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BMI-based Norms for a Culturally Relevant Body Image Scale among African Americans

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Abstract

The present study provides body mass index (BMI) standards for interpreting culturally relevant body image figure scores among African American men and women. Concordance between participants' and independent raters' figure selection is evaluated and the sensitivity and specificity of the figures for predicting overweight status is reported. African American adults ($n = 498$, 71% female) selected the figure most closely resembling them currently, and had their height and weight measured to calculate BMI. Three independent raters selected the figure that most closely resembled a subset of the participants ($n = 277$, 75% female). Probability that overweight status was correctly identified was 85% for participants and 98% for raters. ROC analysis showed that figures selected by raters (86%) and participants (83%) were equally sensitive in predicting overweight status using the gold standard, BMI. Figures selected by raters (98%) were more specific in predicting overweight status than when selected by participants (75%). Considerations in using participant- or rater-based norms for interpreting figure scores are discussed.

Keywords

body image; African American; BMI; body size; perception; figure

1. Introduction

Body image is an important factor influencing weight related perceptions and activities (Fitzgibbon, Blackman, & Avellone, 2000; Grabe & Hyde, 2006; Kronenfeld, Reba-Harrelson, Von Holle, Reyes, & Bulik, 2010; Roberts, Cash, Feingold, & Johnson, 2006). Therefore, there is a need for reliable and valid measures of body image, especially among

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African Americans who experience high rates of obesity (Pan et al., 2009). A culturally relevant body image tool for African American men and women was developed in 2004, demonstrating strong psychometric properties and cultural acceptability among African Americans (Pulvers et al., 2004). Although silhouette scales have limitations compared to multi-dimensional body image scales, the simplicity, brevity, and minimal literacy requirements offer practical benefits for community based assessment. Anchors for interpreting body image scores enhance the usefulness of such scales. The purpose of the present study is to provide BMI standards for interpreting body image scores for African American men and women.

The study presents descriptive data on current body size among African American adult men and women, with separate age group norms. Average BMI is provided for men and women choosing each current body size figure. Furthermore, descriptive data is presented on current body size based on ratings from independent observers for two reasons. First, the original scale development study showed that individual raters' figure choice was more strongly associated with objective markers such as BMI than participants' figure choice (Pulvers et al., 2004). Second, previous research has shown differences in body figure perceptions between objective raters and individuals (Pulvers et al., 2008). Therefore, concordance between participant and independent raters' figure choice is evaluated, and best fit prediction models of overweight status using figure ratings are made. All data is drawn from the same sample upon which the original scale development article was based (Pulvers et al., 2004).

2. Material and Methods

Data were collected as part of a health behavior change trial in nine public housing developments in the greater Kansas City metropolitan area. The detailed methods for this trial are described in Pulvers et al., (2004). Participants were presented with the gender-appropriate version of the random-order body image instrument and asked to select the figure that mostly closely resembled them currently. Three research staff rated the residents' body size using a sheet containing a set of male figures in a random order and a set of female figures in a random order. Participants' height and weight were anthropometrically measured for BMI calculation.

3. Analytic Approach

Current figure norms were developed by calculating means and standard deviations on the BMI associated with each figure size. This was done separately for men and women, and by age group. Furthermore, this was done separately based on participant and rater selection of figure size. A composite rater size was created by averaging the figure selected by the three raters. Kendall's coefficient of concordance was used to estimate agreement between participants' and raters' figure choice by gender. Kendall's coefficient of concordance is better suited for ordinal data such as ours than is the Kappa statistic.

Receiver operating characteristic (ROC) curves were developed to predict overweight status using the gold standard BMI of ≥ 25 for participant and raters' choice of figures. In this study, the area under ROC curve (AUC) was used to compare accuracy of figure choice predicting overweight status as measured by BMI between participants and raters. An AUC of 1.0 indicates perfect discrimination, while an AUC of 0.70 indicates good discrimination, and an AUC of 0.50 or less indicates poor discrimination.

Results

4.1 Norms

Table 1 provides the number of individuals by age group (women and men, respectively) who chose each figure, along with their measured mean BMI, for the full sample. The use of traditional BMI category definitions (underweight = < 18.5; normal = 18.5-24.9; overweight = 25-29.9; obese I = 30-34.9; obese II = 35-39.9; obese III = 40) (National Institutes of Health, 1998; World Health Organization, 2000) provided an anchor for the weight classification of participants choosing each figure. Among females of all ages, Figures 1-3 would be classified as Normal, Figure 4 as Overweight, Figure 5 as Obese I, Figure 6 as Obese II, and Figures 7-9 as Obese III. Among men of all ages, Figures 1-3 would be classified as Normal; 4 as Overweight; 5 as Obese I; and 6 as Obese II; and 7 as Obese I. The small number of men choosing Figure 7 is noteworthy. Although Figures 8 and 9 were not selected, they would be presumed to be classified as Obese II or III.

In considering the utility of age-based norms, shifts in BMI classification are observed. For example, among all female participants, Figure 3 is used to classify participants with a “normal” BMI among those ages 18-40, whereas Figure 3 is used to classify “overweight” BMI for those who are over age 40. In addition, the modal Figure shifts by age, with a mode of 4 (overweight) for those 18-30 and a mode of 5 (Obese I) or higher for those over the age of 30. Among men, the modal Figure is 4 (overweight) for those 18-40 and 3 for those over the age of 40.

4.2 Comparison between Participant and Rater Current Figure Choice

The pattern of results shows that participants and raters used the figural scale differently. Notably, the distribution of raters' figure choices is shifted one figure to the right of participants', given that raters did not select Figure 1 in any cases. Raters classified more female participants with figures that correspond to overweight and obesity, and this becomes more pronounced the larger the figure size, peaking at Figure 6. For example, 33 women rated themselves as a 4 versus raters who placed 36 women in this category; 39 women rated themselves as a 5 versus raters who placed 42 women in this category; and 19 women rated themselves as a 6 compared to raters who put 33 women in this category. A similar, but less pronounced pattern was evident among men.

Concordance between participants' and raters' choice of figures was adequate, but not as strong as concordance among the three raters' choice of figures. Kendall's Tau-b coefficient of concordance between participants' and raters' figure choice was 0.70 for all participants, 0.71 for female participants, and 0.53 for male participants. In contrast, Kendall's coefficient of concordance between the three raters' figure choice was 0.91 for all participants, 0.92 for female participants, and 0.86 for male participants.

Raters' figure choice was more strongly associated with BMI ($r_s = 0.93$) for all participants than was participants' rating ($r_s = 0.81$). This pattern was less pronounced for females, whose self-ratings correlated ($r_s = 0.82$) with BMI compared to raters' ($r_s = 0.93$), whereas males' self-ratings correlated ($r_s = 0.62$) with BMI compared to raters' ($r_s = 0.91$).

In order to further evaluate whether participants or raters were more accurate in their figure selection, ROC curves to predict overweight status using figure ratings were developed. The area under the ROC curve (AUC) for all participants' figure choice to predict overweight was 0.88 (95% CI of 0.83-0.92). The AUC for raters' figure choice to predict overweight was 0.96 (95% CI of 0.94-0.98). The difference of AUC between raters' and participants' figure choice to predict overweight was 0.08 (95% CI of 0.05-0.12) with p value <0.0001.

Using a BMI of 25 or greater, sensitivity, specificity, and the AUC for predicting overweight status were calculated. Examination of the coordinates of the ROC curve provided an estimate of the optimal figure cut point for maximizing the detection of overweight status using the gold standard, BMI. The optimal cut-point differed for participants and raters overall, with a cut-point of Figure 4 for participants and Figure 5 for raters. Using these cut points, sensitivity was comparable between participants and raters; however, specificity was markedly greater for raters (98%) than participants (75%). The probability that overweight status was correctly identified (i.e., positive predictive value; PPV) was comparable between participants (85%) and raters albeit higher for raters (98%). The probability that non-overweight status was accurately identified (i.e., negative predictive value; NPV) was comparable, ranging from 72% (participants) to 80% (raters).

The difference of AUC to compare the prediction accuracy of overweight status between raters' and participants' figure choices was maintained when examining men and women separately. The AUC for female participant's figure choice to predict overweight was 0.89 (95% *CI* of 0.84-0.93). The AUC for raters' figure choice to predict overweight of female participants was 0.97 (95% *CI* of 0.95-0.99). The difference of AUC between raters' and female participant's figure choice to predict overweight of female participants was 0.08 (95% *CI* of 0.03-0.12) with *p* value <0.0001. Results for sensitivity, specificity, PPV, and NPV for females were comparable to all participants, with sensitivity, PPV, and NPV being comparable between participants and raters, and specificity being higher for raters.

However, the optimal cut-point for predicting overweight status was consistent between male participants and raters, at Figure 4. Sensitivity and NPV were better for raters than male participants, and specificity and PPV were comparable between male participants and raters. The AUC for male participant's figure choice to predict overweight was 0.80 (95% *CI* of 0.69-0.91). The AUC for raters' figure choice to predict overweight of male participants was 0.94 (95% *CI* of 0.89-0.99). The difference of AUC between raters' and male participant's figure choice to predict overweight of male participants was 0.14 (95% *CI* of 0.04-0.25) with *p* value 0.008.

5. Discussion

The present study provides BMI-based norms for interpreting scores on a culturally sensitive figural scale among African American men and women. Validity of participant self-ratings is supported given significant correlations with BMI and accuracy in predicting overweight status in ROC analyses. Also noteworthy is the incremental validity of raters' figure selection and higher specificity of raters' figure selection for predicting overweight status. Therefore, investigators may also consider using rater-based norms (available upon request) in anchoring figures to a particular BMI and related weight status.

Differences in body figure perceptions between objective raters and participants in the present study are consistent with previous research (Pulvers et al., 2008). Body figure ratings may be external and one-dimensional when rated by observers, whereas for participants, body image is multi-dimensional and includes a broader self-concept than BMI/weight classification alone (Cash & Grasso, 2005; Williams, Gleaves, Cepado-Benito, Eerath, & Cororve, 2001). It is likely that participants take more information into account when evaluating body size, such as their internal experience of their bodies and their overall self-image (Schwartz & Brownell, 2004). Men in particular are known to be less accurate than women in judging their body size (Wardle & Johnson, 2002), especially at larger sizes (Pulvers et al., 2008). It is possible that sociocultural differences in the relatively greater emphasis placed on appearance for women than men (Strahan, Wilson, Cressman, & Buote, 2006; Wilson, Tripp, & Boland, 2005a, 2005b) explain why men are less attuned to their

body size than women. Furthermore, men may take different information into account when judging their body size, such as muscularity (Jones & Morgan).

In considering the data in the present study, it must be noted that it was collected in conjunction with a clinical trial among low income individuals in one geographic area. Therefore, caution must be used in applying the results to individuals of diverse socioeconomic statuses and in different geographic areas (Phuong Do et al., 2007; Ruel, Reither, Robert, & Lantz, 2010). BMI was calculated from measured height and weight which lends confidence to the results. Furthermore, a variety of ages were represented in the sample. However, the numbers of individuals in some age categories were relatively small, especially among men. Readers concerned about the small sample size in certain cells should use the norms for “all” participants in their data interpretation. Continued research with African American participants of diverse ages, particularly men, is recommended. This is the first known study to provide BMI-based norms for a culturally relevant figural scale for African American individuals. Results may prove useful for researching obesity among African Americans, especially in community-based studies where time and feasibility are measurement issues.

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Highlights

- BMI standards for interpreting figural scores among African Americans are provided
- Probability that overweight status is identified from figure score is strong
- Participant- and rater-selected figures are equally sensitive in predicting overweight
- Rater-selected figures are more specific in predicting overweight status

Table 1

Table 1. A

Current size (women); body mass index [mean(SD)] of the individuals who chose each figure image

Current Female Body Image number ('Which female figure do you think looks the most like you now?')*

Age Range	(smallest)								(largest)
18-97 (all) (N= 354)	(n=13)	(n=28)	(n=54)	(n=75)	(n=82)	(n=43)	(n=32)	(n=20)	(n=7)
BMI	21.37 (4.30)	21.49 (3.88)	24.36 (5.48)	27.18 (4.14)	32.05 (5.06)	36.02 (6.12)	40.59 (5.59)	44.07 (9.14)	50.43 (7.06)
18-30 (n= 115)	(n=1)	(n=11)	(n=23)	(n=31)	(n=26)	(n=6)	(n=8)	(n=6)	(n=3)
BMI	19.50 --	19.47 (2.73)	22.50 (2.64)	26.50 (3.28)	31.22 (5.15)	37.20 (9.32)	44.35 (4.30)	50.82 (5.32)	48.53 (10.28)
31-40 (n= 66)	(n=5)	(n=3)	(n=10)	(n=12)	(n=18)	(n=7)	(n=5)	(n=3)	(n=3)
BMI	21.14 (5.95)	19.43 (.74)	21.97 (2.91)	28.12 (3.94)	33.47 (6.30)	36.87 (5.76)	43.52 (3.97)	46.53 (6.70)	54.03 (2.40)
41-60 (n= 104)	(n=3)	(n=5)	(n=10)	(n=20)	(n=19)	(n=21)	(n=16)	(n=10)	(n=0)
BMI	19.43 (3.60)	22.26 (2.17)	26.04 (2.43)	27.91 (4.86)	31.85 (4.42)	36.52 (5.34)	39.43 (4.62)	37.84 (7.23)	-- --
61-97 (n= 69)	(n=4)	(n=9)	(n=11)	(n=12)	(n=19)	(n=9)	(n=3)	(n=1)	(n=1)
BMI	23.58 (2.59)	24.22 (4.80)	28.88 (9.59)	26.94 (5.27)	32.05 (4.29)	33.40 (6.00)	31.90 (5.13)	58.40 --	45.30 --

*BMI values indicate women's self-rated current body image. Values in parentheses below each BMI value are the SD.

Table 1. B

Current size (men); body mass index [mean(SD)] of the individuals who chose each figure image

Current Male Body Image number ('Which male figure do you think looks the most like you now?')*

	1	2	3	4	5	6	7	8	9
<i>Age Range</i>	<i>(smallest)</i>								<i>(largest)</i>
18-97 (all) (N = 144)	(n=14)	(n=20)	(n=38)	(n=38)	(n=25)	(n=7)	(n=2)	(n=0)	(n=0)
BMI	22.19 (4.52)	22.93 (3.93)	24.09 (4.89)	26.20 (3.54)	32.35 (3.96)	35.23 (2.50)	32.40 (3.82)	-- --	-- --
18-30 (n=15)	(n=1)	(n=1)	(n=4)	(n=7)	(n=1)	(n=1)	(n=0)	(n=0)	(n=0)
BMI	23.30 --	23.10 --	23.58 (.55)	25.21 (3.14)	33.50 --	36.70 --	-- --	-- --	-- --
31-40 (n= 24)	(n=2)	(n=1)	(n=7)	(n=8)	(n=5)	(n=1)	(n=0)	(n=0)	(n=0)
BMI	27.75 (.35)	23.10 --	24.46 (8.08)	26.79 (3.60)	33.26 (3.97)	35.30 --	-- --	-- --	-- --
41-60 (n= 65)	(n=4)	(n=12)	(n=17)	(n=15)	(n=13)	(n=4)	(n=0)	(n=0)	(n=0)
BMI	19.40 (4.12)	22.20 (2.62)	24.70 (4.36)	25.27 (4.03)	32.64 (3.96)	35.23 (3.32)	-- --	-- --	-- --
61-97 (n= 40)	(n=7)	(n=6)	(n=10)	(n=8)	(n=6)	(n=1)	(n=2)	(n=0)	(n=0)
BMI	22.03 (4.48)	24.32 (6.32)	23.02 (4.31)	28.24 (2.09)	30.77 (4.54)	33.70 --	32.40 (3.82)	-- --	-- --

*BMI values indicate men's self-rated current body image. Values in parentheses below each BMI value are the SD.