FOCUS: NURSING

Alternative Methods for Measuring Obesity in African American Women

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The use of body mass index (BMI) may not be the most appropriate measurement tool in determining obesity in diverse populations. We studied a convenience sample of 108 African American (AA) women to determine the best method for measuring obesity in this at-risk population. The purpose of this study was to determine if percent body fat (PBF) and percent body water (PBW) could be used as alternatives to BMI in predicting obesity and risk for hypertension (HTN) among AA women.

After accounting for age, BMI, and the use of anti-hypertensive medication, PBF (p = 0.0125) and PBW (p = 0.0297) were significantly associated with systolic blood pressure, while BMI was not. Likewise, PBF (p = 0.0316) was significantly associated with diastolic blood pressure, while PBW and BMI were not. Thus, health care practitioners should consider alternative anthropometric measurements such as PBF when assessing obesity in AA women.

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†Abbreviations: AA, African American; CVD, cardiovascular disease; BMI, body mass index; BP, blood pressure; HTN, hypertension; PBF, percent body fat; PBW, percent body water; DXA, dual energy X-ray absorptiometry; NIH, National Institutes of Health; NCHS, National Center for Health Statistics; SBP, systolic blood pressure; DBP, diastolic blood pressure; IRB, Institutional Review Boards; SAS, statistical analysis software; AHA, American Heart Association; VAT, visceral adipose tissue; NHANES, National Health and Nutrition Examination Survey.

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INTRODUCTION

Body mass index (BMI) has historically been the gold standard in anthropometric measurement of obesity in adults. BMI standards were created based on population samples comprised solely of Caucasians and calculated using height and weight measurements (weight in kilograms divided by height in meters squared) [1]. Research has now shown that BMI alone may not be an appropriate tool in determining obesity, due to differences in ethnicity and individual genetic make-up [2]. This study examines percent body fat (PBF) and percent body water (PBW) as viable alternatives for measuring obesity in African American (AA) women. PBF and PBW are measurements based on an individual’s height, age, weight, and self-reported physical activity level using an electronic measurement scale.

The National Center for Health Statistics (NCHS), part of the Centers for Disease Control and Prevention, has been examining trends in BMI in adult women since 1960. Research has shown that AA women have significantly higher rates of obesity compared to other ethnic groups in the United States [3]. It is imperative to examine and address methods clinicians use to measure obesity to adequately diagnose, treat, and monitor patients for health-related risks and illnesses. Prevalence rates are increasing at greater numbers among all population groups, with AA women at highest risk [3,4]. In a 12-year study by Flegal et al. measuring BMI, obesity increases were significant for non-Hispanic AA women (p = 0.04) and Mexican American women (p = 0.046) when compared to women overall in the United States [5].

Obesity is defined by the health community using anthropometric measurements of BMI to screen an individual for obesity-related health risks. Obesity is a medical condition where excess body fat has accumulated to 20 percent or more over an individual’s ideal body weight and may result in adverse health effects. Body mass index (BMI) has notably been the most widely used tool for diagnosing obesity due to its quick and inexpensive nature. Yet, BMI classifications created between 1830 and 1850 by Adolphe Quetelet (known as the Quetelet Index) gained popularity much later [6]. In 1972, Ancel Keys suggested BMI to be the best measure for body fat percentage simultaneously as Western cultures noted rising incidences [7]. While clinicians extensively began to use BMI to interpret a patient’s weight-associated medical problems, this heavy reliance on a numerical value lost its potential effectiveness in considering adiposity. To add complication, BMI standards and ranges have evolved and transformed a number of times, with the National Institutes of Health (NIH) providing the recommendations and guidance for determining standards [8,9]. Current BMI cutoff values (obesity, 30kg/m or higher) recommended by the NIH have failed to identify nearly half of reproductive-aged women who met criteria for obesity by PBF [10]. Recently, the appropriateness and use of BMI measures have come under scrutiny, giving rise to alternative measures such as PBF, as there has been an outgrowth of inaccurate interpretations of BMI and a subsequent delay in identifying AA women at risk for cardiovascular disease (CVD) [10,11]. Consequently, BMI and PBF have been studied with regard to ethnicity and race. Therefore, the use of ethnicity-specific BMI cutoff values would be more accurate in identifying obesity [10]. Although BMI has been considered the standard for determining classifications of underweight, normal weight, overweight, and obese, other methods, such as PBF and PBW, should be considered when determining obesity in AA.

Age, sex, and ethnic variations are not a consideration in BMI standard calculations for determining obesity. Yet evidence indicates the relationship between BMI and PBF is affected by ethnic and age differences. In a study of three distinct populations in Africa examined to determine if BMI was an adequate predictor of hypertension (HTN), results showed that as individuals aged, HTN worsened, regardless of BMI [12]. This disparity was attributed to socioeconomic influences and possibly ethnic vari-
ations and suggests that lifestyle factors and gene-environment interactions may play an important role in assessing risk for HTN. Further studies are indicated, though, to assess and better understand the multiplicity of factors contributing to this epidemic. The purpose of this study is to determine if PBF and PBW can be used as alternatives to BMI in predicting obesity and risk for HTN among AA women. The research questions include the independent influence of PBF, PBW, and BMI on systolic blood pressure (SBP) and diastolic blood pressure (DBP) for AA women across various age groups.

METHODS

Design

The study utilized a descriptive correlation research design to address the research questions posed. Correlations between variables (BP, BMI, PBF, and PBW) were examined to assess the strength and direction of the variables in question.

Sample and Setting

This study used a convenience subgroup sample of 108 AA women who participated in the “Hypertension and Heredity: Hypertension Genetic Polymorphisms in Three Generations of African American Women” parent study and were originally recruited from the Detroit metropolitan area after receiving approval from the Institutional Review Boards (IRB) at the University of Michigan and Wayne State University. In the parent study, three generations of maternally blood-related women were recruited to examine HTN susceptibility genes [13]. To meet the inclusion criteria for the parent study, participants were required to self-identify race as AA and possess a living family tree of three generations to constitute a triad: grandmother-mother-granddaughter. Although participants self-identified as AA, the recruiters were aware of the heterogeneity of blacks in America that included, but was not limited to, blacks of mixed heritage, African immigrants, Caribbean blacks, and blacks of various other origins. Participants were literate to a sixth-grade level. For those with a diagnosis of HTN, blood pressure (BP) had to average 140/90 or higher (Stage 1 or 2 HTN) without use of medication. Individuals who reported taking anti-hypertensive medications were included in the study. Participants who were diabetic were included in the study if their average BP was at least 130/80 without medication. Also, normotensive participants were included. Exclusion criteria included having co-morbidities of substance abuse, mental illness, end-stage cancer, end-stage renal disease, or other terminal illnesses. More detailed information on inclusion and exclusion criteria can be found in Wu, Prosser & Taylor [14].

Recruitment measures included: a) the use of flyers posted in neighborhood areas, including local stores, markets, and community centers; b) advertisements and announcements at local churches; c) advertisements and announcements at historically black sororities; and d) the use of participant resource pools from the University of Michigan and Wayne State University [13]. After agreeing to participate in the study, informed consent was obtained during home visits that served as the site for data collection. Research assistants were trained by the principal investigator regarding all data collection methods, home visits, and coordinating visits.

The parent study was expanded to offer participants an opportunity to take part in a follow-up study that measured changes in lifestyle behaviors after genetic counseling. It was during this time that the variables PBW, PBF, BMI, and BP readings were taken. The present study included 108 AA women who completed the genetic counseling follow-up. More information regarding the genetic counseling intervention can be found in Taylor & Wu [15]. This sample size of 108 AAs was sufficient for a power of 0.80 at an alpha level of 0.05 with a moderate effect size.

MEASURES

Demographic Questionnaire

The demographic survey was developed to obtain information from participants regarding age, educational level, household
income, marital status, and employment status. This instrument was used to provide a profile of participants.

**Blood Pressure, Weight, and Height**

Blood pressure (BP) was measured using a digital BP monitor with a size-appropriate upper arm cuff (model # A&D UA 767PC). BP measurements represent an average of three seated BP readings. Procedures for participant preparation for BP measurement were in accordance with JNC-7 recommendations [16]. Each of the three BP readings was taken 5 minutes apart. Participants wore nonrestrictive clothing, had their feet on the floor, their backs supported, and upper extremities at heart level. Hypertension (HTN) was defined as SBP >140mm Hg or DBP > 90mm Hg or taking anti-hypertensive medication. Weight was measured by a medical calibrated digital electronic scale with subjects wearing undergarments (BWB/807 Tanita Tokyo, Japan). Height was measured by a portable stadio-meter (Model 214 Road Rod, Seca Corporation, Hanover, MD).

**Percent Body Fat and Percent Body Water**

PBF and PBW were obtained by the electronic scale that also measured the weight of the participants. The research assistant entered the participants’ height, age, and self-reported activity level into the scale prior to the participant standing on it for their weight. The scale automatically calculated the PBF and PBW based on the participants’ height, age, weight, and self-reported physical activity level. PBF greater than 35 percent in women is considered obese [17]. Body mass index (BMI) (the relationship between weight and height associated with body fat and health risk) was calculated using weight and height measurements (weight in kilograms divided by height in meters squared, BMI <18.5 normal weight, BMI 18.5-24.9 overweight, BMI 25.0-29.9 overweight, BMI 30.0 or more, obese) [1].

**Statistical Analysis**

Statistical analysis software (SAS) 9.1 (SAS Institute, NC) was used to calculate Pearson’s correlation coefficient for variable pairs and to perform linear mixed effects regression modeling. Pearson’s correlation coefficient measures the correlation between two continuous variables (Table 2). Since participants were recruited from families, linear mixed effects modeling was used to account for correlation among observations from related individuals by allowing each family to have its own intercept term. To examine whether BMI was a predictor of BP after accounting for the effects of age and use

| Variables                          | Mean  | SD   |
|------------------------------------|-------|------|
| Age (years)                        | 48.33 | 16.42|
| BMI (kg/m²)                        | 32.31 | 7.23 |
| Percent Body Water                 | 45.03 | 10.2 |
| Percent Body Fat                   | 41.55 | 12.06|
| Systolic Blood Pressure (mm Hg)    | 132.41| 21.35|
| Diastolic Blood Pressure (mm Hg)   | 82.1  | 13.39|

| Hypertension                       | Number | Percentage |
|------------------------------------|--------|------------|
| Not Hypertensive                   | 50     | 46.3       |
| Hypertensive                       | 58     | 53.7       |

| Taking Antihypertensive Medication | Number | Percentage |
|------------------------------------|--------|------------|
| Yes                                | 35     | 32.41      |
| No                                 | 73     | 67.59      |

Table 1. Demographic Characteristics among African American Women (N=108).
of anti-hypertensive medication, a model that included all of these variables as predictors was constructed (Table 3). We also constructed a similar model using PBW and PBF instead of BMI (Table 4). Finally, BMI, PBW, and PBF were used as predictors in a single multivariable model to assess which was the best predictor of BP after accounting for age and use of anti-hypertensive medication (Table 5). Statistical significance was assessed using an alpha level of 0.05.

### RESULTS

#### Demographics of the Sample

The descriptive statistics for 108 AA women are presented in Table 1. The mean age was approximately 48.33 years with a standard deviation of 16.42. The mean BMI was 32.31±7.23 kg/m2, which was considered obese, according to CDC [1]. The average PBW and PBF are 45.03±10.2 and 41.55±12.06, respectively. The average SBP and DBP readings for this sample were 132.41±21.35 mmHg and 82.1±13.39 mmHg. Approximately half of the subjects (53.7 percent) had blood-pressure readings indicative of HTN, but only one-third (32.41 percent) of the total number of subjects were on anti-hypertensive medications (Table 1).

#### Correlation Analyses

Pearson’s product moment correlations between BMI, PBF, PBW, and BP readings are presented in Table 2. SBP was significantly correlated with age (r = 0.30, p = 0.002), PBF (r = 0.25, p = 0.008), and PBW (r =0.36, p = 0.002). DBP was significantly correlated with BMI (r = 0.24, p = 0.013) and PBF (r = 0.33, p = 0.0005). PBF was significantly correlated with age (r = 0.31, p = 0.0009) and BMI (r = 0.72, p < 0.0001), while PBW correlated with these two variables. A statistically significant positive correlation was found between PBF and PBW (r = 0.29, p = 0.003). Age negatively correlated with BMI (r = -0.27, p = 0.004; Table 3).

| Measure                 | 1  | 2  | 3  | 4  | 5  | 6   |
|-------------------------|----|----|----|----|----|-----|
| 1. Age                  |    |    |    |    |    |     |
| 2. BMI                  |    | -0.27** |    |    |    |     |
| 3. Systolic Blood Pressure | 0.30** | 0.14 |    |    |    |     |
| 4. Diastolic Blood Pressure | -0.06 | 0.24* | 0.66*** |    |    |     |
| 5. Percent Body Fat      | -0.31*** | 0.72*** | 0.25** | 0.33*** |    |     |
| 6. Percent Body Water    | 0.15 | 0.15 | 0.36*** | 0.18 | 0.29** |    |

*p<.05, **p<.01, ***p<.001

| Outcome                  | Age (β(SE)) | Antihypertensive Medication (β(SE)) | BMI (β(SE)) |
|--------------------------|-------------|-------------------------------------|-------------|
| SBP                      | 0.39(0.14)** | -5.98(4.70)                         | 0.68(0.28)* |
| DBP                      | -0.08(0.09)  | -5.46(3.07)                         | 0.42(0.18)* |

*p<.05, **p<.01, ***p<.001

Table 2. Intercorrelations among Age, BMI, Blood Pressures, Percent Body Fat, and Percent Body Water (N = 108).

| Measure                 | 1 | 2  | 3  | 4  | 5  | 6   |
|-------------------------|---|----|----|----|----|-----|
| 1. Age                  |  |    |    |    |    |     |
| 2. BMI                  |    | -0.27** |    |    |    |     |
| 3. Systolic Blood Pressure | 0.30** | 0.14 |    |    |    |     |
| 4. Diastolic Blood Pressure | -0.06 | 0.24* | 0.66*** |    |    |     |
| 5. Percent Body Fat      | -0.31*** | 0.72*** | 0.25** | 0.33*** |    |     |
| 6. Percent Body Water    | 0.15 | 0.15 | 0.36*** | 0.18 | 0.29** |    |

*p<.05, **p<.01, ***p<.001

Table 3. Linear Mixed Effects Model of the Association between Blood Pressure and BMI (Accounting for Age and Use of Antihypertensive Medication) (N=108).

Clark et al.: Alternative methods for measuring obesity
Association of Percent Body Fat, Percent Body Water, BMI, and Blood Pressure

Table 3 shows the results from a linear mixed effects model that included BMI as a predictor of BP after accounting for age and use of anti-hypertensive medication. BMI was found to be statistically associated with SBP (p = 0.0173) and DBP (p = 0.0238; Table 3). In a model that included both PBF and PBW, PBF was found to be associated with both SBP (p = 0.0022) and DBP (p = 0.004) after accounting for age and medication (Table 4). In this model, PBW was only found to be associated with SBP (p = 0.0271). When BMI, PBW, and PBF were all included as predictors in a single model, PBF was still significantly associated with SBP (p = 0.0125) and DBP (p = 0.0316). PBW also remained significantly associated with SBP (p = 0.0297) but not with DBP (p = 0.4169; Table 5). BMI was not significant when PBF and PBW were included in the model.

DISCUSSION

Obesity is one of the most important risk factors for predicting HTN in a high-risk female AA population [18]. According to Gallagher [19] and the American Heart Association [20], overweight individuals are at a greater risk for mortality. However, the prevalent use of BMI as an anthropometric measurement for determining obesity in AAs has resulted in inaccurate measurements of adiposity, thus inaccurately identifying individuals with CVD risk factors. If medical practitioners were instead to use PBF and PBW as a way to determine obesity, AA women who are at risk for HTN could be identified and treated earlier. BMI alone is not an adequate predictor of determining CVD risk factors. However, using PBW and PBF together may be better predictors of HTN (specifically SBP) in AA women while also accounting for age, BMI, and HTN medication. Data in the present study showed PBF to be a better predictor of DBP as well when accounting for age, BMI, and HTN medication. Thus, PBF and PBW are both significant predictors of BP and risk for heart disease in AA women.

The most accurate means of measuring obesity includes weighing an individual under water or in a chamber that uses air displacement to measure body volume; another option involves an X-ray test (dual en-
ergy X-ray absorptiometry, DXA). As these elaborate methods are not easily accessible for the typical clinician, simpler methods have been employed, such as using an electronic scale (as evidence in this study), to measure PBF and PBW. Researchers are becoming aware of the necessity to add other screening modalities for diagnosing obesity. Other measurements of obesity include measuring thickness of fat under the skin in various parts of the body, sending a small amount of electricity through an individual’s body to calculate fat or the aforementioned DXA scan, which all require specific equipment not easily available to clinicians. Therefore, the health care profession still relies heavily on BMI as the standard of care.

Although evidence points to quantity of abdominal fat as a better predictor of risk for diseases and/or death than generalized adiposity, the community still has not reached consensus [21]. Accurate determination of obesity is essential as obesity is the leading health indicator associated with increased risk for coronary heart disease, type 2 diabetes, cancers (endometrial, breast, colon), dyslipidemia, stroke, liver and gallbladder disease, sleep apnea and respiratory problems, osteoarthritis, and gynecological problems (abnormal menses and infertility) [22]. BMI values alone have misclassified body fat in 41 percent of chronic heart failure study participants in a study by Orepoulous et al. [23]. Therefore, a review of the literature suggests that BMI may not be the best predictor of obesity and could be an inaccurate calculation for assessing obesity and associated comorbidities. According to Leitzmann et al. [21], failure of BMI to determine the difference between “fat and fat free mass” makes it an unreliable anthropometric measurement for determining obesity. In some ethnic groups, such as AAs, the use of BMI to establish obesity has resulted in individuals being misidentified as obese and others classified as normal weight, thereby skewing national statistics and personal risk factors. Additionally, it is estimated that there is a 25 percent increase in health care costs when caring for an obese patient compared to care of an individual with a BMI less than 25kg/m [24,25].

Hypertension and Body Mass Index

AAs have the most prevalent rates of HTN, such that the Centers for Disease Control and Prevention now consider this to be an epidemic within the community [2,26]. The American Heart Association (AHA) reported the prevalence of HTN among this group at 44 percent, and the 2001-2002 National Health and Nutrition Examination Survey (NHANES) reported that 41.5 percent of AA women were considered obese, compared to 19.3 percent of Caucasian women [27]. These high rates of obesity and comorbidities in a population that historically has been excluded from research defining anthropometric measures raise concern about the accuracy of defining obesity, risk factors, and comorbid conditions among AA women. This has given rise to research in defining obesity by alternative measures such as visceral adipose tissue (VAT) to assess disease correlates. A significant relationship was found between VAT and HTN among women (p = 0.006), independent of BMI, with AA women exhibiting increased odds of HTN when compared to Hispanic-American women (p < 0.001) [28].

Researchers have found BMI to be significantly related to increases in SBP and DBP in AAs [14]. Race, ethnicity, genetics, biological, behavioral, and environmental factors, including diet and physical activity, also have been implicated as determinants of BP within and across populations [29]. Independent and dependent gene environment interactions have been found with BMI as a predictor of increases in BP among AA women [30]. Considering BMI when assessing high BP in AA populations has been standard care, but there are crucial alternative measures, such as PBF and PBW, that should be elucidated when examining obesity in at-risk populations [2].

Percent Body Fat and Body Mass Index

While PBF is calculated as total body fat mass divided by total mass (from dual energy X-ray absorptiometry × 100), BMI is
calculated using weight and height measurements (weight in kilograms divided by height in meters squared) [1]. According to the World Health Organization, the criterion standard for obesity is PBF greater than 25 percent in men and 35 percent in women [17]. Classification of BMI is as follows: underweight = BMI<18.5, normal weight = BMI 18.5-24.9, overweight = BMI is 25.0-29.9, and obese = BMI is 30.0 or more [1]. Yet accuracy of BMI cutoff values has come under scrutiny. Accuracy of BMI as a diagnostic tool, with cutoff values of > or = 30 kg m (-2), has been found to provide good specificity but miss more than 50 percent of individuals with excess fat [31]. The diagnostic performance of BMI also has been shown to weaken with increasing age and to poorly differentiate between PBF and lean body mass in men and women in the intermediate BMI range (of 25-20.9kg m (-2)) from the third National Health and Nutrition Examination Survey [31]. Due to BMI’s inability to directly measure fat mass and its inherent inability to take into account PBF, this may be an inappropriate tool for detecting obesity, especially given variables such as age, gender, and ethnicity. Using a U.S. population sample from the NHANES to compare PBF, BMI, waist circumference, and waist stature ratio as more accurate measurements for adiposity, the relation of BMI to percentage of fat varies by sex, age, and ethnicity [19]. Therefore, BMI alone may not be the best predictor of obesity.

Postmenopausal women as a cohort also have been overlooked for obesity because of inaccurate measurements of obesity [32]. Blew et al.’s [32] research demonstrated current NIH BMI-based calculations for obesity may be misleading due to a higher PBF in the elderly, yet these individuals generally weigh less than those younger and whose weight may account for muscle mass. Postmenopausal women tend to gain more central adiposity, predisposing them to CVD, and this can vary significantly by ethnicity [33,34]. Results from this study could inform the community by increasing awareness within pre- and postmenopausal cohorts for obese-related health risks, such as HTN and CVD. The established links between BMI and HTN provide evidence for the relevance of measuring obesity as a risk factor [15]. BMI distribution of fat within different age groups does not consider ethnicity as a factor, thereby making it an unreliable method of measurement.

A number of studies link abdominal adiposity to CVD risk [21,23,28]. While BMI has been shown to predict abdominal fat and abdominal subcutaneous fat, waist circumference has been shown to predict visceral fat, thus reinforcing the use of both BMI and waist circumference in clinical practice [2,28]. This suggests that waist circumference and PBF are better indicators than BMI when examining risk for CVD. A higher prevalence of HTN also has been shown to associate with elevated BMI levels among obese Japanese males, even when weight remained stable [35]. Because BMI does not differentiate between body fat and lean mass across age groups, Matsuo et al. suggest regardless of PBF or lean mass, those individuals with higher BMI levels possess higher risks for CVD and could benefit from weight management encouragement [35].

Significant research in the field supports this assertion that BMI may not be an ideal predictor for HTN in AA women. According to Ode et al. [36], “[a]lthough BMI is moderately correlated (r = 0.60-0.82) with PBF,” the use of BMI as opposed to PBF is not recommended because of limited research on the topic. According to Litwin [37], for most people, BMI is an easy, safe, and inexpensive means of determining health risks based on weight; however, use of BMI alone will result in an inaccurate estimate of obesity in AA women and their risk for CVD. Based on Litwin’s [37] results, women’s SBP and DBP show a significantly positive correlation with PBF. Therefore, it may not be the best predictor of weight-related health problems among AA women.

Determining the best method for quantifying adiposity is important as this could potentially identify patients who require health care interventions and different levels of treatment. Although it has not been examined rigorously, in one current study,
associations were significant among women for waist circumference as a more sensitive indicator for obesity than BMI, and this correlated to local gray matter volumes of the brain [38]. Other evidence has shown that when comparing AA and Caucasian postmenopausal women, race significantly altered the prediction of PBF by BMI, whereby, for a given BMI, AA women had a lower PBF compared to Caucasian women [39]. These findings provide evidence that the BMI cut point of 30 kg/m² may be too high for defining obesity in AA and Caucasian postmenopausal women. Although the use of BMI to screen for obesity is important and necessary in primary care and public health arenas, it is also important to acknowledge BMI’s limitations in assessing relative body fatness on an individual level particularly in older women [40].

Limitations of this study include a lack of generalizability, as the study was conducted only on AA women in a particular geographical location. It would serve the scientific community to replicate this study using a larger cohort in a diverse community, as the heterogeneity of AA women in this sample may not be representative of the entire population of AA women. The subjects were also drawn from a convenience sample, not randomly, thereby limiting the representativeness and generalization of data to all AA women. While DXA, a newer, more expensive method of estimating percent body fat, has recently gained momentum in the literature, for the present study, an electronic scale for height and weight measurements was used. Certain scale mechanics could have led to possible inaccuracies of measurements.

Clinical Relevance

Obesity is an epidemic in the United States, especially among minorities, with AAs accounting for the majority of obese and morbidly obese individuals [17]. Accurately identifying obese AAs will assist health care providers in early enrollment of obese patients in CVD risk prevention programs. Though the practicality of obtaining an electronic scale to measure PBF and PBW may not be feasible for all clinicians, if stakeholders and government entities could allocate funding, time, and energy on introducing PBF and PBW into clinic settings, patients would benefit. Patients could receive essential screening, testing, treatment, education, and support to decrease or even eliminate some of their individual risk factors for CVD. By identifying patients who are obese and at risk for CVD, nurses could begin patient education in this domain on day one of hospital admission. Early education allows nurses to reevaluate patients’ knowledge and provide reinforcement education. Early education also allows patients to seek clarification and ask questions regarding the information they received [17].

Our results indicated that for one unit of change in PBF, SBP increases by 0.59 mmHg, and for one unit change in PBW, SBP increases 0.43 mmHg. This finding may aid health care practitioners in considering alternative anthropometric measurements that are clinically important for overall health implications, such as determining obesity in AA women with CVD risk factors. BMI score, which defines weight, was established based on Caucasian men and women [41]; thus BMI is an inaccurate method for identifying obesity in AA women. BMI classifications need to be established to accurately identify AAs at risk for CVD. Late identification of women at risk for CVD could be decreased, and early prevention of heart disease may one day become a reality. By incorporating PBF and PBW into everyday practice, fewer women may be misclassified as obese, thus reducing CVD and associated health disparities.

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