

An Overview of Body Size Preference, Perception and Dissatisfaction in Sub-Saharan Africans Living in the United States

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Purpose: Body image affects health practices. With acculturation superimposed on globalization, 21st century body size preferences of African immigrants, one of the fastest growing populations in the United States, are unknown. Therefore, in African immigrants living in America we assessed: 1) body size preference; and 2) body size dissatisfaction.

Methods: Participants chose two silhouettes from the Stunkard Figure Rating Scale: one for body size preference and one for perceived body size. Each silhouette corresponds to a BMI category: (a) Underweight: 1 and 2; (b) Normal weight: 3 and 4; (c) Overweight: 5, 6 and 7; (d) Obesity: 8 and 9. Dissatisfaction was defined as the difference between silhouette numbers for perceived and preferred body size.

Results: Characteristics of the 412 participants were: women: 42% (174/412), age 40±11y (mean±SD), range 20–69 y, BMI 27.9±4.6, range 19.5–47.3 kg/m². As a body size of preference, no one (0/412) chose obese silhouettes. Normal weight silhouettes were chosen as their body size of preference by 75% (131/174) of women and 60% (143/238) of men. Overweight silhouettes were chosen as their preferred body size by 11% (19/174) of women and 26% (62/238) of men. Combining normal and overweight silhouettes into one group, 86% (150/174) of women and 86% (205/238) of men preferred to be either normal or overweight. Underweight silhouettes were preferred by 14% (24/174) of women and 14% (33/238) of men. Dissatisfaction because body size was too large occurred in 78% (135/174) of women and 53% (126/238) of men. Dissatisfaction because body size was too small occurred in 6% (11/174) of women and 16% (38/238) of men.

Conclusion: African immigrants prefer body sizes which are normal or overweight. However, and presumably attributable to the combined influence of globalization and acculturation, a worrisome fraction of African immigrants favor an underweight silhouette.

Plain Language Summary: Understanding the attitudes of Africans towards body size is important because these attitudes affect health behaviors. The 20th century consensus was that Africans viewed large body sizes as a sign of the health, beauty, fertility, and prosperity. In addition, underweight silhouettes were viewed with fear and considered to be a sign of poverty, malnutrition, and HIV infection. In the 21st century, African attitudes towards body size are unknown.

African immigrants are a rapidly growing segment of the American population. Their attitudes toward body size are influenced by both globalization and acculturation.

In our cohort, we found 86% of the Africans living in America wanted to be either normal or low range overweight. However, and very concerning, 14% of African immigrants chose underweight silhouettes to represent their body size of preference.

As weight loss programs are brought forward in and by African communities living in the United States, the emphasis must be on achieving a healthy weight and not glorification of underweight silhouettes.

Keywords: Africans, body image, figure rating scale, body size dissatisfaction

Introduction

In the first two decades of the 21st century, the population of sub-Saharan Africans living in the United States increased by 246% from 600,000 to 2.0 million.¹ Therefore, Africans comprise 42% of the foreign-born Black population in the United States.¹ To ensure that the health needs of this growing population are met, current data on African immigrant health are urgently needed.

In many sub-Saharan African countries, obesity and its attendant consequences of heart disease, diabetes, and hypertension are reaching epidemic proportions.^{2–6} While no medical registry exists which documents the health status of immigrants at entry to the United States, Africans are likely to be arriving in the United States at a higher BMI and with worse cardiometabolic health in the 21st century than in the 20th century. Furthermore, due to easily accessible, inexpensive, highly processed prepared food, African immigrants often gain weight once in the United States.⁷

As cultural attitudes about body size are highly correlated with health, health behaviors, and stress, improved insight into how Africans across the continent and in the African Diaspora view body size is necessary.^{8,9} However, understanding African attitudes towards body size is hindered by changing nomenclature, and a lack of investigations which have combined body image scale assessment with actual BMI measurements.^{8,10–13}

Before 1998, “overweight” was defined as BMI ≥ 27.3 kg/m² for women and ≥ 27.8 kg/m² for men. Obesity was defined as BMI ≥ 32.2 kg/m² for women and ≥ 31.1 kg/m² for men.^{10–12} Therefore, prior to 1998, a BMI of 30.0 kg/m² would have been classified as overweight, but after 1998 a BMI of 30.0 kg/m² would be classified as obese.^{10–13} These 1998 changes in the BMI thresholds for overweight and obesity were made by the Expert Panel on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults because review of literature published from 1980 to 1997 revealed convincing evidence that adverse health effects began with a BMI of 25.0 kg/m² and increased at 30.0 kg/m².¹³

As a result of these definitional changes, studies conducted before 1998 cannot be interpreted by current standards because older definitions of obesity and overweight do not conform to 21st century definitions.

Since 1998, there has been worldwide acceptance of the BMI guidelines put forward by the Expert Panel on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults. In contrast to earlier guidelines, the 1998 BMI guidelines do not differ by gender. BMI categories are: Underweight (<18.5 kg/m²), Normal Weight (18.5 to 24.9 kg/m²), Overweight (25 to 29.9 kg/m²) and Obesity (≥ 30.0 kg/m²).¹¹

Yet, independent of challenges related to changing nomenclature, there has been a consensus that Africans traditionally viewed obesity as a sign of prosperity and health and for women, in particular, beauty and fertility.^{14–17} However, more recently, studies from countries which span the African continent have begun to reveal a strong preference for normal weight and overweight body sizes silhouettes.^{8,14–21}

As 75% of African immigrants have arrived in the United States in the 21st century with an acceleration since 2010, our attention in this rapidly growing group is focused on body size preference.¹ We hypothesize that body size preference in African immigrants reflects the combined effects of globalization and acculturation.^{22–24} We anticipate that after living in the United States (a) globalization and acculturation leads to greater acceptance and preference of smaller body sizes than in the immigrants’ country of origin; (b) acculturation leads to diminution of regional differences in attitudes about body size preferences which may have existed prior to immigration. While there are many studies of body size preference in African immigrants to Europe, data on body size preference in African immigrants to the United States is scant.^{24–26} Except for one small study which combined first and second-generation African immigrants into a single group, we are not aware of any study which has used a figure rating scale to assess body size preference in African-born immigrants living in the United States.²⁷

In short, to design effective programs to decrease the risk and severity of obesity, as well as obesity-related diseases, a true perspective and cultural appreciation of African immigrant attitudes towards body size is required.²⁸ Using the Stunkard Figure Rating Scale (Supplement Figure 1),²⁹ we assessed in 412 African-born Black immigrants living in the metropolitan Washington, DC area: (1) body size **preference** and (2) body size dissatisfaction.

Materials and Methods

The Africans in America study was designed to assess the combined influence of social and physiologic factors on the cardiometabolic health of African-born Black individuals living in the United States.^{30–34} Recruitment was achieved with the use of the NIH Clinical Trials recruitment website, newspaper advertisements, presentations at community events and previous participant referrals as well as by flyers posted in libraries and local businesses. The Institutional Review Board of the NIH is in compliance with Helsinki Declaration and has approved the protocol (Clinical Trials.gov Identifier: NCT00001853). Prior to enrollment each participant gave written informed consent.

To determine eligibility, interested individuals were interviewed by telephone. Each person had to be between 20 and 70 years old, report no known history of diabetes, currently live in the metropolitan Washington DC area, and state that both they and their parents self-identify as Black and were born in a sub-Saharan African country.

After eligibility confirmed by telephone screening, 412 African-born Black individuals living in the Washington, DC area were invited to the NIH Clinical Center for the first of two visits. At Visit 1, all 412 persons had social and medical histories taken, height and weight measured, a physical examination, an electrocardiogram, and routine blood tests. In addition, each enrollee was presented with a representation of the nine Stunkard Figure Rating Scale silhouettes and asked to choose the silhouette that best represented their wish body size and then the silhouette which represented their perceived body size ([Supplement Figure 1](#)).

One to two weeks after Visit 1, 92% (380/412) of enrollees returned for Visit 2. Of the 8% (32/412) of individuals who did not proceed to Visit 2, 60% (19/32) were pre-menopausal women who were found to be anemic (hemoglobin <11 g/dL). Of the remaining 40% (13/32), one person had hypothyroidism, one person had abnormal liver function, and the remaining 11 had either scheduling challenges or no longer wanted to participate.

At Visit 2, a 2h oral glucose tolerance test (Trutol 75, Custom Laboratories, Thermo Fisher Scientific, Middletown, VA) was performed with samples drawn at –15, 0, 30, 60 and 120 minutes to determine: (a) glucose tolerance status, (b) insulin resistance by the Matsuda Sensitivity Index and (c) insulin secretion by the insulin secretion index.³³ In addition, lipids, apolipoproteins, and inflammatory markers, specifically high-sensitivity C-Reactive Protein (hsCRP) and fibrinogen were measured.

BMI Status

BMI was calculated as weight in kilograms divided by height in meters squared. BMI category was defined by standard criteria (Underweight: BMI <18.5 kg/m²; Normal weight: BMI 18.5 to 24.9 kg/m²; Overweight: BMI 25.0 to 29.9 kg/m²; Obesity: BMI ≥30 kg/m²).¹³

Stunkard Figure Rating Scale

The Stunkard Figure Rating Scale has nine silhouettes which correspond to four BMI categories: Underweight: 1 and 2; Normal-Weight: 3 and 4; Overweight: 5, 6 and 7; Obesity: 8 and 9 ([Supplement Figure 1](#)).²⁹ Each participant was asked to point to which of the nine silhouettes of the Stunkard Figure Rating Scale showed how they would like to look (preferred body size) and then, which of the nine silhouettes corresponded to their current body size (perceived body size).³⁵ Body size dissatisfaction was calculated as the difference between perceived and preferred silhouette.³⁵ A positive score meant dissatisfaction was present, and it was due to feeling too large. A score of zero corresponded to body size satisfaction. A negative score indicated dissatisfaction was present, and it was due to feeling too small.

Sociodemographic Factors

All participants were asked if they self-identified as: African, African-American or open-ended for personal choice.

The participants were also queried about 9 socioeconomic behavioral and demographic variables, specifically: income (≥45k/year or <45k/year), health insurance coverage (yes or no), education (college graduate, yes or no), smoking (yes or no), alcohol intake (one or more drinks per week versus less than once per week), partner status, physical activity, age of immigration and duration of residence in the United States. Partnered status was defined as married or living with

a significant other versus not partnered which was defined as never married, separated, divorced or widowed.³⁶ Physical activity was determined by the International Physical Activity Questionnaire (IPAQ) categories and dichotomized as sedentary (IPAQ category: Low) or active (IPAQ categories: Moderate or High).³⁶

Current age was used as both a continuous variable or dichotomized at age 40 years (≥ 40 y or < 40 y). In addition, age of immigration was dichotomized as adult immigrant (≥ 18 y at United States entry) or child immigrant (< 18 y at United States entry). Duration of residence in the United States was classified by number of years in the United States and dichotomized as residence in the United States for ≥ 10 y or < 10 y.

Insulin Resistance and Insulin Secretion

Insulin resistance was determined with the use of the Matsuda Sensitivity Index.³⁷ Insulin secretion was assessed with the insulin secretion index, which is calculated as the area under the insulin curve from 0 to 2 hours, divided by area under the glucose curve from 0 to 2 hours.

Assays

Glucose, cholesterol, triglyceride (TG), high-density lipoprotein (HDL), apolipoprotein A (apoA), apolipoprotein B (apoB), fibrinogen, and high sensitivity C-reactive protein (hsCRP) were measured in plasma and insulin was measured in serum (Roche Cobas 6000 analyzer (Roche Diagnostics, Indianapolis, IN, USA)). Low-density lipoprotein (LDL) was calculated using the Friedewald equation.³⁸ LDL particle size and number were determined by NMR using the Lp3 algorithm on the Vantera Analyzer (LabCorp, Burlington, NC). A1C was determined by high performance liquid chromatography using Bio-Rad kits approved by the National Glycohemoglobin Standardization Program (NGSP).

Statistical Analyses

Unless stated otherwise, data are presented as mean \pm SD. Comparisons were by unpaired t-tests or One-Way Analyses of Variance (ANOVA) with Bonferroni corrections for continuous variables and by Pearson's chi-squared tests for categorical variables. Pearson correlation coefficients with 95% CI were used to characterize the relationship between perceived and measured BMI as well as preferred body size and measured BMI. To determine factors associated with dissatisfaction because body size was perceived as too large ($n=261$), a logistic regression model yielding odds ratios was performed. The dependent variable was dissatisfaction, and the dichotomized independent variables were as follows: gender, income (≥ 45 k/y), age (≥ 40 y), African region of origin (West African vs South or East Africa), duration of United States residency (≥ 10 y), age at immigration (≥ 18 y), education (college graduate: yes or no), and physical activity (sedentary or active). Due to the small sample size ($n=49$) data from participants who were dissatisfied because they felt too small, could not be used to perform valid logistic regression models.

P -values ≤ 0.05 were considered significant. Data were managed with Research Electronic Data Capture (REDCap).³⁹ Analyses were performed with STATA v18 (College Station, Texas).

Results

The participants were 412 African-born Black individuals currently living in the Washington, DC area (women: 42% (174/412), age 40 ± 11 y (mean \pm SD), range 20–69 y, range, BMI 27.9 ± 4.6 kg/m², range 19.5–47.3 kg/m²) (Table 1).

African Origin: Region and Country

The number of different birth countries represented in this survey is thirty. The African region of origin of the participants were: West: 50% (207/412); Central: 11% (44/412); East: 38% (156/412); and South: 1% (5/412). The number of participants per country of origin is illustrated in Figure 1.

For analytic purposes, the 5 Africans from the southern African countries of Zambia ($n=3$), Namibia ($n=1$) and South Africa ($n=1$) were analyzed with the East African group.

By African region of origin, there was no difference in age or gender distribution or sociodemographic factors including age of immigration, years in the United States, marital status, sedentary lifestyle, alcohol consumption or

Table 1 Participant Characteristics

Characteristics ^a	Total n=412	Women n=174 (42%)	Men n=238 (58%)	P-value ^b
Age (y)	40±11	40±11	40±11	0.633
BMI (kg/m ²)	27.9±4.6	29.1±5.0	27.1±4.2	<0.001
Prevalence of Obesity	32%	45%	22%	<0.001
Sociodemographic Factors				
Self-Identify as African ^c	92%	93%	91%	0.628
West African origin	50%	47%	53%	0.279
US arrival in 2000 or later	71%	70%	73%	0.485
Adult Immigrant ^d	83%	79%	85%	0.142
US residence≥10y	52%	57%	48%	0.071
Income (≥\$45k/year)	54%	55%	53%	0.716
College Graduate	76%	74%	78%	0.398
Partnered	55%	48%	60%	0.017
Sedentary Lifestyle ^e	78%	74%	81%	0.092
Alcohol Intake (≥1 drink/wk)	24%	18%	29%	0.012
Smoke	4%	0%	8%	<0.001
Body Size Preference				
Obesity	0%	0%	0%	0.999
Overweight	20%	11%	26%	<0.001
Normal Weight	66%	75%	60%	0.001
Underweight	14%	14%	14%	0.983
Body Size Perception				
Overestimated	4%	4%	4%	0.696
Correct	42%	35%	47%	0.019
Underestimated	54%	61%	49%	0.013
Body Size Dissatisfaction				
Dissatisfaction Overall	75%	84%	69%	<0.001
Too Large	63%	78%	53%	<0.001
Satisfied	25%	16%	31%	<0.001
Too Small	12%	6%	16%	0.003

Notes: ^aData presented as mean±SD or Percent. ^bComparison by unpaired t-test or chi-square as appropriate. ^cSelf-identify as African versus African-American versus open ended choice. ^dEntered the United States at age 18 y or older. ^eIPAQ score Low.

cigarette smoking (Table 2). However, participants born in West African countries had higher BMI and had lived in the United States for a longer period of time than their East African counterparts (both $P<0.05$) (Table 2).

Wish Body Size and Body Size Dissatisfaction, the two parameters under major consideration in this investigation, did not differ by African region of origin (Table 2).

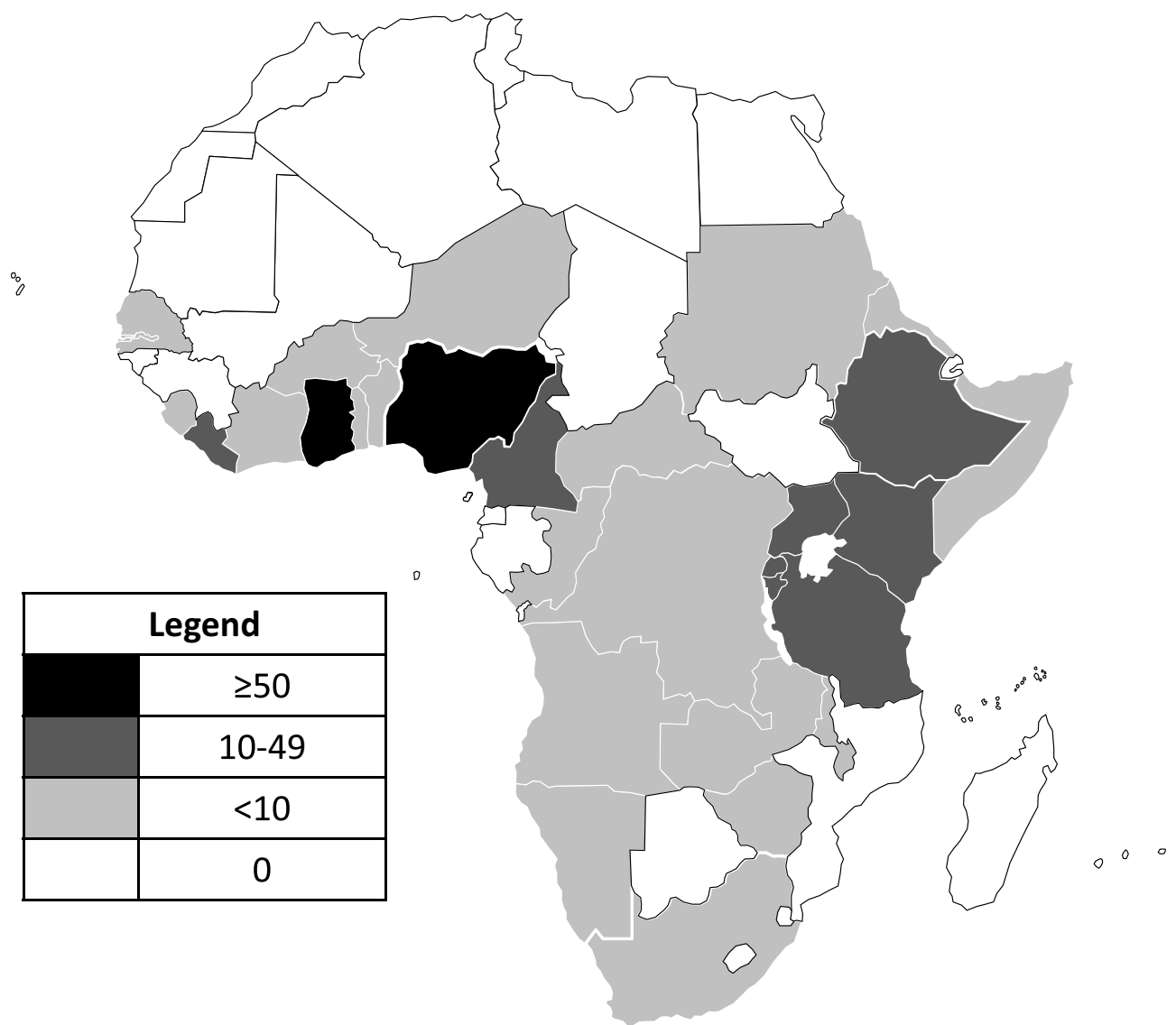


Figure 1 Frequency of African country of origin of participants.

Ethnic Identification

Ninety-two percent of the participants self-identified as African rather than African-American or an open-ended choice (Table 1). Self-identification as African did not differ by gender (93% vs 91%, $P=0.628$) or whether immigration occurred as an adult (age \geq 18 y) or child (age<18 y) (93% vs 86%, $P=0.091$).

Characteristics by Gender

Age and African region of origin did not differ by gender (Table 1). However, compared to men, women had a higher BMI (29.1 \pm 5.0 vs 27.1 \pm 4.1 kg/m², $P<0.001$) and a higher prevalence of obesity (45% vs 22%, $P<0.001$). In addition, there were three other gender differences; (a) women had a lifetime partner less frequently than men (48% vs 60%, $P=0.017$); (b) women consumed less alcohol than men (18% vs 29%, $P=0.012$); and (c) no women were smokers compared to 8% of men (0% vs 8%, $P<0.001$). There was no difference by gender in income, education, years in the United States, or frequency of sedentary lifestyle.

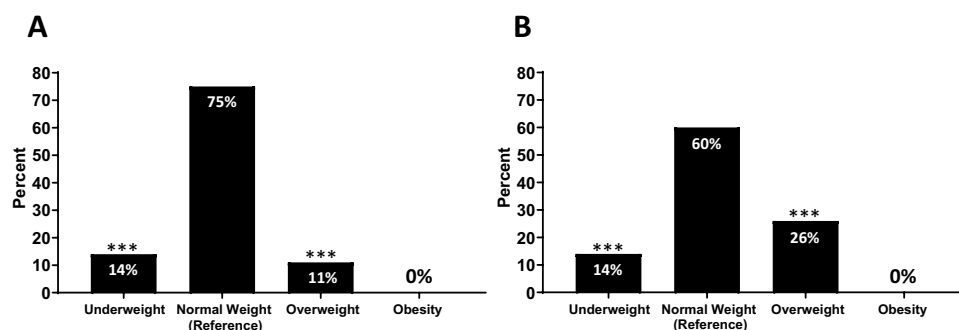
Table 2 Participant Characteristics by African Region of Origin

Characteristics ^a	West n=207 50%	Central n=44 11%	East n=161 39%	P-value ^{b,c}	F-Statistic ^d
Female Gender (%)	40%	36%	57%	0.242	N/A
Age (y)	40±11	42±13	39±10	0.226	1.49
BMI (kg/m ²)	28.4±4.7	28.4±4.9	27.2±4.3	0.027b*	3.64
Hematologic/Genetic Factors					
Sickle Cell or HbC Trait	18%	23%	8%	0.007	N/A
G6PD Deficiency (n=227) ^e	16%	6%	0%	0.016	N/A
Sociodemographic Factors					
Living in US since 2000 or later	71%	70%	73%	0.485	N/A
Years in US	13.7±10.9	13.6±11.0	10.6±9.4	0.011b*	4.52
Age of Immigration	26±12	29±10	29±11	0.066	3.34
Income (≥\$45k/y)	58%	46%	52%	0.283	N/A
College Graduate	81%	73%	71%	0.058	N/A
Partnered	54%	52%	58%	0.675	N/A
Sedentary Lifestyle	82%	80%	76%	0.507	N/A
Alcohol Intake (≥1 drink/wk)	25%	21%	24%	0.838	N/A
Smoke	4%	7%	4%	0.685	N/A
Body Size Data					
Body Size Preference ^f	4±1	4±1	4±1	0.524	0.65
Body Size Perception ^f	5±1	5±2	5±1	0.911	0.09
Body Size Dissatisfaction ^g	75%	66%	78%	0.239	N/A

Notes: ^aData presented as mean±SD or Percent. ^bOne-way ANOVA with or chi-square as appropriate. ^cOne-way ANOVA notation: ^adifference between West & Central Africa, ^bdifference between West & East Africa, ^cdifference between Central & East Africa have statistical significance according to: *<0.05. ^dProvided for continuous variables (Degrees of Freedom=2). ^eAssay done in 227 consecutively enrolled participants. ^fBased on participant selection of Stunkard Figure Rating Scale silhouette. ^gDifference between Perceived and Preferred Body Size not equal to zero (%).

BMI Category of Preference

As their body size of preference, no one (0/412) chose obese silhouettes (Figure 2A and B). However, as their body size of preference, normal weight silhouettes were chosen by 66% (272/412) of participants (women: 75% (131/174); men:

**Figure 2** Preferred Body Size (A) Women; (B) Men. Reference Group is Normal Weight.

Notes: Comparison to reference group: *** $P < 0.001$.

60% (142/238)), while overweight silhouettes were chosen by 20% (82/412) of participants (women: 11% (20/174); men: 26% (62/238)). Combining normal and overweight silhouettes into one group, 86% (150/174) of women and 86% (204/238) of men wanted to be either Normal or Overweight. Underweight silhouettes were chosen as their body size of preference by 14% of women (24/174) and 14% of men (33/238).

Body Size Dissatisfaction

Overall dissatisfaction with perceived body size was 75% (309/412) (Table 1). Sixty-three percent (261/412) of participants selected a BMI silhouette smaller than their current size, suggesting that this proportion of participants were dissatisfied with their size by feeling too large. In contrast, 12% (49/412) chose a larger BMI than their current size, suggesting dissatisfaction because they felt too small.

When examined by gender, more women than men were dissatisfied because they considered themselves to be too large (78% (135/174) vs 53% (126/238), $P<0.001$). In contrast, more men were dissatisfied than women, because they considered themselves to be too small (Men: 16% (38/238) Women: 6% (11/174) ($P=0.003$)).

Mean BMI of women who thought of themselves as too large was: 30.3 ± 4.6 kg/m² (21.3 to 42.0 kg/m²). Women who wanted to be smaller than their current body size, chose as their wish body size silhouettes between 1 and 6 (Figure 3A).

Mean BMI of men who thought of themselves as too large was: 29.2 ± 3.9 kg/m² (21.9 to 47.3 kg/m²). Silhouettes men chose for their wish body size were: 1 to 5 (Figure 3B).

Mean BMI of women who thought they were too small was: 23.4 ± 3.3 kg/m² (range 19.8 to 29.4 kg/m²) their wish body size silhouettes were: 2 to 6 (Figure 4A).

Mean BMI of men who thought of themselves as too small was 23.0 ± 2.7 kg/m² (range 19.5 to 30.9 kg/m²). Their wish body size silhouettes were: 3 to 6 (Figure 4B).

Satisfied with Perceived Body Size

Twenty-five percent (103/412) of the participants were satisfied with their perceived body size (Table 1). By gender, women had a lower rate of satisfaction with their perceived body size than men (16% (28/174) vs 31% (74/238), $P<0.001$).

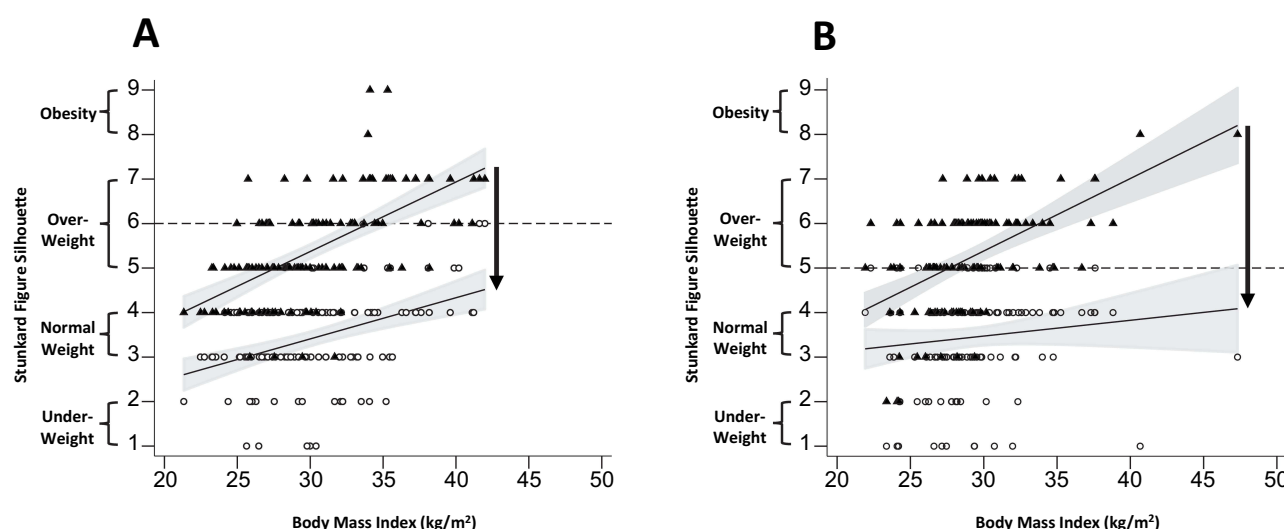


Figure 3 Perceived and Preferred Body Size in Immigrants Dissatisfied because Body Size Perceived as too Large (A) Women; (B) Men. Δ Perceived Body Size. \circ Wish Body Size. Y-axis: Stunkard Figure Rating Scale Silhouettes. X-axis: BMI calculated from height and weight. Regression lines with 95% CI for relationship between perceived and measured BMI and Wish Body Size and measured BMI are provided. Horizontal dotted line represents highest wish body size (Women: Silhouette 6; Men: Silhouette 5). Downward arrow between regression lines represents desired direction of change in BMI from perceived to wish. Women: regression coefficient between perceived and measured BMI was: $r=2.4$, (95% CI: 1.9, 2.9) and between preferred and measured BMI was: $r=1.8$, (95% CI: 1.1, 2.5). For men, the equivalent data were: $r=1.8$, (95% CI: 1.3, 2.3) and $r=0.4$, (95% CI: -0.2, 0.9) respectively.

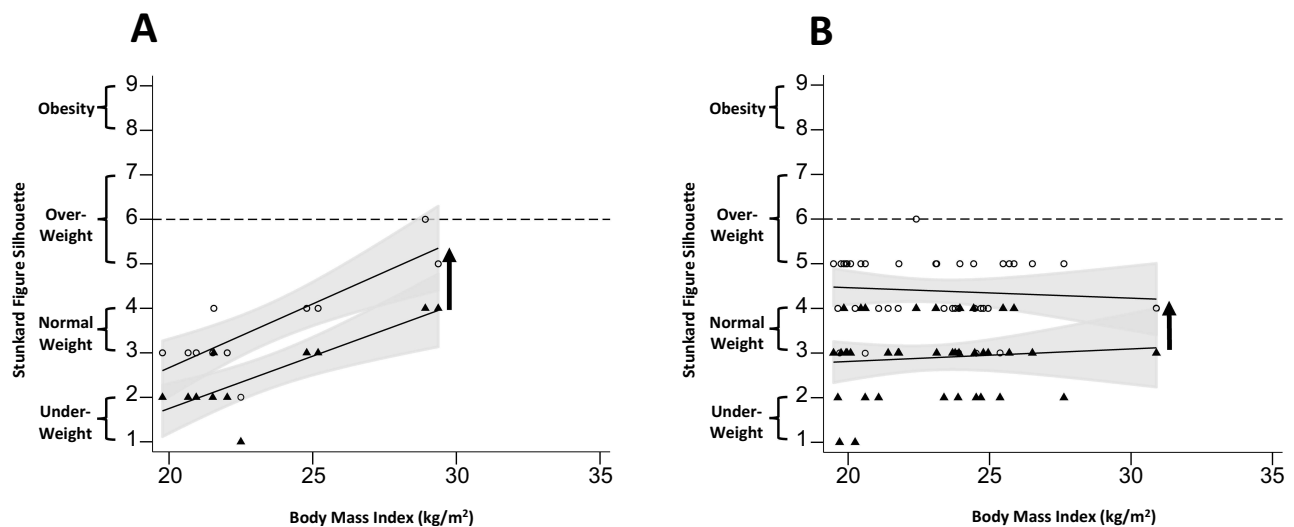


Figure 4 Perceived and Preferred Body Size in Immigrants Dissatisfied because Body Size Perceived as too Small (**A**) Women; (**B**) Men. Δ Perceived Body Size. \circ Wish Body Size. Y-axis: Stunkard Figure Rating Scale Silhouettes. X-axis: BMI calculated from height and weight. Regression lines with 95% CI for relationship between perceived and measured BMI and Wish Body Size and measured BMI are provided. Horizontal dotted line represents highest wish body size (Women: Silhouette 6; Men: Silhouette 6). Upward arrow between regression lines represents desired direction of change in BMI from perceived to wish. Women: regression coefficient between perceived and measured BMI was: $r=2.9$, (95% CI: 1.4, 4.4) and between preferred and measured BMI was $r=2.5$, (95% CI: 1.3, 3.7). For men the equivalent data were: $r=0.3$, (95% CI: -0.8 , 1.4) and $r=-0.3$, (95% CI: -1.5 , 0.9) respectively.

Among the 16% of women satisfied with their body size, 82% (23/28) perceived themselves as normal weight, whereas 11% (3/28) perceived themselves as overweight. This means that 93% (26/28) of women who were satisfied with their body size perceived themselves as normal weight or overweight.

None of the women satisfied with their body size perceived themselves as obese. However, three of the women who were satisfied with their body size had a BMI ≥ 30 kg/m². Each of them underestimated their body size and chose as their perceived body size silhouettes in the normal weight or overweight categories (Figure 5A).

Of the 31% (74/238) of men satisfied with their body size, 61% (45/74) perceived themselves as normal weight and 28% (21/74) perceived themselves as overweight. This means that for men who were satisfied with their body size, 98% (66/74) perceived themselves as normal weight or overweight.

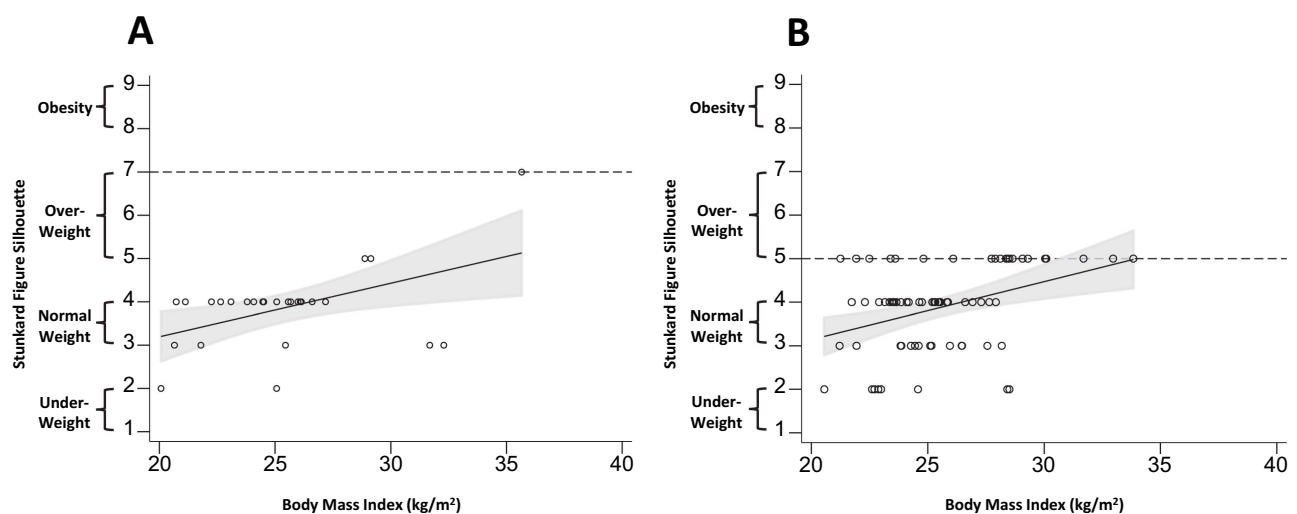


Figure 5 Perceived and Preferred Body Size in Immigrants Satisfied with Current Body Size (**A**) Women; (**B**) Men. \circ Perceived and preferred Body Size are the same \circ and designated by the same symbol. Y-axis: Stunkard Figure Rating Scale Silhouettes. X-axis: BMI calculated from height and weight. Regression line with 95% CI for perceived and measured BMI is provided. Horizontal dotted line represents highest wish body size (Women: Silhouette 7; Men: Silhouette 5). Women: regression coefficients between perceived or preferred and measured BMI were: $r=1.9$, (95% CI: 0.5, 3.3). For men the equivalent data were: $r=1.1$, (95% CI: 0.5, 1.7).

Five of the men who were satisfied with their body size had obesity ($\text{BMI} \geq 30 \text{ kg/m}^2$) (Figure 5B). All 5 of these men underestimated their body size as overweight and chose silhouette 5 to describe their current body size.

Underweight Category

At enrollment, no participants had a measured BMI in the underweight category ($\text{BMI} < 18.5 \text{ kg/m}^2$). However, 14% of women (24/174) and 14% of men (33/238) wanted to be underweight and chose silhouettes 1 or 2 as their wish body size (Figures 3A and 3B).

Cardiometabolic Health and BMI Category

The prevalence of newly diagnosed diabetes was 7% (27/380). Based on the prevalence of diabetes, dyslipidemia, and inflammatory markers, African immigrants who were overweight or obese were less healthy than their counterparts who were normal weight (Supplement Table 1). The adverse effects of being overweight or obese were particularly prominent in men (Supplement Table 1).

Sociodemographic Factors Associated with Dissatisfaction with Large Body Size

The odds of being dissatisfied because of large body size was higher in women than men (OR: 2.89, 95% CI: 1.72, 4.85, $P < 0.001$) or if household income was $\geq 45\text{k}$ (OR: 2.16, 95% CI: 1.26, 3.71, $P = 0.001$). However, dissatisfaction did not appear to be influenced by age greater than 40 years, having a life partner, African region of origin, duration of United States residence, age of immigration, college education or a sedentary lifestyle (Table 3).

Discussion

This is the first investigation to combine measured BMI with a figure rating scale to assess attitudes about body size in African immigrants to the United States. By undertaking this research, we add substantial support to the view that from a health and cultural perspective, African attitudes towards optimal body size are evolving. In many African countries prior to 21st century globalization, obesity, meaning larger silhouettes, was seen as a sign of prosperity, health, fertility and wellness.^{17,40,41} However, more recent surveys of countries across the African continent have demonstrated a significant shift in attitude and large silhouettes are less favored.^{8,14–17,19–21} We now present a similar finding in immigrants living in the United States. Our study enrolled 412 African immigrants and not one person, independent of African country or region of origin, chose as their preferred body size, a silhouette in the largest category. In fact, 86% of African immigrants preferred to have a body size which would be considered mid-range, specifically normal or

Table 3 Reasons for Dissatisfaction Because Body Size Too Large

Variable	Odds Ratio ^a	95% CI	P-value
Female Gender	2.89	1.72, 4.85	<0.001
Income ($\geq \$45\text{k/y}$)	2.16	1.26, 3.71	0.005
Age $\geq 40\text{y}$	1.37	0.77, 2.43	0.278
Partnered	1.29	0.75, 2.21	0.363
Central or East African ^b	1.09	0.67, 1.78	0.735
US Residence $\geq 10\text{y}$	1.04	0.58, 1.88	0.892
Adult Immigrant ^c	0.82	0.37, 1.77	0.607
College Graduate	0.72	0.40, 1.32	0.292
Sedentary ^d	0.71	0.38, 1.34	0.291

Notes: ^aSatisfied with Body Size. ^bCompared to West African origin. ^cEntered the United States at age 18 y or older versus less than 18 y old. ^dIPAQ Score Low.

overweight. We hypothesize in African immigrants the preference for silhouettes in the mid-range reflects the combined effects of globalization and acculturation. However, with the lack of preference for large body sizes, it is important that fat shaming and obesity stigmatization does not develop into a new norm in the African immigrant community.^{24,26,42}

Nonetheless, as body size preference influences health behaviors, and large body sizes are implicated in the development of diabetes and heart disease, the preference for a silhouette which is in the mid rather than high range is a healthy choice.^{5,19,43}

However, there is an additional area of concern with globalization and acculturation. Fourteen percent of the participants in our study chose as their preferred body size a silhouette in the underweight category. This may be secondary to acculturation as it is not characteristic of African communities living on the continent.^{18,26}

Focusing on obesity, the rejection by African immigrants of obesity as desirable was impressive. Independent of whether an individual thought of themselves as too large or too small, no one preferred to be have silhouette which would be considered to be in the obese range. For example, women who had obesity (meaning BM was measured to be ≥ 30 kg/m²) and wanted to be smaller, chose as their ideal body size silhouettes from 1 to 6, meaning underweight to mid-range overweight (Figure 3A). Whereas men with obesity (BMI ≥ 30 kg/m²) who thought of themselves as too large, chose as their ideal body size silhouettes 1 to 5, meaning underweight to slightly overweight (Figure 3B).

On the opposite side of the weight spectrum, the small number of women (n=11, Figure 4A) who thought of themselves as too small and wanted to increase their body size, chose as their wish body size, silhouettes in the upper range of underweight to mid-range overweight (silhouettes 2 to 6). While men who thought of themselves as too small (n=38, Figure 4B), chose as their wish body size, silhouettes 3 to 6, meaning normal or mid-range overweight, but not obese.

Preference for Normal and Overweight Silhouettes

As their wish body size, 75% (131/174) of women and 60% (143/238) of men chose silhouettes 3 and 4. However, both women and men had a stronger preference for silhouette 4 than 3, indicating a preference for the larger side of the normal weight category. In addition, 11% (19/174) of women and 26% (62/238) of men chose overweight as their wish body size. However, while overweight silhouettes were 5, 6 and 7, the maximum size silhouette chosen by participants who wanted to smaller was either 5 or 6 (Figure 3). In short, while some African immigrants preferred to be overweight, none wanted to upper range overweight or obesity.

The observation that a large majority of African immigrants wanted to have a body size in the normal or overweight category was very similar to studies conducted in six African countries and published between 2000 and 2023.^{8,14-21} In brief, these studies reported that the majority of Africans had a disdain for obesity, knowledge that obesity was unhealthy, and a preference for body size silhouettes in the upper range of normal weight or lower range of overweight. In a study of 565 Ghanaians, 70% of participants wanted to be normal weight or overweight with silhouette 4 from the Stunkard Figure Rating Scale being the most favored silhouette.¹⁵ Only 1% of women and 1% of men chose as their ideal body size the obese silhouettes 8 or 9.¹⁵ Three other studies that also used the Stunkard Figure Rating Scale and were conducted in Ghana, South Africa and Nigeria reported highest satisfaction with silhouette 5, which is in the lower range of the overweight category.^{16,19,20}

Using the Silhouette Scale which has just 6 figures from which to choose, Holdsworth et al, queried 301 Senegalese women and found that the body size of preference corresponded to a BMI of 24 to 28 kg/m².¹⁷ In short, the majority of Senegalese women wished that their BMI was in the normal to overweight range. With the use of the BAI-O Scale which has 18 silhouette options, Ettarh et al found in a cohort of 4934 Kenyans living in Nairobi that 78% of women and 73% of men wanted to be normal or overweight. However, about 15% of the women and 21% of the men wished to be obese.¹⁸ While this desire to be obese is higher than reported in other studies, Ettarh et al described the area in which the study was conducted as “slums”. Low income and food scarcity are often associated with the aspiration for a large body size.²⁴ Hence, the results by Ettarh et al may be influenced by profound poverty.²⁴

Globalization and Acculturation

Recent investigations in several African countries have found that globalization, combined with younger age, education, and higher socioeconomic status are linked to greater dissatisfaction with large body sizes. However, degree of dissatisfaction with large body size may be modified by African region of origin. Balogun-Mwangi conducted a direct

comparison of women living in Nigeria to women living in Kenya and found the Nigerian women expressed greater dissatisfaction with large body sizes than Kenyan women.⁸

Beyond globalization, with transcontinental migration, the body image preferences of African immigrants to the United States and Europe are also impacted by the influences of acculturation. Similar to investigations conducted in Africans who reside in Europe,^{24–26} our study of African immigrants living in the United States found that dissatisfaction with larger body sizes was so universal that the dissatisfaction was independent of age, age of immigration, duration of United States residence, marital status, education, income, and even African region of origin.

Influence of Acculturation on Views of Underweight BMI

Ninety-two percent of the Africans enrolled in the Africans in America cohort self-identified as African. Therefore, the effect of acculturation might be expected to be minimal. Nonetheless, concerning attitudes about body size are emerging in African immigrants living in either the United States or Europe. In African countries, an underweight BMI is routinely viewed negatively and seen as a sign of poverty, malnutrition, and ill-health, specifically HIV-infection and tuberculosis.^{15,16,20,21} Therefore, we attribute to acculturation, the observation that 14% of African immigrant women and men chose as their wish body size silhouettes that corresponded to an underweight BMI.

An eagerness to be slimmer, but not necessarily underweight, is characteristic of acculturation. For example, both Zimbabwe-born women and South African born Zulus living in Great Britain prefer smaller body sizes than their counterparts living in their countries of birth.^{25,26} There is even a study comparing Asians born in Kenya and living in Kenya to Asians born in Kenya and living in Great Britain. The investigators found that Asian Kenyans living in Britain preferred smaller body sizes than Asian Kenyans living in Kenya.⁴⁴ In short, as small body sizes are preferred by Africans living in Europe and the United States, it is essential that weight-loss programs do not glorify underweight silhouettes and have the adverse consequence of promoting eating disorders such as bulimia or anorexia nervosa.⁴⁵

Gender Aspects of Body Size Dissatisfaction

Gender differences in body size preferences are linked closely to culture, acculturation, and globalization. In our study, the majority of African immigrants were dissatisfied with their body size. However, and as observed in Africa, women were more dissatisfied with their body size than men.²¹ When divided by reason for dissatisfaction, more women than men were dissatisfied because they were too large, whereas men had a higher rate of dissatisfaction because they were too small. For African women particularly, this is the opposite of what might have been expected in earlier decades.²⁰

For women living in African countries in the 21st century, there appears to be greater acceptance of overweight silhouettes in married than single women.^{14–16} The overweight silhouette in married women in many African communities is viewed as a sign of health and fertility. However, among the African immigrant women in our study, marriage or domestic partnership did not influence body size satisfaction.³⁶ In our study, we attribute to acculturation the fact that having a spouse or partner did not increase satisfaction with a larger body size.

Men in our study who wanted to be larger chose normal or midrange overweight categories as their desirable size. In African countries, as in the United States, it is speculated that the men who wished to be larger actually wanted to increase muscle mass, rather than fat mass.²¹

Strengths and Limitations

There are three main strengths of this study. First, we included both men and women, whereas many studies of body size preferences focus exclusively on women.^{8,14,16,17,19,25}

Second, we enrolled participants from countries that spanned the African continent. We are cognizant of the great diversity of cultural practices across African countries and regions. As we were able to determine that body size preference and body size dissatisfaction did not differ in African immigrants by region of origin, we invoke acculturation from transcontinental migration as the reason for their similar views.

Third, African immigrant concepts of body size preference and body size dissatisfaction were assessed based on an objective figure rating scale and compared to a BMI value which was calculated from measured and not self-reported weight and height.

Nonetheless, this study has three limitations; one, is the use of a convenience sample, two is our sample size and three, is our choice of the Stunkard Figure Rating Scale.²⁹

Even though we used a convenience sample there are three reasons why we feel the participants in the Africans in America cohort are representative of the African immigrant community in the United States. First, the Washington, DC, Maryland and northern Virginia area is a major destination for African immigrants in the United States.⁴⁶ Furthermore, most enrollees lived in Montgomery County, Maryland and the adjacent Prince Georges County. These are two of the five counties in the United States with the highest concentration of African immigrants.⁴⁶ Second, the demographics of our cohort are consistent with known patterns of African immigration. For example, 75% of African immigrants in America arrived in the United States in 2000 or later.¹ In our study, 71% entered the United States in 2000 or later (Table 1). In addition, consistent with immigration demographics, most African immigrants in our cohort were men from West and East Africa than Central Africa. Third, as would be expected in a representative sample, sickle cell trait, hemoglobin C trait, and glucose-6-phosphate dehydrogenase deficiency were more common in immigrants from countries in West and Central Africa than East Africa (Table 2).

In addition, our sample size is 412 African immigrants. This sample size is typical of studies of this type.^{8,14,15,19–21} However, when we sub-divide the cohort by African region of origin, there are only 44 participants from Central Africa. Therefore, when we state that we did not detect any differences by African region of origin, a type 2 error cannot be ruled out.

Another potential limitation of the study is the use the Stunkard Figure Rating Scale which is a continuum of body sizes rather than a specific depiction of any BMI category and was developed in Danes rather than Africans.²⁹ Currently, there are no silhouette scales available which have been developed and validated in an African country. However, the Stunkard Figure Scale which focuses more on body size than fat distribution has been used frequently by investigators across the African continent.^{15,16,19,20} There are other figure rating scales which have been developed and validated in African Americans such as the Body Image Assessment for Obesity (BIA-O) scale and the Pulvers Scale.^{47,48} However, the applicability of these scales to African populations across the continent is unknown.

Conclusions

Overall, we have shown that African immigrants in America do not seek to be obese. Instead, there is a strong preference for mid-range silhouettes. In the 21st century, there is growing international recognition that obesity is both unhealthy and undesirable and increasing in prevalence across the African continent and globally.^{5,43} The consequences of globalization and acculturation are both negative and positive. On the negative side, both globalization and acculturation promote lifestyles which lead to obesity through access to more calories, processed foods, sedentary work, and transportation by bus, train, car and moped rather than walking or bicycle riding. In addition, with globalization and acculturation, there is international praise and adulation for small body sizes and glorification of underweight silhouettes. On the positive side, globalization provides education on nutrition, cardiometabolic health and the value of physical activity and a normal weight body size. The Centers for Disease Control and Prevention has even recently changed its nomenclature and has renamed the “normal weight” category, the “healthy weight” category.⁴⁹ Hence, an important and positive sign of acculturation is that the majority of immigrants in the Africans in America cohort chose silhouettes in the normal weight BMI category as their body size of preference. Furthermore, African immigrants of normal weight had a high degree of body size satisfaction. Overall, health programs must be built for and by Africans which are culturally sensitive and promote, validate, and celebrate healthy body sizes.

Data Sharing Statement

Deidentified participant data will be made available in excel format upon reasonable request to the corresponding author, Anne E Sumner, MD.

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Disclosure

All authors state that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References

1. Key Findings about Black immigrants in the U.S. Pew Research Center; 2022. Available from: <https://www.pewresearch.org/short-reads/2022/01/27/key-findings-about-black-immigrants-in-The-u-s/>. Accessed August 26, 2024.
2. IDF Diabetes Atlas. IDF Diabetes Atlas 2021; 10th edition. Available from: <https://diabetesatlas.org/atlas/tenth-edition/>. Accessed 29 August 2024.
3. Zhou B, Carrillo-Larco RM, Danaei G, et al. Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants. *Lancet*. 2021;398(10304):957–980. doi:10.1016/S0140-6736(21)01330-1
4. Obesity rising in Africa. WHO analysis finds 2022. Available from: <https://www.afro.who.int/news/obesity-rising-africa-who-analysis-finds>. Accessed August 26, 2024.
5. Rocha T, Melson E, Zamora J, Fernandez-Felix BM, Arlt W, Thangaratnam S. Sex-specific obesity and cardiometabolic disease risks in low- and middle-income countries: a meta-analysis involving 3 916 276 individuals. *J Clin Endocrinol Metab*. 2023;2023:1.
6. Abarca-Gómez L, Abdeen ZA, Hamid ZA, et al. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults. *Lancet*. 2017;390(10113):2627–2642. doi:10.1016/S0140-6736(17)32129-3
7. Byiringiro S, Koirala B, Ajibewa T, et al. Migration-related weight changes among African immigrants in the United States. *Int J Environ Res Public Health*. 2022;19(23):15501. doi:10.3390/ijerph192315501
8. Balogun-Mwangi O, Robinson-Wood TL, DeTore NR, Edwards George JB, Rodgers RF, Sanchez W. Body image and Black African women: a comparative study of Kenya and Nigeria. *Body Image*. 2023;45:331–342. doi:10.1016/j.bodyim.2023.03.017
9. Warren CS, Holland S, Billings H, Parker A. The relationships between fat talk, body dissatisfaction, and drive for thinness: perceived stress as a moderator. *Body Image*. 2012;9(3):358–364. doi:10.1016/j.bodyim.2012.03.008
10. Kumanyika SK. Special issues regarding obesity in minority populations. *Ann Intern Med*. 1993;119(7):650–654. doi:10.7326/0003-4819-119-7_Part_2-199310011-00005
11. Nuttall FQ. Body mass index: obesity, BMI, and health: a critical review. *Nutr Today*. 2015;50(3):117–128. doi:10.1097/NT.0000000000000092
12. Sumner AE, Kushner H, Tulenko TN, Falkner B, Marsh JB. The relationship in African-Americans of sex differences in insulin-mediated suppression of nonesterified fatty acids to sex differences in fasting triglyceride levels. *Metabolism*. 1997;46(4):400–405. doi:10.1016/S0026-0495(97)90055-X
13. Panel E. Executive summary of the clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults. *Arch Intern Med*. 1998;158(17):1855–1867. doi:10.1001/archinte.158.17.1855
14. Appiah C, Otoo GE, Steiner-Asiedu M. Preferred body size in urban Ghanaian women: implication on the overweight/obesity problem. *Pan Afr Med J*. 2016;23:239. doi:10.11604/pamj.2016.23.239.7883
15. Agyapong NAF, Annan RA, Apprey C, Aduku LNE. Body weight, obesity perception, and actions to achieve desired weight among rural and urban Ghanaian adults. *J Obes*. 2020;2020:7103251. doi:10.1155/2020/7103251
16. Benkeser RM, Biritwum R, Hill AG. Prevalence of overweight and obesity and perception of healthy and desirable body size in urban, Ghanaian women. *Ghana Med J*. 2012;46(2):66–75.
17. Holdsworth M, Gartner A, Landais E, Maire B, Delpuech F. Perceptions of healthy and desirable body size in urban Senegalese women. *Int J Obes Relat Metab Disord*. 2004;28(12):1561–1568. doi:10.1038/sj.ijo.0802739
18. Ettarh R, Van de Vijver S, Oti S, Kyobutungi C. Overweight, obesity, and perception of body image among slum residents in Nairobi, Kenya, 2008–2009. *Prev Chronic Dis*. 2013;10:E212. doi:10.5888/pcd10.130198
19. Gradidge PJ, Norris SA, Micklesfield LK, Crowther NJ. The role of lifestyle and psycho-social factors in predicting changes in body composition in black South African Women. *PLoS One*. 2015;10(7):e0132914. doi:10.1371/journal.pone.0132914
20. Okoro EO, Oyejola BA, Etebu EN, et al. Body size preference among Yoruba in three Nigerian communities. *Eat Weight Disord*. 2014;19(1):77–88. doi:10.1007/s40519-013-0060-9
21. Siervo M, Grey P, Nyan OA, Prentice AM. A pilot study on body image, attractiveness and body size in Gambians living in an urban community. *Eat Weight Disord*. 2006;11(2):100–109. doi:10.1007/BF03327758
22. Ogungbe O, Turkson-Ocran RA, Koirala B, et al. Acculturation and Cardiovascular Risk Screening among African Immigrants: the African Immigrant Health Study. *Int J Environ Res Public Health*. 2022;19(5):2556. doi:10.3390/ijerph19052556
23. Sam DL, Berry JW. Acculturation: when individuals and groups of different cultural backgrounds meet. *Perspect Psychol Sci*. 2010;5(4):472–481. doi:10.1177/1745691610373075
24. Toselli S, Rinaldo N, Gualdi-Russo E. Body image perception of African immigrants in Europe. *Global Health*. 2016;12(1):48. doi:10.1186/s12992-016-0184-6

25. Swami V, Mada R, Tovée MJ. Weight discrepancy and body appreciation of Zimbabwean women in Zimbabwe and Britain. *Body Image*. 2012;9(4):559–562. doi:10.1016/j.bodyim.2012.05.006
26. Tovee M, Swami V, Furnham A, Mangalparsad R. Changing perceptions of attractiveness as observers are exposed to a different culture. *Evol Human Behav*. 2006;27:443–456. doi:10.1016/j.evolhumbehav.2006.05.004
27. Thomas FN, Kleyman KS. The influence of Western body ideals on Kenyan, Kenyan American, and African Americans' body image. *J Prev Interv Community*. 2020;48(4):312–328. doi:10.1080/10852352.2019.1627084
28. Hardin J, McLennan AK, Brewis A. Body size, body norms and some unintended consequences of obesity intervention in the Pacific islands. *Ann Hum Biol*. 2018;45(3):285–294. doi:10.1080/03014460.2018.1459838
29. Stunkard AJST, Schulsinger F. Use of the Danish Adoption Register for the study of obesity and thinness. In: Kety S, editor. *The Genetics of Neurological and Psychiatric Disorders*. New York, NY: Raven Press; 1983:115–120.
30. Briker SM, Aduwo JY, Mugeni R, et al. A1C underperforms as a diagnostic test in Africans even in the absence of nutritional deficiencies, anemia and hemoglobinopathies: insight from the Africans in America Study. *Front Endocrinol*. 2019;10:533. doi:10.3389/fendo.2019.00533
31. Hormenu T, Shoup EM, Osei-Tutu NH, et al. Stress measured by allostatic load varies by reason for immigration, age at immigration, and number of children: the Africans in America Study. *Int J Environ Res Public Health*. 2020;17(12):4533. doi:10.3390/ijerph17124533
32. Jagannathan R, DuBose CW, Mabundo LS, et al. The OGTT is highly reproducible in Africans for the diagnosis of diabetes: implications for treatment and protocol design. *Diabet Res Clin Pract*. 2020;170:108523. doi:10.1016/j.diabres.2020.108523
33. Ishimwe MCS, Wentzel A, Shoup EM, et al. Beta-cell failure rather than insulin resistance is the major cause of abnormal glucose tolerance in Africans: insight from the Africans in America study. *BMJ Open Diabetes Res Care*. 2021;9(1):e002447. doi:10.1136/bmjdr-2021-002447
34. Gatete JD, Worthy CC, Jagannathan R, DuBose CW, Sacks DB, Sumner AE. Fructosamine is not a reliable test for the detection of hyperglycemia: insight from the Africans in America Study. *Diabet Metab Syndr Obes*. 2023;16:2689–2693. doi:10.2147/DMSO.S426406
35. Lynch E, Liu K, Wei GS, Spring B, Kiefe C, Greenland P. The relation between body size perception and change in body mass index over 13 years: the coronary artery risk development in young adults (CARDIA) study. *Am J Epidemiol*. 2009;169(7):857–866. doi:10.1093/aje/kwn412
36. Shoup EM, Hormenu T, Osei-Tutu NH, et al. Africans who arrive in the United States before 20 years of age maintain both cardiometabolic health and cultural identity: insight from the Africans in America Study. *Int J Environ Res Public Health*. 2020;17(24):9405. doi:10.3390/ijerph17249405
37. Matsuda M, DeFronzo RA. Insulin sensitivity indices obtained from oral glucose tolerance testing: comparison with the euglycemic insulin clamp. *Diabetes Care*. 1999;22(9):1462–1470. doi:10.2337/diacare.22.9.1462
38. Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. *Clin Chem*. 1972;18(6):499–502. doi:10.1093/clinchem/18.6.499
39. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J biomed informat*. 2009;42(2):377–381. doi:10.1016/j.jbi.2008.08.010
40. van der Sande MA, Ceesay SM, Milligan PJ, et al. Obesity and undernutrition and cardiovascular risk factors in rural and urban Gambian communities. *Am J Public Health*. 2001;91(10):1641–1644. doi:10.2105/AJPH.91.10.1641
41. Walker AR, Adam F, Walker BF. World pandemic of obesity: the situation in Southern African populations. *Public Health*. 2001;115(6):368–372. doi:10.1038/sj/ph/1900790
42. Fearon N, Sudlow A, le Roux CW, Pournaras DJ, Welbourn R. Say what you mean, mean what you say: the importance of language in the treatment of obesity. *Obesity*. 2022;30(6):1189–1196. doi:10.1002/oby.23446
43. Issaka A, Paradies Y, Cameron AJ, Stevenson C. The association between body weight indices, behavioral factors, and type 2 diabetes mellitus in Africa: a systematic review and meta-analysis of population-based epidemiological studies. *Nutr, Metab Cardiovasc Dis*. 2024;34(1):1–18. doi:10.1016/j.numecd.2023.06.011
44. Furnham A, Alibhai N. Cross-cultural differences in the perception of female body shapes. *Psychol Med*. 1983;13(4):829–837. doi:10.1017/S0033291700051540
45. Gibson D, Workman C, Mehler PS. Medical Complications of Anorexia Nervosa and Bulimia Nervosa. *Psychiatr Clin North Am*. 2019;42(2):263–274. doi:10.1016/j.psc.2019.01.009
46. Esheverria-Estrada C, Batalova J. Sub-Saharan African Immigrants in the United States: migration Policy Institute; 2019. Available from: <https://www.migrationpolicy.org/article/sub-saharan-african-immigrants-united-states>. Accessed August 26, 2024.
47. Pulvers KM, Lee RE, Kaur H, et al. Development of a culturally relevant body image instrument among urban African Americans. *Obes Res*. 2004;12(10):1641–1651. doi:10.1038/oby.2004.204
48. Williamson DA, Womble LG, Zucker NL, et al. Body image assessment for obesity (BIA-O): development of a new procedure. *Int J Obes Relat Metab Disord*. 2000;24(10):1326–1332. doi:10.1038/sj.ijo.0801363
49. Healthy weight, nutrition and physical activity; 2024. Available from: https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html. Accessed August 26, 2024.

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