

# DO THE SAME CENTRAL ANTHROPOMETRIC VARIABLES THAT BEST PREDICT BLOOD PRESSURE IN EUROPEAN AMERICANS ALSO BEST PREDICT BLOOD PRESSURE IN AFRICAN AMERICANS?

L. Jerome Brandon, PhD<sup>1</sup>;  
Larry D. Proctor, PhD<sup>2</sup>

**Objectives:** The purpose of this study was to determine if central anthropometric variables that best estimate blood pressure risks in European Americans also best estimate blood pressure risks in African Americans.

**Design:** The participants were 357 normotensive African and European American volunteers with a mean age of  $32.6 \pm 12.4$  years. Participants were evaluated for central adiposity with dual energy X-ray absorptiometry, abdomen and thigh skinfolds, waist and hip circumferences, waist/hip ratio, waist/height ratio, body mass index, and systolic and diastolic blood pressures. Descriptive statistics, partial correlations, ANOVA and stepwise regressions were used to analyze the data.

**Results:** Central adiposity anthropometric indices made different contributions to blood pressure in African and European American men and women. When weight was held constant, waist circumference shared stronger partial relationships with blood pressure in African Americans ( $r = .30$  to  $.47$ ) than in European Americans ( $r = .11$  to  $.32$ ). Waist circumference in combination with other indices was a predictor of systolic and diastolic blood pressures in European American men ( $P < .05$ ) but only a predictor for diastolic blood pressure in African American men and women ( $P < .01$ ). Hip circumference was the only predictor for systolic blood pressure ( $P < .01$ ) in African American men and women.

**Conclusions:** Further research on the relative contributions of central anthropometric indices to blood pressure in African and European Americans is warranted. A better understanding of this relationship may help reduce hypertensive morbidity and mortality disparities between African and European Americans. *Ethn Dis.* 2020;30(2):349-356; doi:10.18865/ed.30.2.349

## INTRODUCTION

Obesity is a global epidemic associated with other cardiometabolic (CMO) risks for developing hypertension and other cardiovascular diseases (CVD) such as type 2 diabetes, dyslipidemia, certain cancers, and sleep apnea.<sup>1</sup> The location of adiposity deposit may generate greater risk than total body fat as stronger relationships have been reported to exist between excess abdominal or central adiposity, hypertension, type 2 diabetes and CVD<sup>2,3</sup> in mostly European American (EA) populations.

Studies in the literature report that African Americans (AA) have a disproportionate prevalence of

elevated central adiposity deposits and more negative health outcomes related to elevated BP than EA.<sup>4,5</sup> Individuals with elevated central adiposity typically have higher CMO risk levels related to increased clustering of CMO risk factors.<sup>2,6</sup> African American women (AAW) also have higher rates of hypertension and CVD (49%) than African American men (AAM; 44%), European American men (EAM; 37%) or European American women (EAW; 32%).<sup>4,5,7,8,9</sup> Forty-two percent of AAW are reported to have elevated blood pressure compared with 27.5% of EAW and 176.4/100,000 AAW die from heart disease compared with 134.6/100,000 EAW. Among men, 289.1/100,000 AAM compared with 217.9/100,000 EAM die from heart disease.<sup>7,10</sup>

Percent trunk fat measured by DXA (a three-component system) has been found to correlate significantly ( $r = .83$ ) with visceral fat measured by magnetic resonance imaging (MRI).<sup>11</sup> The finding that DXA trunk fat can effectively predict central adiposity has been validated by other studies in the literature.<sup>12,13</sup> Since central adiposity is a major contributor to CMO risks and may be partially responsible for

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**Keywords:** Central adiposity; African Americans; Blood Pressure; Anthropometric Variables; European Americans

<sup>1</sup> Department of Kinesiology & Health, Georgia State University, Atlanta, GA

<sup>2</sup> Department of Kinesiology, Sport and Leisure Studies, Grambling State University, Grambling, LA

Address correspondence to L. Jerome Brandon, PhD, FACS; Department of Kinesiology & Health, 125 Decatur Street, Georgia State University, Room 137, Atlanta, GA 30303; 404.413.8368; lbrandon@gsu.edu

the CVD prevalence disparity between AA and EA, a procedure that is simple, effective, inexpensive and population-sensitive is needed.<sup>14</sup>

Waist circumference (WC) is currently the procedure frequently used to assess central adiposity but appears to be less sensitive identifying CMO risks and subsequently CVD in AA, especially AAW.<sup>7,14,15</sup> Reasons for observed discrepancies are not clear but may be related to WC cut-points used to identify CMO risks. The low sensitivity of WC for detecting either elevated BP

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or hypertension suggests that current WC cut-points fail to provide consistency when predicting the likelihood of developing CVD in AA.<sup>14,15</sup>

Waist circumferences  $\geq 102$  cm for men and  $\geq 88$  cm for women have been proposed by an expert panel as cut-points for identifying increased risk for the development of CVD in adults.<sup>14</sup> Studies that serve as the bases for these cut-points were conducted with mostly

EA participants and have more utility for identifying CMO risks in that population than in AA.<sup>14</sup> One study recognized differences in anthropometric estimated central adiposity, morbidity and mortality between AA and EA but suggested that the differences would not justify separate cut-points.<sup>15</sup> However, employing the current system, AA continue to have elevated central adiposity and a higher prevalence CVD morbidity and mortality than EA.<sup>14</sup>

Due to inconsistencies of WC estimating the likelihood of developing CVD for multiracial populations, other anthropometric variables and combinations of variables have been evaluated. Waist-to-height ratios (WHtR) and waist-to-height ratio to the .5 power (WHtR<sup>.5</sup>) have been shown to be effective predictors of central adiposity in AA men and women.<sup>9,16</sup> In a study with 4758 AA adults from the Jackson Heart Study where three measures of body anthropometry (BMI [body mass index], WC, and WHtR) were evaluated for relationship with five CMO risk factors (HDL and LDL cholesterol, triglycerides, diabetes, and hypertension), WHtR correlated higher with HDL cholesterol, triglycerides, diabetes, hypertension, and multiple combinations of the above listed risk factors compared with BMI, and WHtR was also stronger correlate with HDL cholesterol when compared with WC. This study indicates that WC may not be the best anthropometric variable to identify elevated BP or hypertension in AA.<sup>16</sup> Therefore, the purpose of this study was to determine if central adiposity anthropometric indices that best

predict blood pressure in EA also best predict blood pressure in AA.

## METHODS

We employed a comparative research design for this study of 357 volunteer adults (41 AAM; 101 EAM; 98 AAW; 117 EAW) who were aged  $32.6 \pm 12.4$  years and from a Southeast metropolitan area. The participants self-reported racial identity and their fitness levels ranged from poor to moderate as most were not actively participating in structured fitness programs. They were not taking medications that affected body composition or BP. Participants were normotensive and signed an institutional approved informed consent form prior to participation in this study.

All participants were measured for all variables including abdominal (Abd SF) and thigh skinfolds (thigh SF), WC and hip circumferences (hip C), waist-to-hip ratio (WHR), WHtR, WHtR<sup>.5</sup> and BMI. A Lange caliper was used by the same-trained investigator to measure Abd SF and thigh SF to the nearest .5 centimeters (cm). Both variables were measured in triplicate on the right side of the body and a mean of the trials within one cm of each other was the selected value. Waist and hip circumferences were measured in duplicate as WC measurement site was at the level of the naval and hip C was the largest portion of the hip area with the mean of the two trials used as the WC and hip C values, respectively.

Trained staff measured resting blood pressure after the participants

had maintained a sitting position for a minimum of 10 minutes. Two blood pressure measurements were taken five minutes apart and the average of the two measurements was the value used in this study. If participants had elevated blood pressure readings, they were instructed to immediately contact their family physician to have it re-evaluated.

Percent body fat measured by a Lunar DPX-L dual-energy X-ray absorptiometer (model DPX-L with version 3.6R software, Lunar Radiation Corp., Madison, WI) was used as the standard for body composition and central adiposity assessments in this study. This is a non-invasive procedure where measurements are taken as the subject lies in a supine position on a table. Low non-harmful amounts of radiation are emitted during body fat assessments. This procedure uses a three-compartment

model (bone, fat and lean soft tissue) and assumes that the hydration of the mineral-free lean tissue is constant at 0.73 ml g<sup>-1</sup>. Dual-energy X-ray absorptiometry was used for regional and whole-body estimates of bone, fat and lean tissue by measuring the attenuation of two energies of X-rays through the body. The amount of absorbed energy from the X-ray source is used to determine body fat percentages. Dual-energy X-ray absorptiometry performs a series of transverse scans moving from head to toe at 1-cm intervals. Three different scan speeds exist and are based on subject size. Dual-energy X-ray absorptiometry software has the capability of adjusting for subject sex, race and age. Dual-energy X-ray absorptiometer scanners are reported to accurately estimate soft tissue composition with a precision of 1% to 1.5%.<sup>13,17</sup> Total percent

body fat (BF%), trunk BF%, and lean trunk mass were measured.<sup>18</sup>

Dual-energy X-ray absorptiometry trunk measurement provides strong estimates of visceral adipose tissue as high correlations with MRI measures (r=.94 in men and r=.93 in women) was observed in a study by Mohammad et al.<sup>18</sup> These authors concluded that trunk DXA is a valid estimate of visceral adiposity even though it tends to overestimate visceral adipose tissue as BF% levels increase.<sup>18</sup> Therefore, DXA trunk BF% was the assessment for central adiposity in this study.

Data analyses included means and standard deviations calculated with descriptive statistics. Differences between the groups based on sex and race were evaluated with a one-way ANOVA. Partial correlations with weight held constant were calculated to determine the

**Table 1. Physical, circulatory and morphological characteristics of the participants,  $\bar{x} \pm SD$**

Variable	AAM, n = 41	EAM, n=101	AAW, n=98	EAW, n=117	Total, N = 357
Age, yrs	31.4 ± 13.8 <sup>a</sup>	34.5 ± 12.6 <sup>a</sup>	30.2 ± 10.8 <sup>a</sup>	33.4 ± 12.7 <sup>a</sup>	32.6 ± 12.4
Height, cm	181.9 ± 9.7 <sup>a</sup>	178.3 ± 8.4 <sup>b</sup>	168.1 ± 9.6 <sup>c,e</sup>	166.4 ± 8.4 <sup>c,e</sup>	172.2 ± 11.9
Weight, kg	87.2 ± 15.6 <sup>a</sup>	78.7 ± 12.7 <sup>b</sup>	74.0 ± 15.6 <sup>c,e</sup>	64.1 ± 10.4 <sup>d,e</sup>	73.6 ± 15.3
BMI, kg/m <sup>2</sup>	26.0 ± 4.0 <sup>a,b</sup>	24.8 ± 3.4 <sup>a,c</sup>	26.2 ± 5.0 <sup>b</sup>	23.2 ± 3.4 <sup>c</sup>	24.8 ± 4.3
Body fat, %	18.7 ± 9.0 <sup>a</sup>	18.7 ± 7.1 <sup>a</sup>	31.9 ± 9.1 <sup>b,e</sup>	29.0 ± 8.5 <sup>c,e</sup>	25.7 ± 10.2
Central fat, %	20.6 ± 10.8 <sup>a</sup>	21.1 ± 8.5 <sup>a</sup>	31.3 ± 9.8 <sup>b,e</sup>	28.5 ± 9.5 <sup>b,e</sup>	26.3 ± 10.4
Central fat, kg	5.1 ± 5.6 <sup>a</sup>	4.3 ± 3.6 <sup>a</sup>	8.5 ± 6.1 <sup>a</sup>	6.0 ± 4.3 <sup>a</sup>	6.1 ± 5.1
Lean trunk, kg	30.1 ± 4.6 <sup>a</sup>	28.8 ± 3.8 <sup>b</sup>	21.5 ± 43.4 <sup>c,e</sup>	20.8 ± 3.5 <sup>c,e</sup>	24.3 ± 5.6
Waist C, cm	85.3 ± 12.2 <sup>a</sup>	84.8 ± 10.6 <sup>a</sup>	79.2 ± 11.5 <sup>b,e</sup>	74.5 ± 8.6 <sup>c,e</sup>	80.0 ± 11.3
Hip C, cm	101.8 ± 8.1 <sup>b,c</sup>	99.1 ± 7.0 <sup>a,b</sup>	102.0 ± 11.3 <sup>c</sup>	97.1 ± 6.6 <sup>a</sup>	99.5 ± 8.3
Abdom SF, mm	22.6 ± 12.5 <sup>a</sup>	21.9 ± 9.3 <sup>a</sup>	25.0 ± 9.1 <sup>b,e</sup>	22.2 ± 8.8 <sup>a</sup>	22.9 ± 9.6
Thigh SF, cm	14.6 ± 7.8 <sup>a</sup>	15.7 ± 10.1 <sup>a</sup>	30.6 ± 10.7 <sup>b,e</sup>	26.0 ± 8.6 <sup>c,e</sup>	23.0 ± 11.6
WHR	.83 ± .07 <sup>a</sup>	.86 ± .09 <sup>a</sup>	.77 ± .07 <sup>b</sup>	.77 ± .09 <sup>b</sup>	.80 ± .09
WHtR	.47 ± .07 <sup>a,b</sup>	.48 ± .07 <sup>a,b</sup>	.49 ± .07 <sup>b</sup>	.45 ± .05 <sup>a</sup>	.47 ± .06
WHt.5R	.23 ± .03 <sup>a,b</sup>	.24 ± .03 <sup>a,b</sup>	.25 ± .04 <sup>b</sup>	.22 ± .03 <sup>a</sup>	.22 ± .03
SBP, mm Hg	125.9 ± 12.0 <sup>a</sup>	119.7 ± 15.9 <sup>b</sup>	117.0 ± 11.7 <sup>b,c</sup>	114.0 ± 11.4 <sup>c,e</sup>	117.7 ± 13.4
DBP, mm Hg	81.4 ± 11.4 <sup>a</sup>	78.4 ± 10.9 <sup>a,b</sup>	75.8 ± 8.0 <sup>b</sup>	74.6 ± 7.2 <sup>b,e</sup>	76.8 ± 9.3

a, b, c, d. Sample means with the same letter are not different at P<.05.

e. Means are different at P<.05 based on gender.

C, circumference; WHR, waist-to-hip ratio; BMI, body mass index; WHtR, waist-to-height ratio; WHt.5R, waist\*height to .5 ratio; AAM, African American males; EAM, European American males; AAW, African American women; EAW, European American women; SD, standard deviation.

**Table 2. Partial correlations with weight held constant between blood pressure, central adiposity and circulatory variables, r values**

Variables	AAM, n=41		EAM, n=101		AAW, n=98		EAW, n=117	
	SBP	DBP	SBP	DBP	SBP	DBP	SBP	DBP
Waist C, cm	.46 <sup>b</sup>	.47 <sup>b</sup>	.32 <sup>b</sup>	.28 <sup>a</sup>	.30 <sup>a</sup>	.32 <sup>b</sup>	.26 <sup>a</sup>	.11
Hip C, cm	.38 <sup>a</sup>	.29	.37 <sup>b</sup>	.42 <sup>b</sup>	.34 <sup>b</sup>	.30 <sup>a</sup>	.15	.07
ABD SF, mm	.17	.28	.21 <sup>a</sup>	.24 <sup>a</sup>	.20	.24 <sup>a</sup>	.10	-.01
BMI, kg/m <sup>2</sup>	.36 <sup>a</sup>	.24	.10	.13	.25 <sup>a</sup>	.27 <sup>*</sup>	.22 <sup>a</sup>	.15
WHR	-.06	-.11	.61 <sup>b</sup>	.60 <sup>b</sup>	.10	.13	.15	.06
WHR	.36 <sup>a</sup>	.45 <sup>b</sup>	.35 <sup>a</sup>	.60 <sup>b</sup>	.30 <sup>a</sup>	.22	.31 <sup>b</sup>	.33 <sup>b</sup>
Height, cm	.13	.14	.06	.11	.02	.04	.03	-.15
CA fat, %	.26	.43 <sup>b</sup>	.09	.08	.09	.05	.19 <sup>a</sup>	.20 <sup>a</sup>
CA fat, kg	.31 <sup>c</sup>	.45 <sup>b</sup>	.07	.04	.13	.13	.20 <sup>a</sup>	.24 <sup>a</sup>

a. Significant relationship at  $p < .01$ .

b. Significant relationship at  $p < .05$ .

c. Significant relationship at  $p < .10$ .

Waist C, waist circumference; Hip C, hip circumference; ABD SF, abdominal skinfold; BMI, body mass index; WHR, waist hip ratio; CA fat %, central adiposity; CA fat-kg, central adiposity mass; SBP, systolic blood pressure (mm Hg); DBP, diastolic blood pressure (mm Hg); WHtR (waist to height ratio); AAM, African American males; EAM, European American males; AAW, African American women; EAW, European American women.

independent relationship between central adiposity anthropometric indices, SBP and DBP. Regression procedures were used to determine the anthropometric variables that best predicted SBP and DBP from central anthropometric indices.

## RESULTS

The four groups had a mean age of  $32.6 \pm 12.4$  yrs. and were not different ( $P > .05$ ) for age, but AAM ( $87.2 \pm 15.6$  kilograms - kg) were heavier than EAM ( $78.7 \pm 12.7$  kg) and AAW ( $74.0 \pm 15.6$  kg) were heavier than EAW ( $64.1 \pm 10.4$ ) (Table 1). The AAM ( $26.0$  kg/m<sup>2</sup>) and AAW ( $26.2$  kg/m<sup>2</sup>) had a trend toward higher BMI values than EAM ( $24.8$  kg/m<sup>2</sup>) and their BMI values were higher ( $P < .05$ ) than EAW ( $23.2$  kg/m<sup>2</sup>). The BMI values for AA men and women fell within the overweight category while the EA men and women val-

ues fell within the healthy category.

Body fat% of the AAM and EAM (18.7 % each) placed them in a healthy category and were lower than BF% for AAW (31.9%) and EAW (29.0%). The men were not different and had favorable values for DXA measured central adiposity compared with women (men  $\bar{x}$  BF% 20.9%; women 30.5%) and men had a larger lean trunk mass (men 29.5 kg; women 20.4 kg). Interestingly, the trunk fat mass (kg) based on race and sex were not different.

Men had larger WC and smaller thigh SF than the women. African American women had larger values than EAW for all anthropometric measurements, except for WHR. Waist circumferences of the AAW was 79.2 cm compared with 74.5 cm ( $P < .05$ ) for the EAW (Table 1). When the ratio between weight and WC was assessed, the weight/WC ratio was .91 kg/cm for the AAW and .85 kg/cm for the EAW.

Circulatory comparisons indi-

cate that SBP was statistically different between races within sex (125.9 mm Hg AAM vs 119.7 mm Hg EAM) and women (117.0 mm Hg AAW vs 114.0 mm Hg EAW); AAM had higher values ( $P < .05$ ) than any other group. AAW and EAW BP was not different from each other nor from EAM. The AAM DBP was greater than DBP for EAM and women in both races.

With weight held constant, the relationships between central adiposity, SBP and DBP show that WC was related to SBP and DBP in all groups (r values ranged from .26 to .47) except DBP in EAW ( $r = .11$ ). The highest relationships were observed in AAM for both SBP and DBP. Hip C was related to SBP and DBP in EAM ( $r = .37$  and  $.42$ , respectively, SBP) and AAW ( $r = .34$  and  $.30$ , respectively, DBP). Hip C was also related to SBP in AAM ( $r = .38$ ). Abdominal SF was related to SBP and DBP for the EAM (r values range of .21 to .24;  $P < .05$ )

**Table 3. Regression equations where systolic blood pressure is predicted from anthropometrical measurements, R<sup>2</sup> & SEE**

Significant predictor variables, P<.05	AAM, n=41	EAM, n=101	AAW, n=98	EAW, n=117
WHR, abdominal SF, waist C, Hip C, Hip C	.30 & 10.1	.48 & 11.8		
Hip C			.22 & 10.8	
Abdominal and thigh SF, Hip C,				.17 & 10.3

C, circumferences (units centimeters); SF- skinfolds (units millimeters); WHR (units centimeters) ratio, weight (kg), systolic blood pressure (mm Hg), WHtR (waist/height ratio); SEE, standard error of estimates; AAM, African American males; EAM, European American males; AAW, African American women; EAW, European American women.

and to DBP (r=.24) in AAW (Table 2). Waist-to-hip ratio was related to SBP and DBP in EAM and shared the strongest relation of all variable with BP. WHtR was related to SBP and DBP for all groups, except DBP in AAW. Central adiposity fat % and central adiposity fat mass in kg relationships with SBP and DBP were typically not as strong as those for WC and WHtR with SBP and DBP in any of the groups.

When stepwise regressions were used to predict SBP hip C was included in the equations for each sex and race (P<.05), except DBP for EAW. Hip C was the only predictor for AAM and AAW (Table 3). Equations for EAM and EAW included multiple predictors with abdominal SF and hip C included among the predictor variables for SBP equations. The standard er-

ror of estimates (SEE) for the equations ranged between 10.1 to 11.8 mm Hg with AAM having the smallest SEE (10.1 mm Hg).

For DBP, waist C was included in all equations, except for EAW and was the only predictor in SBP equation for AA men and women. The only predictor for EAW DBP equation was WHtR. Multiple predictors were included in both SBP and DBP equations for EAM which accounted for more variance (48% and 52%, respectively) than any other group as neither of the equations for AAs accounted for more than 35% of the variance and the smallest amount of variance was observed for EAW SBP and DBP. Smaller SEEs were observed for women of both sexes for DBP with the largest SEE produced by the DBP equation for AAM (Table 4).

## DISCUSSION

The participants did not differ for age based on sex or race, but AA men and women were heavier and had different BMI classifications than the EA men and women. Findings from this study are based on data from normotensive overweight AA and healthy weight EA adults and may have limited applications for other populations including obese individuals. Racial differences in obesity classifications in this study may have influenced the relationship between select anthropometric variables with BP. To partially offset this difference, weight was held constant when calculating relationships between anthropometric and BP variables. The possibility that different obesity classifications for the races influencing anthropometric and BP rela-

**Table 4. Regression equations where diastolic blood pressure is predicted from anthropometrical measurements, R<sup>2</sup> & SEE**

Significant predictor variables, P<.05	AAM, n=41	EAM, n=100	AAW, n=70	EAW, n=103
WHR, Abdominal SF, Waist C, Hip C		.52 & 7.8		
Waist C	.35 & 9.3			
Waist C			.18 & 7.2	
WHtR				.09 & 6.9

C, circumferences (units centimeters); SF- skinfolds (units millimeters); WHR (units centimeters) ratio, weight (kg), diastolic blood pressure (mm Hg), WHtR (waist/height ratio); SEE, standard error of estimates; AAM, African American males; EAM, European American males; AAW, African American women; EAW, European American women.

tionships is consistent with results observed by others<sup>14,19</sup> in multicultural studies where participants were a similar age, but AA had different relationships between BP and BMI.

The purpose of this study was to determine if central adiposity anthropometric variables that best estimate BP in EA also best estimate BP in AA. Since anthropometric indices can be assessed quickly and reflect different aspects of adiposity, the questions addressed in this study

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*Findings from this study suggest that WC independently or in combination with other anthropometric variables is a significant predictor of DBP in AA and EA, and SBP in EAM.*

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were how effective these indices are for estimating SBP and DBP and whether there are consistency and errors of estimates similar for EA and AA populations. The cut-points for these anthropometric procedures were established with majority EA populations; one study indicates a different relationship between central adiposity, and BP in AA and EA.<sup>14</sup> Inappropriate WC cut-points may be partially responsible for dis-

proportionate success predicting CVD from central anthropometric indices in people of African descent.<sup>20</sup>

Central adiposity estimated by DXA (BF% and fat mass in kg) have been reported to correlate with CMO risks, and these variables were correlated ( $P < .05$ ) in AAM and EAW in this study. This was true when central adiposity was expressed as BF% and fat mass in kg for both sexes and races. Based on findings in this study, relationships between central anthropometric indices and BP were generally stronger than relationships between central adiposity measured by DXA and BP for EAM and AAW.

Waist circumference frequently used as an estimate of central adiposity was different between AAW and EAW, which could be partially responsible for differences observed for relationships between central adiposity and BP in the women. In the current study, AAW had smaller relative WC as their weight/WC ratio was 0.91 kg/cm while the weight/WC ratio for EAW was .85 kg/cm. Waist circumference had a moderate relationship with BP for both AA and EA with AA having stronger within sex relationships when weight was held constant. The significantly higher relationships in AAM for SBP and DBP and the higher relationship for DBP in AAW suggest different relationships between anthropometric assessed central adiposity and BP in AA and EA adults. Consistent with findings in this study, anthropometric ratios (WHtR, WHtR<sup>5</sup>, and WHR) have been shown to produced different associations with central adiposity and disease for EA and AA.<sup>21</sup> Other stud-

ies suggest that WC affects AA and EA differently and perhaps different cut-points should be used for the two races.<sup>4,14,16,20,21</sup> For example, in a 12-year follow up, WC was shown to have a different influence on mortality in AA and EA.<sup>21</sup> Their findings indicate that a WC >102 cm resulted in a 17% greater mortality than a waist circumference of 92.6 cm in EA. In AA participants, a waist circumference of 100 cm had 4.5% lower mortality rate than those with a waist circumference of 94.3 cm. On the other hand, men and women of both races have been reported to experience similar relationships between anthropometric variables correlated with blood pressure and central adiposity.<sup>17,21</sup> Thus, caution appears warranted when using the same WC cut-points as indicators of CMO risks in AA and EA.<sup>14,19,22</sup>

Findings from this study suggest that WC independently or in combination with other anthropometric variables is a significant predictor of DBP in AA and EA, and SBP in EAM. Hip circumference was a significant and only predictor of DBP for both AA men and women. Only single variables (WC for DBP and Hip C for SBP) were predictors of BP in AA, but multiple central anthropometric variables typically were predictors of BP in EA.

These finding suggest that central adiposity anthropometric variables have a different relationship and contribute differently to BP in AA and EA men and women and this finding is consistent with other studies in the literature.<sup>19,23,24,25</sup> Limitation of this study are that the data are for normotensive middle

age EA and AA adults. Part of the differences observed for relationships between central anthropometric indices and BP may be related to the fact that the AA were classified as overweight while the EA were classified as healthy weight.

Further research with a larger number of morphologically diverse AA and EA participants is needed to evaluate the validity of findings in this study. The investigations should evaluate the contributions of race/ethnic central anthropometric indices to BP to determine if different central anthropometric indices or if different combination of indices provide improved clinically meaningful estimates of BP in AA adults.

CONFLICT OF INTEREST

No conflicts of interest to report.

AUTHOR CONTRIBUTIONS

Research concept and design: Brandon, Proctor; Data analysis and interpretation: Brandon, Proctor; Manuscript draft: Brandon, Proctor; Acquisition of funding: Proctor; Administrative: Brandon; Supervision: Proctor

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