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Physical Characteristics Associated with Weight Misperception among Overweight and Obese Men: NHANES 1999-2006

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Abstract

Objective—The purpose of this study was to 1) determine the prevalence of weight misperception among overweight and obese men with total body fat levels ≥ 25%; and 2) examine associations of weight misperception with anthropometric and body composition measures.

Methods—Data came from 4,200 overweight or obese men from the 1999-2006 National Health and Nutrition Examination Surveys. Weight misperception was operationalized as having a dual energy x-ray absorptiometry (DXA) derived total body fat percent (TBF) ≥ 25% and classifying oneself as either “underweight” or “about right weight.” Logistic regression was used to determine physical characteristics associated with weight misperception.

Results—Weight misperception was highest among Mexican American (35.9%) followed by Black (30.8%) and White men (22.9%). Physical characteristics (OR, 95% CI) associated with weight misperception were decreased arm fat (0.95, 0.91-0.98), being overweight (9.02, 5.34-15.24), and having a waist circumference ≤ 94 cm (2.31, 1.72-3.09).

Conclusions—Findings suggest that future research should include a measure of adiposity in the operationalization of weight misperception among male populations.

Keywords

misperception; obesity; weight; males; race

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Introduction

Obesity remains a prioritized public health issue in the United States. Over 36% of all adult men over the age of 20 years or older in the United States are classified as obese (1). Being overweight or obese increases one's risk for heart disease (2), type II diabetes (3), and hypertension (4), as well as all-cause mortality (5). More research is needed among men, especially amongst minority groups who are more likely to be affected by obesity-related outcomes (6, 7, 8, 9).

The limitations of body mass index (BMI) in epidemiological research are well documented in the literature. Though convenient and acceptable under various circumstances, BMI is limited in utility when quantifying body composition (10). As a result, otherwise healthy adults, especially men with more lean mass may be misclassified as either obese or overweight.

One potential barrier to health protective weight management practices among people at risk for being obese is misperception of one's weight. Weight misperception, the discrepancy between perceived weight status and actual weight status, is associated with attempts to lose, gain, or maintain weight among adults (11). Previous findings suggest that individuals classified as overweight by BMI are at increased likelihood for underestimating their weight (11, 12) without discriminating those that are lean and those with high proportions of body fat. Previous findings suggest that overweight and obese men that accurately estimate their weight status are more likely to self-report that they desire and have attempted to lose weight (11, 12). Compared to women, previous national prevalence estimates suggest that overweight and obese men are more likely to underestimate their weight status (12). Findings examining the relationship of weight misperception within male racial groups are scarce, but there is literature that suggests there are differences in body composition by race/ethnicity among males (13, 14). Li and colleagues' findings from a US nationally representative population suggest that variation in dual energy x-ray absorptiometry (DXA) measured total body fat percentage by race among men does exist, such that Black men had lower body fat percentage compared to both White and Mexican American men at comparable BMI levels (14). As such, these body composition differences may lead to some male racial groups, especially Black men, being at increased odds of being classified as misperceiving (i.e., underestimating) their weight when they are actually relatively lean. Hence, the failure to account for body composition might bias prevalence estimates of weight misperception within various male populations. To that extent, the current approach to measuring weight misperception may obscure the true need for weight management campaigns targeting overweight and obese men.

Perception of an individual's body stature, as well as motivation to achieve and maintain healthy weight may vary by sex due to differences in preferred body types. Females' body dissatisfaction is generally associated with the drive for thinness (15). In contrast, men's body dissatisfaction is more associated with the distribution of body weight (16) rather than aggregate weight. The literature recognizes that height, leg mass, and arm mass are physical characteristics associated with masculinity and ideal body image among men (17, 18). More

specifically, men that adopt and adhere to gender roles in Western society, often desire to be taller and have larger upper-body mass. Hence, operationalizing weight misperception without a measure of body composition may be inappropriate for men who prefer to attain a "masculine" shape independent of their aggregate weight. Therefore, it is plausible that males' estimation of body stature may vary due to sex-related perception of ideal body characteristics, and not their "obesity" status. For example, using the traditional method of operationalizing weight misperception, overweight and obese men who are taller, have lower amounts of leg fat (i.e., do not have pear shape), and have lower amounts of arm fat may be more likely to misperceive their weight regardless of excessive body fat in other areas.

The objective of our study was to examine differences in weight misperception by anthropometric measures, body composition measures, and race in a nationally representative population of overweight and obese males after including total percent body fat (TBF%) from dual energy x-ray absorptiometry (DXA) in its operationalization. We hypothesize that: 1) the prevalence of weight misperception would decline after including DXA-TBF% in its operationalization; 2) taller overweight and obese men with a DXA-TBF % ≥ 25 are more likely to underestimate their weight, and men with high amounts of leg and arm fat will be less likely to underestimate their weight; and 3) weight misperception will vary by race among men with a DXA-TBF% ≥ 25.

Methods and Procedures

Sample

This cross-sectional analysis comprised of 4,200 overweight or obese (BMI≥25 kg/m^2) White (n = 2,205), Black (n = 856), or Mexican American (n = 1,139) male participants from the 1999-2006 examinations of the National Health and Nutrition Examination Survey.

Measures

Outcome variable—The dependent variable in our study was *weight misperception*. Weight misperception was defined as overweight and obese participants that subjectively underestimated their weight status. We operationalized weight misperception from a question of the *Weight History Questionnaire* of NHANES. More specifically, participants were asked, "How do you consider your weight?" Possible responses to the question were *overweight*, *underweight*, or *about the right weight*. In accordance with previous research (11), (12, 19) and for comparative purposes, we classified overweight and obese males that responded *underweight* or *about the right weight* as having misperceived their body weight using the traditional approach. To empirically account for BMI's body composition limitation, an additional criterion of weight misperception was included where the outcome of interest was operationalized as having a DXA-TBF% > 25% (20, 21, 22, 23, 24, 25) and classifying oneself as either *underweight* or *about right weight*.

Independent variables—The predictor variables in the analyses were age, race, anthropometric, and body composition measures. Participants of NHANES self-reported their age and race. This analysis comprised White, Black, and Mexican American men. Age

was categorized into the four following groups: 20-29 years, 30-39 years, 40-59 years, and 60 years or older. We obtained participants' body composition measures from the *Body Measures* and the *Dual-Energy X-ray Absorptiometry* examination data sections of NHANES. The Center for Disease Control and Prevention used the Hologic QDR 4500A to obtain participants' DXA measurements (26). Anthropometric predictor measures in this analysis were standing height (centimeters), and waist circumference (centimeters), and BMI. Trained CDC staff collected the aforementioned measured variables through use of a scale, stadiometer, and tape measure. We calculated BMI from measured height and weight, and used the following categories in our statistical models: overweight (BMI 25-29.9 kg/m^2), Obese class I (BMI 30-34.99 kg/m^2), and Obese Class II/II (BMI>35 kg/m^2). Following the World Health Organization's recommended waist circumference cut-points for increased risk of metabolic complications,(27) waist circumference was categorized as ≤ 94 cm and > 94 cm. Height was a continuous predictor in the statistical model. DXA-adiposity predictors included total leg percent body fat (DXA-LF%) and total arm percent body fat (DXA-AF%) as continuous variables.

Other variables—Since educational achievement is associated with accuracy of health perception in the literature, self-reported years of completed education was included in the analysis as a covariate.

Statistical Analysis

Descriptive statistics were used to estimate the prevalence of weight misperception and summarize participants' physical characteristics. Chi-square analysis was conducted to compare weight misperception prevalence with and without the inclusion of DXA-TBF% in the operationalization process. Logistic regression was used to determine physical characteristics associated with weight misperception among overweight or obese males with a DXA-TBF% ≥25%. Since NHANES has a multistage, complex survey design to allow generalizations to the US population, appropriate data analytic guidelines were followed (28). We accounted for the sampling weights, strata, and clusters by using PROC SURVEYFREQ, PROC SURVEYMEANS, and PROC SURVEYLOGISTIC in SAS v.9.3 (SAS Institute, Cary, NC). Due to missing DXA-related data among participants, NHANES generated five imputed data sets to account for this limitation associated with analyses of incomplete data that is not completely missing at random. Subsequently, SAS PROC MIANALYZE was used for analyses with DXA-adiposity measures.

Results

Sample Characteristics

Table 1 summarizes characteristics among the analytic sample of participants with a DXA-TBF% ≥ 25, which included 1,992 White, 664 Black, and 1,023 Mexican American men. The mean age among all sampled men was 47.7 years (47.0, 48.4), with a DXA-TBF% of 31.4% (31.3, 31.6), a BMI of 30.7 kg/m^2 (30.4, 30.9), and a waist circumference of 107.4 cm (106.8, 108.0). Overweight and obese White men had significantly higher levels of DXA-TBF%, than both Black and Mexican American men. Mexican American men on average had lower body weight (mean = 87.4 kg, 95% CI: 86.3, 88.5) and waist

circumference (mean = 102.8 cm, 95% CI: 102.0, 103.5) compared to both Black and White men.

Table 2 represents un-weighted and weight prevalence estimates and within group percentages of weight misperception among participants with a DXA-TBF% ≥ 25% by the categorical predictors race, BMI groups, age, and waist circumference. These estimates suggest that Black and Mexican American men are more likely to underestimate their weight compared to White males. Table 2 findings also suggest that overweight (BMI 25-29.9 kg/m^2) and those with a waist circumference ≤ 94 cm are more likely to underestimate their weight.

Prevalence of Weight Misperception

Using the traditional method of measurement, the prevalence for weight misperception for all participants was 34.6% (95%CI: 33.0%, 36.2%). Prevalence for weight misperception for White, Black, and Mexican American men were 31.0% (95% CI: 28.9%, 32.5%), 52.8% (95% CI: 48.9%, 56.6%), and 46.7% (95% CI: 43.4%, 50.0%) respectively, when using the traditional measurement of this variable (figure 1). However, after adding DXA-TBF% ≥ 25 to the operationalization of weight misperception, the overall prevalence reduced to 25.0% (95% CI: 23.6%, 26.5%). More specifically, 22.9% (95% CI: 21.2%, 24.7%) of White, 35.9% (95% CI: 33.1%, 38.9%) of Mexican American, and 30.8% (95% CI: 27.0, 34.9%) of Black males underestimated their weight (figure 1). The prevalence of the traditional method for estimating weight misperception was statistically higher than our method among all men ($p < .001$) and within each race ($p < .001$).

Associations of BMI, Demographic Factors, and Weight Misperception

Among men with a DXA-TBF% ≥ 25, age, race, waist circumference, and arm fat were associated with the misperception of weight after controlling for education (Table 3). Black men (OR = 2.41; 95% CI: 1.84, 3.15) and Mexican American men (OR = 1.38; 95% CI: 1.07, 1.79) were more likely to underestimate their weight than were White men. Compared to men that were classified as overweight (25-29.9 kg/m^2), those that were moderately obese (30-34.9 kg/m^2) were 73% less likely to underestimate their weight, and those that were severely obese (≥ 35 kg/m^2) were 89% less likely to underestimate their weight. There were no statistical differences in weight misperception among younger (20-29 year olds) and older men (≥ 60 year olds) (OR = 0.99; 95% CI: 0.74, 1.33). Men aged in their 30s (0.52, 95% CI: 0.36, 0.74) and 40s/50s (0.59, 95% CI: 0.45, 0.77) were at lower odds to underestimate their weight compared to men in their 20s. Compared to men with a waist circumference ≤ 94 cm, those with higher waist circumferences had lower odds for underestimating their weight (0.43 95% CI: 0.32, 0.58). Higher amounts of DXA-AF% among men decreased the odds of weight misperception (0.95, 95% CI: 0.91, 0.98). Reported findings in Table 3 show that the aforementioned demographic and physical characteristics associated with weight misperception are similar within each race included in the analysis.

Discussion

To our knowledge, this is the first study to examine weight misperception using a measure of adiposity. Including body fatness in the measurement of weight misperception enabled us to better determine a population of men that are at high risk. Hence, eliminating the 521 relatively lean heavy-massed men (150 of whom underestimated their weight) better informs medical clinicians and researchers on men in need of obesity-related interventions. As hypothesized, the prevalence of weight misperception attenuated after including DXA-TBF % in the operationalization process. Also consistent with our expectations, race was associated with weight misperception among men with a DXA-TBF% ≥ 25. Measured physical characteristics were associated with weight misperception, but selected masculinity characteristics were not associated with weight misperception among men with a DXA-TBF % ≥ 25.

Findings from this study suggest that the estimated prevalence of weight misperception among men can vary greatly based upon inclusion of body fatness in its operationalization. Yaemsiri and colleagues' study (12) examining weight status and weight control practices using 2003-2008 NHANES data concluded that 48.1 % of overweight men and 13% of obese men underestimated their weight using the traditional approach of operationalizing weight misperception. When examined using the traditional approach, this study's results produced similar findings, but the prevalence of weight misperception attenuated after including a measure of adiposity, with the prevalence of Black men changing the most between methodologies. Findings from body composition research (14) suggest that Black men have lower levels of DXA-TBF% compared to White and Mexican American men across all BMI categories. Hence, as posited by Burkhauser and Cawley (13), BMI is more likely to misclassify Black men as overweight and obese when they have a relatively lean body stature. Therefore, this study's findings suggest that results pertaining to Black men from previous weight misperception research that does not include a measure of body composition should be interpreted with caution.

Physical characteristics not typically associated with high levels of fatness (e.g., lower waist circumference, lower arm fat percentage, etc.) are associated with increased odds of weight misperception among Black, White, and Mexican American men. Thus, many men with obese levels of body fat who underestimate their weight have yet to reach levels of obesity where the physical characteristics associated with excess fatness are visibly noticeable to the individual. In this study, men with an obese BMI were less likely to underestimate their weight. Intuitively, this makes sense in that it is more difficult to accurately estimate your weight, if one has subtle or limited physical characteristics associated with obesity. Hence, it is critical that overweight men (25-29.9 kg/m^2) with high levels of body fat are cognizant of their weight status because overweight and obese men that accurately estimate their weight are more likely to engage in behaviors that prevent weight gain (29).

Though attenuated after including a measure of adiposity in the operationalization process, Black and Mexican American men remain at higher odds to underestimate their weight compared to White men. Though lower in magnitude, the association of race and weight misperception among men is consistent with other studies (11),(30, 31). An examination of

model predictors suggests that education moderates the association between weight misperception and race, but the difference in weight misperception prevalence between races cannot solely be attributed to education status. Godino and colleagues' (32) examined factors related to weight misperception among urban Black men and concluded that Black men with minimal comorbid conditions and physiological signs of illness are more likely to misperceive their weight. Since many of obesity's comorbidities have very few physiological signs of illness in its early stages, cognizance and implementation of health protective behaviors without obvious signs of morbidity is paramount in the fight to curb cardiometabolic diseases worldwide. Future research should examine weight misperception and its association with men's subjective definition of good health and weight-stature within the White, Black, and Mexican American population separately. It is possible that Black and Mexican American men on average believe that “feeling” healthy is a sufficient condition to conclude that they have a healthy body stature, which may be deleterious to their health and America's fight against obesity.

There are two primary limitations in this study. First, conclusions about weight misperception among males from other racial/ethnic groups cannot be drawn due to the inclusion criteria of being Black, White, or Mexican American. Also, due to the cross-sectional design, it is not possible to determine the effect that weight misperception has on future weight change among participants in this study. These study limitations are balanced by several strengths. First, this analysis included overweight and obese participants from a nationally–representative sample, which strengthens the generalizability of findings to Black, White, and Mexican American men. Another strength of this study is the use of a DXA adiposity measure to operationalize weight misperception. Additional strengths include the inclusion of measured anthropometric outcomes in the analyses.

As obesity prevalence grows and/or remains a public health issue, it is reasonable to believe that the prevalence of weight misperception will also grow, as obesity becomes a global norm (29). Paraphrasing the words of Robinson and Kirkham (33), as we become more exposed to obesity, perceptions of a “normal” body-type will also change. With this statement serving as a plausible hypothesis, weight misperception is a growing trend among overweight and obese men that needs to be addressed.

Since weight misperception is a personal assessment of being overweight or obese, perception among men of susceptibly to being obese is an area that needs further examination. Hence, we agree with Duncan and colleagues' (11) suggestion that obesity-related interventions addressing weight misperception modeled after Hochbaum, Rosenstock, and Kegels' Health Belief Model is plausible. According to the model, there are various approaches to increasing behavior adoption. Increasing men's cues to action (external cues that may lead to initiation of behavior or at least contemplation of behavior) may serve as an effective means to promote perception of obesity susceptibility among Black and Mexican American men. The rationale behind this approach is that being aware of the true risks for being obese may increase motivation to prevent weight gain among men that are at risk for underestimating their weight.

We believe that the practical value of our findings lie in the potential implications of previous research focused on weight misperception among male populations. If clinicians or researchers use overweight males' weight perception as an additional factor to better estimate their motivation to prevent weight gain (i.e., future obesity risk), using BMI as the criterion measure may be problematic among some populations. By the same token, the challenge that our findings present to clinicians cannot be overlooked because the same population that is at increased odds of being misclassified when weight misperception is operationalized using BMI (i.e., Black men) remains at increased odds (albeit to a lesser extent) of weight misperception when operationalized using DXA. Given the impracticalities of using DXA in most clinical settings, clinicians should consider other proxies of body composition that can be administered to complement BMI. Also as few clinicians measure waist circumference during clinic visits, weight-related conversations centered on male patients' pants waist size (standardized in inches in the US) may serve as an effective cue to understanding obesity status for men at increased odds of misperceiving their weight. Pants waist size has been suggested to be a reliable proxy of waist circumference for men (34), and have been suggested to be independently associated with disease risk (35). In conclusion, future research should include a measure of adiposity in the operationalization of weight misperception among male populations.

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What is already known about this subject

- Weight misperception is associated with interest and attempts to lose weight among obese individuals.
- Previous research suggests that men are more likely to misperceive their weight status compared to women.

What this study adds

- To date, this is the first study to operationalize weight misperception using an objective measure of adiposity, compared to previously used proxy measures such as body mass index or waist circumference.
- To date, no studies have determined body characteristics associated with weight misperception.
- Findings suggest that results from previous studies examining weight misperception among men may have miscalculated the magnitude of the problem and therefore, should be interpreted with caution.

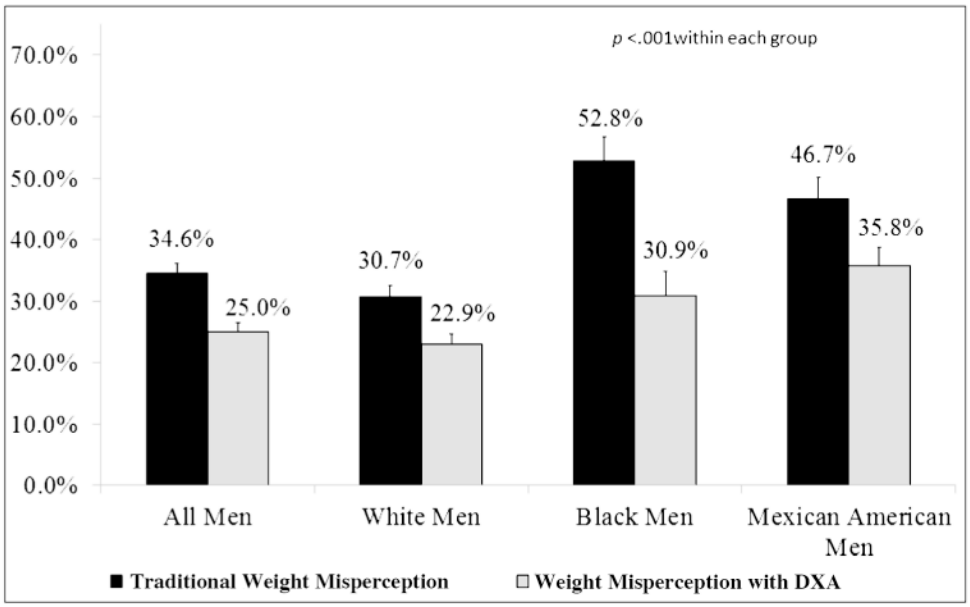

Figure 1. Changes in weight misperception prevalence with and without DXA-TBF% in its operationalization

Table 1

Participants' Anthropometric and DEXA Characteristics of Continuous Variables and Other Variables of Interest among Participants with a DXA-TBF% ≥25.

	White n= 1,992	Black n=664	Mexican American n= 1,023	All Men n=3,679
Age, years (*CI*) [a,b,c]	49.12 (48.38, 49.85)	44.95 (43.76, 46.15)	39.17 (38.18, 40.15)	47.73 (47.04, 48.42)
BMI, $\frac{kg}{m^2}(CI)$ [a,c]	30.61 (30.32, 30.91)	31.89 (31.37, 32.42)	30.15 (29.87, 30.43)	30.68 (30.43, 30.93)
Measured Weight, kg (*CI*) [a,b,c]	96.37 (95.40, 97.35)	100.17 (98.29, 102.05)	87.40 (86.29, 88.52)	95.81 (94.99, 96.64)
Measured Height, cm (*CI*) [b,c]	177.29 (176.96, 177.62)	176.96 (176.38, 177.53)	169.97 (169.34, 170.60)	176.52 (176.25, 176.80)
Waist, cm (*CI*) [b,c]	107.99 (107.29, 108.70)	107.04 (105.67, 108.41)	102.77 (102.01, 103.53)	107.38 (106.77, 107.99)
Total Body Fat % (*CI*) [a,b]	31.58 (31.36, 31.80)	30.75 (30.38, 31.11)	30.78 (30.51, 31.06)	31.43 (31.25, 31.61)
Leg Fat % (*CI*) [b,c]	30.42 (30.17, 30.68)	30.79 (30.37, 31.21)	29.43 (29.10, 29.77)	30.36 (30.15, 30.56)
Arm Fat % (*CI*) [a,b]	29.31 (29.06, 29.55)	27.68 (27.24, 28.12)	27.71 (27.37, 28.06)	29.00 (28.80, 29.20)

note: statistical comparisons account for appropriate sampling weights, strata, and clusters for generalizations to White, Black, and Mexican American US populations with a DXA-TBF% ≥ 25

[a] Black vs. White, $p < 0.001$

[b] Mexican American vs. White $p < 0.001$

[c] Black vs. Mexican American $p < 0.001$

Obesity (Silver Spring). Author manuscript; available in PMC 2016 January 01.

Table 2

Cross-tabulation Frequencies of Weight Misperception by Anthropometric Categorical Measures Among Participants with a DXA-TBF% ≥ 25.

		White Men Underestimated n (%)		Black Men Underestimated n (%)		Mexican American Men Underestimated n (%)		All Men Underestimated n (%)	
		Un-weighted	Weighted (in millions)	Un-weighted	Weighted (in millions)	Un-weighted	Weighted (in millions)	Un-weighted	Weighted (in millions)
Race**									
	White							576 (29.0)	8.22 (26.0)
	Black							277 (42.0)	1.47 (42.4)
	Mexican American							421 (41.7)	1.61 (41.2)
BMI Group **									
	25-29.9	489 (43.0)	6.92 (39.6)	191 (62.4)	1.00 (64.3)	349 (56.4)	1.26 (54.6)	1,029 (49.9)	9.17 (43.0)
	30-34.9	76 (12.8)	1.12 (11.4)	66 (31.1)	0.37 (32.1)	67 (23.8)	0.32 (27.3)	209 (19.2)	1.81 (14.9)
	>=35	11 (4.3)	0.18 (4.1)	20 (14.1)	0.11 (14.3)	5 (4.6)	0.03 (7.1)	36 (7.2)	0.32 (5.8)
Age **									
	20-29.9 years	64 (33.5)	1.27 (34.2)	41 (48.2)	0.29 (48.7)	88 (48.6)	0.57 (49.4)	193 (42.2)	2.13 (39.0)
	30-39.9 years	61 (24.1)	1.19 (22.8)	53 (47.3)	0.37 (48.9)	58 (33.7)	0.38 (33.5)	172 (32.0)	1.93 (27.2)
	40-59.9 years	166 (23.5)	3.24 (22.1)	91 (37.3)	0.55 (36.3)	130 (39.9)	0.52 (40.2)	387 (30.3)	4.31 (24.7)
	60+ years	282 (34.2)	2.52 (31.4)	92 (42.4)	0.27 (43.8)	145 (44.2)	0.14 (43.3)	519 (37.9)	2.93 (32.6)
Waist **									
	<=94cm	69 (58.0)	1.49 (51.3)	56 (72.7)	0.43 (74.3)	97 (67.4)	0.51 (64.7)	222 (65.3)	2.42 (56.9)
	>94 cm	483 (26.6)	6.73 (23.5)	206 (36.9)	1.05 (36.2)	314 (37.2)	1.10 (35.3)	1,003 (31.2)	8.87 (25.6)

Table presents unweighted frequencies and percentages;

‡within group percentage;

*<0.05 and

**<0.01 indicate statistically significant relationship

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Table 3

DXA and Anthropometric Adjusted Associations with Weight Misperception Among Participants with a DXA-TBF% ≥ 25.

		White Men ORs (*CI*)	Black Men ORs (*CI*)	Mexican American Men ORs (*CI*)	All Men ORs (*CI*)
Race					
	White				ref
	Black				**2.41 (1.84, 3.15)
	Mexican American				**1.38 (1.07, 1.79)
Education					
	< HS	ref	ref	ref	ref
	Completed HS	0.72 (0.47, 1.09)	0.92 (0.51, 1.63)	**0.46 (0.27, 0.78)	**0.69 (0.51, 0.95)
	Some College	**0.50 (0.32, 0.79)	**0.52 (0.32, 0.82)	0.58 (0.31, 1.07)	**0.49 (0.35, 0.69)
	Completed College	**0.39 (0.26, 0.60)	** 0.46 (0.24, 0.86)	**0.31 (0.15, 0.63)	**0.39 (0.28, 0.55)
BMI Group					
	25-29.9	ref	ref	ref	ref
	30-34.9	**0.24 (0.16, 0.35)	**0.33 (0.23, 0.47)	**0.51 (0.34, 0.76)	**0.27 (0.21, 0.37)
	≥ 35	**0.10 (0.04, 0.20)	0.13 (0.07, 0.27)	**0.17 (0.06, 0.48)	**0.11 (0.07, 0.19)
Age					
	20-30 years	ref	ref	ref	ref
	30-39.9 years	**0.50 (0.32, 0.81)	0.63 (0.32, 1.21)	**0.47 (0.28, 0.78)	**0.52 (0.36, 0.74)
	40-59.9 years	**0.61 (0.43, 0.85)	**0.41 (0.24, 0.71)	0.63 (0.39, 1.01)	**0.59 (0.45, 0.77)
	60+ years	1.03 (0.73, 1.46)	0.58 (0.29, 1.15)	1.03 (0.57, 1.86)	0.99 (0.74, 1.33)
Height (*cm*)		1.01 (0.99, 1.03)	1.01 (0.98, 1.04)	1.00 (0.97, 1.03)	1.01 (0.99, 1.03)
Waist (*cm*)					
	≤ 94 cm	ref	ref	ref	ref
	> 94 cm	**0.41 (0.28, 0.62)	** 0.40 (0.23, 0.67)	**0.51 (0.31, 0.84)	**0.43 (0.32, 0.58)
Leg Fat %		0.99 (0.95, 1.03)	1.01 (0.96, 1.07)	1.00 (0.94, 1.07)	1.00 (0.96, 1.03)
Arm Fat %		*0.96 (0.92, 0.99)	**0.93 (0.89, 0.98)	**0.87 (0.79, 0.96)	**0.95 (0.91, 0.98)

*<0.05 and

**<0.01 indicate statistically significant relationship