 (50)
Total	93.0 ± 12.7[a] (97)	89.6 ± 15.2[ab] (86)	82.3 ± 21.7[bc] (59)	78.1 ± 22.4[c] (95)

	(BMI kg/m^2)			
	25-29.9	30-34.9	35-39.9	40+
IWQOL-Lite total				
Black	89.3 ± 11.1 (49)	83.4 ± 15.0 (47)	81.9 ± 14.3 (28)	72.6 ± 17.6 (47)
White	81.7 ± 14.3 (50)	74.2 ± 14.5 (39)	62.4 ± 20.2 (32)	49.4 ± 18.8 (50)
Total	85.4 ± 13.3[a] (98)	79.2 ± 15.4[a] (86)	71.5 ± 20.1[b] (60)	60.7 ± 21.5[c] (97)

Mean ± SD (n). Means with common subscripts are not significantly different based on Tukey's hsd ($p \leq 0.05$).

Table 3. Predictors of IWQOL-Lite scores based on hierarchical linear regression

	b	SE b	β	Adjusted R^2
IWQOL-Lite Total				
Step 1				0.26
(constant)	122.16	4.49		
BMI	-1.35	0.12	-0.51*	
Step 2				0.42
(constant)	101.62	13.05		
BMI	-0.13	0.35	-0.05	
race	13.95	8.0	0.35	
age	-0.01	0.07	-0.004	
BMI*race	-0.81	0.22	-0.87*	
IWQOL-Lite Physical Function				
Step 1				0.34
(constant)	133.86	4.80		
BMI	-1.76	0.13	-0.59*	
Step 2				0.43
(constant)	130.71	14.66		
BMI	-0.83	0.39	-0.28*	
race	11.44	9.0	0.25	
age	-0.39	0.08	-0.19*	
BMI*race	-0.59	0.25	-0.55*	
IWQOL-Lite Self Esteem				
Step 1				0.07
(constant)	99.49	7.38		
BMI	-1.05	0.20	-0.27*	
Step 2				0.33
(constant)	64.11	20.47		
BMI	0.58	0.55	0.15	
race	12.00	12.51	0.20	
age	0.47	0.12	0.18*	
BMI*race	-1.11	0.34	-0.81*	
IWQOL-Lite Sexual Life				
Step 1				0.02
(constant)	98.57	6.36		
BMI	-0.48	0.18	-0.15*	
Step 2				0.11
(constant)	74.51	19.66		
BMI	0.64	0.53	0.20	
race	14.00	12.14	0.29	
age	0.11	0.12	0.05	
BMI*race	-0.78	0.34	-0.68*	

		b	SE b	β	Adjusted R^2
IWQOL-Lite Public Distress					
Step 1					0.40
	(constant)	151.42	4.58		
	BMI	-1.89	0.13	-0.63*	
Step 2					0.48
	(constant)	109.99	13.91		
	BMI	-0.41	0.37	-0.14	
	race	24.28	8.50	0.53*	
	age	0.13	0.08	0.06	
	BMI*race	-0.99	0.23	-0.93*	
IWQOL-Lite Work					
Step 1					0.10
	(constant)	114.55	4.74		
	BMI	-0.81	0.13	-0.32*	
Step 2					0.21
	(constant)	99.65	14.59		
	BMI	0.17	0.39	0.07	
	race	10.28	8.87	0.27	
	age	-0.03	0.08	-0.02	
	BMI*race	-0.64	0.24	0.72*	

*$p<0.05$

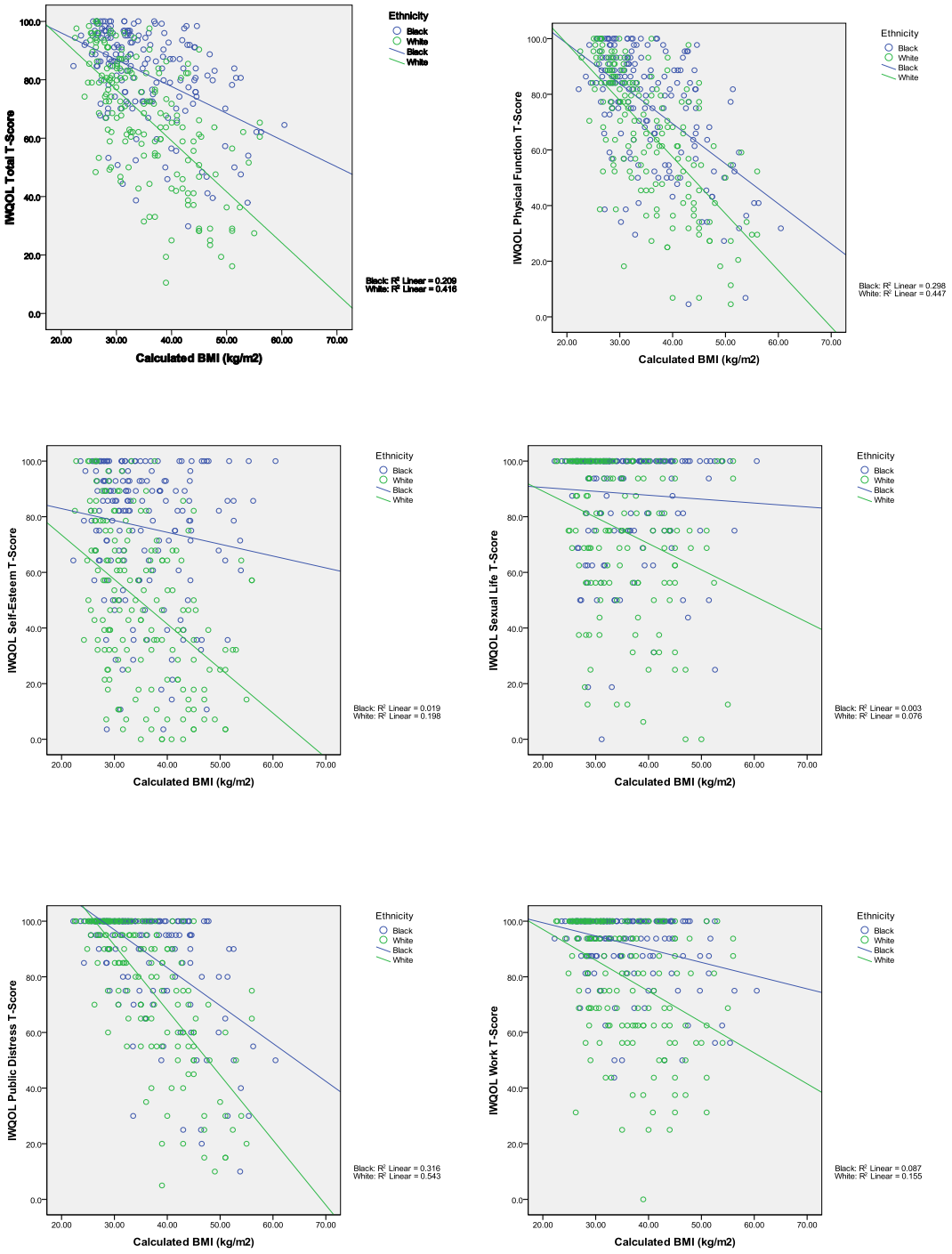

Figure 1. The association between BMI and IWQOL-Lite scores by race

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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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Introduction

The obesity epidemic in black women is well documented. However, the impact of obesity on black women is less understood. There is evidence that excess weight has both physiologic and psychological effects on black women that differ from white women. For example, despite a high prevalence of obesity-related diseases, findings from early research by Kumanyika et al indicated that the prevalence of several obesity-related diseases did not simply parallel the excess prevalence of obesity in black women.[1] For example, 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 psychological perspectives on obesity in these two groups. For example, it is well documented that black women are more satisfied with their body size than 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.[9]

The interplay of psychological factors related to obesity such as quality of life and body image warrant further study. There is a well established relationship between weight and quality of life in women. In general, as body mass index (BMI) increases, quality of life decreases.[10,11] However, black women consistently report higher quality of

life when compared to white women of similar BMIs.[12-14] Reasons for this difference in weight-related quality of life are still unclear. There is evidence to support that self-perception of weight status may influence physical and mental aspects of quality of life.[15] This might suggest that the positive self body image of black women[16-18] may contribute to their weight-related quality of life.

The purpose of this study was to examine body image among a sample of overweight and obese black women and to determine whether body image dissatisfaction mediated the relationship between BMI and weight-related quality of life in this sample.

Methods

Study population

Participants were community volunteers from the Birmingham, AL metropolitan area. The study was announced via flyers, emails, 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, black, were at least 19 years old, and had a self-reported BMI $\geq$ 25 kg/m^2. Of the eligible individuals, 150 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 the protection of human subjects.

Measures

At the clinic visit, participants completed a demographics questionnaire, the Impact of Weight on Quality of Life-Lite survey[19] and the Pulvers Figure Rating Scale.[20] Additionally, we measured height, weight and waist circumference 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: ((weight in kilograms)/(height in meters)^2). Waist circumference was measured to the nearest 0.1 centimeter using an anthropometric measuring tape. Waist was measured at 1 centimeter above the umbilicus.

Body Image/Body Satisfaction Measure

Body image was assessed using the Pulvers Figure Rating Scale (figure 1), a validated figural stimuli instrument that is culturally appropriate for Blacks, with strong psychometric properties including high inter-rater reliability (α=0.95).[20] Participants were shown a series of nine body figures (1=smallest to 9=largest) and asked to select which

figure she thought most closely resembled her current body size ($BI_{current}$) and which figure she 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 body image 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 body image and $BD > 0$ indicated a desire to be smaller than one's current perceived body image.[6,21]

Impact of Weight on Quality of Life – Lite

Weight-related quality of life (QOL) was assessed using the Impact of Weight on Quality of Life – Lite survey (IWQOL-Lite). The original IWQOL was the first instrument specifically developed to assess the effects of obesity on the quality of life of persons who were seeking treatment for obesity. The IWQOL-Lite was developed as a shorter version to be conveniently used to assess obesity-specific quality of life in clinical trials. This survey has been validated and has demonstrated test-retest reliability (ICC>.93).[19]

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 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 5 response options which are "never true," "rarely true," "sometimes true," "usually true," and "always true."

Key Covariates

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 and years of education were also self-reported.

Statistical analysis

Descriptive statistics were calculated and summarized as means ± 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. All values were deemed statistically significant at $p<0.05$.

The proposed mediation of the BMI-QOL relationship by BD was tested using the Baron and Kenny test for mediation (figure 1).[22] In short, four conditions must be met to establish the mediating role of a variable: (1) show that the initial variable is correlated with the outcome, (2) show that the initial variable is correlated with the mediator, (3) show that the mediator is correlated with the outcome, (4) examine the reduction of the predictor-outcome relationship for evidence of partial or total mediation.[24]

Results

A description of study participants is shown in table 1. Participants were 150 black females with a mean BMI of 36.1 kg/m^2. On average, participants were 40 years of

age and well educated. Table 2 shows participants' IWQOL-Lite subscale and total scores. Participants reported the greatest impairment of quality of life in the physical function domain and the least impairment in the work domain.

Perceived body image is described in table 3. On average, participants' current perception of body image was larger than their ideal body image ($BI_{current}$= 6.0 ± 1.4 vs. BI_{ideal}= 3.7 ± 0.9) (see figure 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 indicated that individuals in the 25-29.9 BMI category and 30-34.9 BMI category did not differ from one another in their perceived current body image or their ideal body image.

The test for mediation revealed that BD partially mediated the relationship between BMI and several IWQOL-Lite subscales and total score. There was a significant initial relationship between the BMI and IWQOL-Lite total score (β = -0.48, p < 0.001). After controlling for BD, the magnitude of the association decreased, but remained statistically significant (β = -0.26, p < 0.001) indicating that BD partially mediated the relationship between BMI and IWQOL-Lite total score. Partial mediation was also indicated for the physical function, public distress, and work IWQOL-Lite subscales (table 4). There was a significant inverse relationship between the BMI and IWQOL-Lite self-esteem subscale score (β = -0.16, p = 0.048). However, after controlling for BD, the direction of the relationship changed and was no longer statistically significant (β = 0.10, p = 0.24) indicating that BD completely mediated the relationship between BMI and IWQOL-Lite self esteem score. Finally, BMI was not associated with the IWQOL-lite

sexual life subscale score in step 1 of the test for mediation indicating that there was no relationship to be mediated for the IWQOL-Lite sexual life subscale.

Discussion

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

Our findings are consistent with the current literature which shows that though there is desire to be thinner in both black and white women,[23] black women's quality of life is not greatly impaired by excess weight.[10,11] Additionally, though there has been evidence to suggest that BD may impact weight-related quality of life, this study is one of the first to explicitly test BD as a mediator in the BMI-QOL relationship. These findings demonstrate that in black women, weight-related quality of life is influenced by how far one is from her desired body size. The psychological nature of several of the IWQOL-Lite subscales such as self-esteem and public distress may be heavily 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 quality of life 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 due to the fact that self-esteem is an interpersonal psychological trait rather than a physical action, feeling, or trait that one may experience.

Identifying BD as a mediator of weight-related quality of life 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, i.e. body image dissatisfaction, was in the pathway of the association between BMI and IWQOL-Lite scores. Thus, body image dissatisfaction may explain more regarding black women's weight-related quality of life than actual BMI.

This study has strengths and limitations. Participants were a volunteer community sample and not seeking weight-loss treatment increasing the generalizability of the results. This study was also strengthened by the use of the Pulvers Figure Rating Scale which is appropriate for assessing body image in black women. Previous body image research in black women has admittedly been potentially limited by use of a figure rating scale that may not be culturally sensitive in assessing body image 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 quality of life and/or body image.

In summary, black women reported experiencing body image dissatisfaction. Black women's body dissatisfaction mediated the relationship between BMI and weight-related quality of life. This implies that body image is a psychological 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. However, our findings remind us 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 quality of life. However, we may also hypothesize that perceived quality of life may also influence a woman's body dissatisfaction. Therefore, further cross-sectional and prospective exploration of the role of body image in black women may help to better understand black women's perception of weight and subsequent weight-related behaviors. Additionally, future research comparing weight-related quality of life in black and white women with similar body image dissatisfaction may help to explain why black and white women experience weight-related quality of life differently.

Table 1. Description of the study population (n=150)

	mean ± sd
Age (yrs)	40.5 ± 11.1
Weight (kg)	97.1 ± 22.1
BMI (kg/m^2)	36.1 ± 8.0
Waist circumference (cm)	104.8 ± 17.5
Education (yrs)	15.6 ± 2.5
Yearly household income	%
$0-29,999	26.7
$30,000-59,999	45.3
≥ $60,000	26.0
Did not report	2.0

Table 2. Mean Impact of weight on Quality of Life – Lite Scores (n=150)

IWQOL Physical Function	74.7 ± 21.0
IWQOL Self Esteem	75.6 ± 23.3
IWQOL Sexual Life	88.8 ± 18.2
IWQOL Public Distress	88.5 ± 20.1
IWQOL Work	91.5 ± 13.2
IWQOL Total	81.1 ± 15.8

Table 3. Description of body image variables by BMI category

	BMI Category				
	25-30 (n=39)	30-35 (n=43)	35-40 (n=23)	40+ (n=45)	Total (n=150)
$BI_{(current)}$	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

Means with common subscripts are not significantly different based on Tukey's hsd ($p \leq 0.05$).

Table 4. Results for test of BD mediation of BMI-QOL relationship

	Model 1		Model 4	
	B	p	β	p
Total	-0.478	<0.001	-0.261	0.001
Physical Function	-0.542	<0.001	-0.416	<0.001
Self Esteem	-0.162	0.048	0.102	0.24
Sexual Life	-0.089	0.28	0.059	0.535
Public Distress	-0.561	<0.001	-0.401	<0.001
Work	-0.315	<0.001	-0.269	0.003

Model 1 establishes a relationship to be mediated between BMI and QOL. Model 4 includes BD in the model as a mediator assuming that assumptions have been met in steps 1-3.

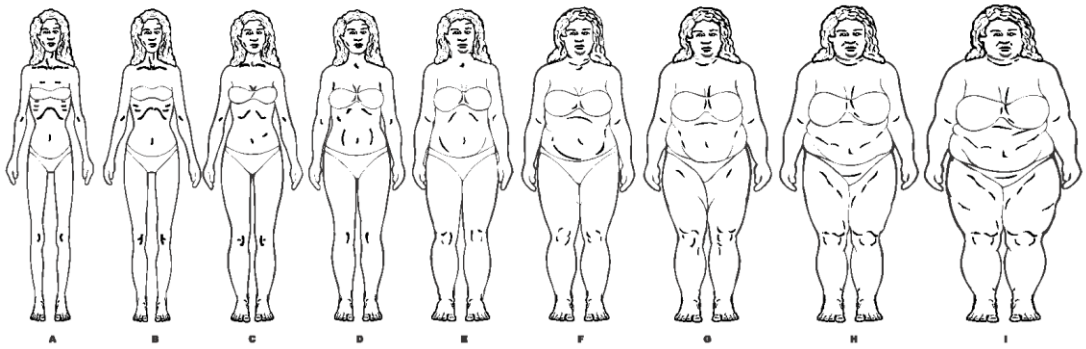
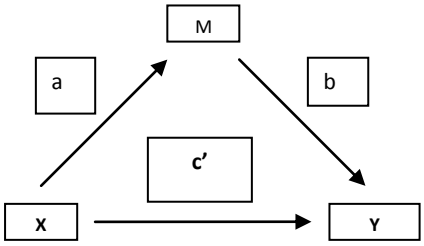
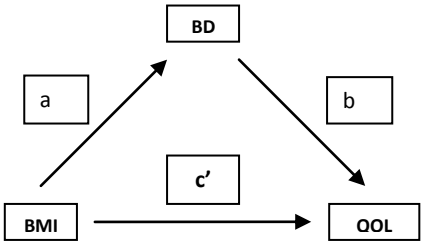


Figure 1. Pulvers Figure Rating Scale, with permission of Dr. Kimberly Pulvers





Legend

X: initial variable

Y: outcome variable

M: mediating variable

C': direct effect

A: x-m correlation

B: m-y relationship, controlling for x

Figure 2a. Diagram of Baron and Kenny mediational model

Figure 2b. Diagram of Baron and Kenny mediational model using specific variables being tested

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SUMMARY CONCLUSION

Overview of Results

In this sample of overweight and obese women, BMI was inversely associated with IWQOL-Lite total and subscale scores for black and white women. When BMI was categorized into groups (25-29.9, 30-34.9, 35-39.9, 40+), there was a significant main effect of BMI on IWQOL-Lite total and subscale scores except for the sexual life subscale. There was also evidence of a BMI-by-race interaction as a predictor of IWQOL-Lite subscale and total scores indicating that the relationship between BMI and IWQOL-Lite scores was modified by race.

Based on these findings, a subgroup analysis was conducted on 150 black females to examine other factors, specifically body image satisfaction, that may be associated with quality of life in black women. The mean IWQOL-Lite total score for this subgroup was 81.1 ± 15.8 (0-worst to 100-best). The physical function subscale was the most impaired indicating that physical function is the most adversely affected domain of the IWQOL-Lite subscales.

Body image was also examined in this subgroup using the Pulvers Figure Rating Scale. Participants indicated body image dissatisfaction by indicating that their ideal body image was smaller than their current body image. Additionally, there was a significant main effect of BMI on body image dissatisfaction suggesting that those with

higher BMIs were further away from their desired body image. Body image dissatisfaction was shown to partially mediate the relationship between BMI and IWQOL-Lite total score in this subgroup. Partial mediation was also indicated for the physical function, public distress, and work IWQOL-Lite subscales. Body image dissatisfaction completely mediated the relationship between BMI and the self-esteem subscale score. Finally, BMI was not associated with the sexual life subscale score.

Strengths

The major strengths of this study are the sources of data and the composition of the sample. Participants are from the community and intended to represent the general population extending generalizability beyond clinical populations or those seeking weight loss treatment. Additionally, this study sample is comprised of 50% Blacks, which adds to the literature that currently contains numerous studies of majority white populations. Another strength of this study is the use of the Pulvers Figure Rating Scale which is appropriate for assessing body image in black women. Previous body image research in Black women has admittedly been potentially limited by use of a figure rating scale that may not be culturally sensitive in assessing body image in this unique population (30). Additionally, participants were a volunteer community sample and not seeking weight-loss treatment increasing the generalizability of the results.

Limitations

This study also has limitations. One limitation is the source of data for half of the study sample. Data were collected for 172 and matched to 171 additional participants from the normative database, which contained data collected at a different time and location than participants who provided original data for this study. This could potentially introduce bias related to the source of data. However, statistical testing for potential effects of data source were not significant suggesting that data source did significantly impact our findings. Another potential limitation is the self-reported height and weight data of participants in the normative database. However, Kolotkin et al report that the prevalence of overweight and obesity in a sample from the normative database is similar to data from the National Center for Chronic Disease Prevention and Health Promotion, which includes both self-reported and measured height and weight (29). Also, previous studies using this data are comparable to other studies where height and weight are measured suggesting that the potential bias of self-report is minimal and does not substantially affect the association between weight and IWQOL-Lite scores (29).

Implications

The results of this study help to further characterize a greater scope of the obesity epidemic in the United States. This study highlights that the obesity epidemic has consequences that go beyond standard clinical outcomes. Specifically, this study revealed that obesity is associated with reduced quality of life in women. This finding is of note because it provides evidence that women may not be achieving a full and active life due to being overweight or obese.

Our findings also suggest notable psychological differences regarding weight in black and white women. Black women scored much higher than white women on the self-esteem subscale further supporting that black women's self-esteem is not as strongly influenced by weight. In fact, black women have described their standard for beauty based on multiple factors including not only size, but also personal style, grooming, fit of clothes, and ethnic pride. Therefore, measures of quality of life related to self-esteem may not be very closely associated to weight alone.

It remains unclear how the acceptance of larger body sizes affects black women's weight management decisions. On one hand, high self-esteem is associated with several positive outcomes including less depression, greater long-term weight loss and overall better health. Also, there is evidence that black women's positive self body image is protective against disordered eating. However, despite the clear benefits of positive self body image, there is also evidence that body image dissatisfaction is "a principal motivator of weight management efforts (31)." Therefore, some researchers conjecture that the strong positive self body image in black women reduces their motivation to seek or maintain a smaller body size. To further complicate the body image construct, we must also consider the fact that there is a growing body of literature that demonstrates that black women do, in fact, have a desire to be smaller while at the same time are accepting of larger body sizes. Therefore, the challenge is to promote black women's desire to be thinner, while not diminishing their positive self body image at their current size.

The differences in the mentality of black women regarding weight would suggest the need for different approaches to promote achieving and maintaining a healthier body size. For example, one approach may be to tailor messages to strongly appeal to the

potential for impaired physical function associated with higher BMIs reported by black women on the IWQOL-Lite physical function subscale. Additional research is needed to understand how to incorporate the weight perspectives of black women into weight management messages and interventions.

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APPENDIX A (IRB approval)

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Institutional Review Board for Human Use

Form 4: IRB Approval Form
Identification and Certification of Research
Projects Involving Human Subjects

UAB's Institutional Review Boards for Human Use (IRBs) have an approved Federalwide Assurance with the Office for Human Research Protections (OHRP). The Assurance number is FWA00005960 and it expires on October 26, 2010. The UAB IRBs are also in compliance with 21 CFR Parts 50 and 56 and ICH GCP Guidelines.

Principal Investigator:	COX, TIFFANY L
Co-Investigator(s):	THOMAS, HELEN OLIVIA
Protocol Number:	**X090706008**
Protocol Title:	*The impact of weight on quality of life in African American women*

The IRB reviewed and approved the above named project on 5-19-10. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

This project received EXPEDITED review.

IRB Approval Date: 5-19-10

Date IRB Approval Issued: 5-19-10

Marilyn Doss

Marilyn Doss, M.A.
Vice Chair of the Institutional Review
Board for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.

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