Differences in MetS marker prevalence between black African and Caucasian teachers from the North West Province:

Sympathetic Activity and Ambulatory Blood Pressure in Africans (SABPA) Study

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Abstract

Background: The aim of this study was to compare metabolic syndrome (MetS) prevalence between black and Caucasian Africans using different definitions, and secondly, to determine the association between MetS, anthropometric markers and the albumin:creatinine ratio using the new joint statement criteria. This was a target population study. It included 409 urban African and Caucasian men and women (aged 25-65 years) from the North West Province, who were stratified into gender and ethnic groups.

Method: We obtained anthropometric measurements, levels of microalbuminuria, and other markers of MetS (systolic and diastolic blood pressure, glucose, triglycerides and high-density lipoprotein).

Results: The joint statement criteria included more persons with MetS than the other definitions, and Africans presented with more cases of MetS than the Caucasians. The most prevalent risk factors were blood pressure among men, and waist circumference (WC) and glucose among women. African men, as a group, presented with more risk factors than the other groups. African women, although obese, seem to have few cardiovascular risk factors, while all groups presented with an unhealthy WC according to European cut-points. Multiple linear regression analysis, independent of covariates, showed that the albumin:creatinine ratio is explained only by glucose in Africans.

Conclusion: African women, as a group, present with few MetS risk factors, and glucose is associated with renal function risk in Africans.

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Introduction

The metabolic syndrome (MetS) consists of a variety of health risk components. Many definitions for diagnosis have been advanced and this has led to confusion concerning which one should be used. Recently, expert panels have reached consensus regarding a new definition.[1] This new joint statement defines the MetS as a condition in which three or more metabolic abnormalities are found. These abnormalities include high glucose, triglycerides, blood pressure (BP) and waist circumference (WC), and low high-density lipoproteins (HDL).

This new definition does not have WC as a prerequisite for the syndrome, as did the previous International Diabetes Federation (IDF) guidelines. However, it is known that WC is a predictor of health risk[2] and can therefore be used as an easy screening tool. Together with WC, the neck circumference (NC) is a promising easy measurement that can also be used as part of the screening tool for MetS.[3] High NC is associated with metabolic disorders and may be an easier screening tool than WC.[4] Both these measurements have been found to be associated with microalbuminuria in urban Africans.[5] In terms of screening, it would prove useful to determine which of these anthropometric measures could best be used to determine the presence of different risk factors of the MetS.

The new definition could reduce inconsistencies in the diagnosis of persons presenting with the MetS, as a standardised definition can now be used. Although standardisation is necessary, anthropometric cut-points cannot easily be standardised because anthropometric profiles differ between ethnic groups[6] and because of differences in relation to risk factors.[1] Physiological differences such as sodium handling and low aldosterone

and renin activity (renin-angiotensin aldosterone system) have also been known to make Africans more prone to developing certain conditions such as hypertension.[7,8] Urbanisation could also be a health risk factor.[9] Urbanised Africans seem more prone to being overweight and obese,[10,11] possibly due to increased intake of saturated fat and low levels of physical activity.[10] Thus, a Western lifestyle among Africans can lead to the increased incidence of chronic diseases such as diabetes, hypertension and other cardiovascular conditions.[11-14]

Microalbuminuria, as a marker of target organ damage, is no longer a part of this new definition as was the case with previous definitions of the MetS.[15] Since persons presenting with MetS are twice as likely to develop microalbuminuria,[16] which is a marker of endothelial dysfunction, it is necessary to determine the association between microalbuminuria and components of the MetS in Africans.[17] Microalbuminuria expressed as a urinary albumin:creatinine ratio is an indicator of endothelial dysfunction and renal impairment, and early identification is necessary.

The aim of this study was, firstly, to compare the MetS prevalence among urban Africans and Caucasians utilising different definitions of the MetS. The second aim was to determine the association between the MetS, anthropometric markers and microalbuminuria in these groups using the joint statement criteria.

Method

Ethical aspects

The North West Department of Education and the South African Democratic Teachers Union gave the necessary authorisation for this study to take place. Participants signed an informed consent form which was approved by the ethics committee of the North-West University (NWU) (NWU-00036-07S6) and the study conformed to the ethical guidelines for human participants of the World Medical Association Declaration of Helsinki.[18]

Participants

Teachers (n = 409) from the Dr Kenneth Kaunda District in the North West Province of South Africa included Africans (men, n = 101; women, n = 99) and Caucasians (men, n = 101; women, n = 108) aged 25-65 years. Exclusion criteria for participation included pregnancy, lactation, temperature > 37°C, and users of alpha and beta blockers. Blood donors and persons who had been vaccinated in the three months prior to participation were also excluded. For the purpose of this study, further exclusions were made for persons with diabetes (n = 12) who were HIV-positive (n = 19) and had hypercholesterolaemia (n = 11).

Design

Collection of data for each participant continued over a 48-hour period in the working week, from February-May 2008, as well as in the same time frame during 2009. Participants had to stay overnight at the metabolic unit research facility on the NWU campus. The metabolic unit consists of bedrooms, bathrooms, a kitchen and a dining room, as well as a living room with a television. Participants were welcomed and introduced to the experimental set-up to reduce unease,[19] after which they fasted from 22h00. The following day, at 06h00, urine was collected, followed by the taking (in triplicate) of anthropometric measurements by registered biokineticists. Subsequently, BP measurement and blood sampling followed, which was obtained by a registered nurse and medical doctor.

Classification

Diagnosis of the MetS was based on the definitions of the new joint statement by the IDF and the National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP) III. The new joint statement requires any three of the following:

- Elevated WC (population- and country-specific values).
- Elevated triglycerides ($\geq$ 1.7 mmol/L), or drug treatment for elevated triglycerides.
- Reduced HDL cholesterol (< 1.0 mmol/L for males and 1.3 mmol/L for females), or drug treatment for reduced HDL cholesterol.
- High fasting glucose ($\geq$ 5.5 mmol/L), or treatment thereof.
- Increased BP (systolic $\geq$ 130 mmHg and/or diastolic $\geq$ 85 mmHg), or antihypertensive treatment.

IDF and NCEP ATP III guidelines correspond, except for WC, which is a prerequisite in the case of the IDF, and the cut-points differ; IDF WC for the MetS is $\geq$ 94 cm and $\geq$ 80 cm for men and women respectively, while the NCEP ATP III values are defined as being a health risk at > 102 cm and > 88 cm in men and women respectively.

Lifestyle factors

Physical activity was measured by means of the Actical® physical activity monitor, which was water resistant, lightweight and small, using one-minute recording epochs. The monitors were initialised and the results were downloaded using a serial port computer interface. The resulting data were exportable as text files.[20] Monitors were fitted to participants' waists and were worn for 24 hours and removed after their overnight stay at NWU.

Cotinine, a metabolite of nicotine, was measured to evaluate exposure to first- and second-hand smoke.

A widely used cut-off point for determining smoking is > 14 ng/mL.[21]

Gamma-glutamyl transferase (GGT) levels were used to determine alcohol consumption. GGT has also been recommended for early diagnosis of the MetS since it can be a marker of oxidative stress and inflammation.[22] Cut-points for this measure are 65 u/l for men and 45 u/l for women.[23]

HIV-positive status was determined by an antibody test provided by the Department of Health, North West Province.

Anthropometric variables

Mass was measured to the nearest 0.1 kg on a Krups® scale, with the participant wearing minimal clothes and with the weight evenly distributed. The abovementioned measurements were used to calculate body mass index (BMI) by dividing weight (kg) by the square of height (m²).[24]

Maximum stature was measured with a stadiometer to the nearest 0.1cm, while the participant's head was in the Frankfort plane, the heels together and the buttocks and upper back touching the stadiometer.[25]

The circumferences were measured with the participant in a standing position, using a non-extendible and flexible anthropometric tape. Firstly, the neck circumference (NC) was taken: immediately superior to the thyroid cartilage perpendicular to the long axis of the neck.[25] Secondly, the WC was taken at the midpoint between the lower costal rib and the iliac crest, perpendicular to the long axis of the trunk.[25] The hip circumference (HC) was taken at the greatest posterior protuberance of the buttocks perpendicular to the long axis of the trunk.[25]

Urine samples

An overnight (eight-hour) fasting urine sample, to measure microalbuminuria, was obtained after the participants awoke at 06h00. Urine was stored at 4°C after collection, and frozen at -80°C. Analysis involved measurement of immunoprecipitation, enhanced by polyethylene glycol at 450 nm with a Konelab™ 20i Sequential Multiple Analyzer (ThermoScientific, Vantaa, Finland) and the timed-end-point method, (Unicel DXC 800, Beckman and Coulter, Germany) at independent accredited laboratories. Microalbuminuria is expressed as the urinary albumin:creatinine ratio (> 2.9 mg/µmol).

Blood pressure

Participants rested for five minutes in a semi-recumbent position before the first measurement was taken. BP was measured with a sphygmomanometer, employing the Riva-Rocci/Korotkoff method[26] on the non-dominant arm, using an appropriate cuff size for obese and normal persons. Two duplicate measures were taken with a three-to-five-minute resting period between each measurement. The last measurement was used to screen for the MetS prevalence.

Blood samples

Following fasting and resting, a blood sample was obtained from the participants, with a winged infusion set, from the brachial vein branches of the dominant arm by a registered nurse. Sodium fluoride glucose and serum samples for MetS markers were handled according to standardised procedures and stored at -80°C. Analysis was completed using the Konelab™ Sequential Multiple Analyzer and the Unicel DXC 800 at independent accredited laboratories.

Statistical analysis

Statistical analysis was performed using Statistica 9.[27] A single 2 x 2 analysis of covariance (ANCOVA) determined interaction between gender (male and female) and ethnicity (African and Caucasian). Participants were stratified into ethnic and gender groups. Proportions were determined with chi-square statistics. To compare variables, a t-test and ANCOVA were performed, including covariates of BMI, GGT and metabolic equivalent. Single and multiple regression models determined associations between the albumin:creatinine ratio as a dependent variable, while MetS indicators and anthropometric measures were independent variables for each ethnic and gender group. Data were regarded as statistically significant when p-value ≤ 0.05.

Results

Significant two-way interaction effects of gender (male x female) and ethnicity (Africans x Caucasians) were found for systolic blood pressure (SBP) $F_{(1\ 400)} = 6.90$, p-value = 0.01, and diastolic blood pressure (DBP) $F_{(1\ 400)} = 12.96$, p-value = 0.00).

Participant characteristics are shown in Table I. Among the lifestyle factors, there were significant values for alcohol consumption or GGT. Both African groups had high levels of this enzyme, revealing high alcohol consumption, although this was not reflected by the mean triglyceride levels. Although the GGT levels were low in both Caucasian groups, the high standard deviation may show that some of the Caucasian men and women also showed high alcohol consumption. Caucasian men had the highest energy output (3 674.35 ± 2 059) as measured with the Actical® activity meter.

Both male groups demonstrated a mean BMI indicating overweight (≥ 25 kg/m²), as well as a WC that presents a health risk.[28] NC was increased in Caucasian, compared to African, men. African men demonstrated higher BP

Table I: Baseline characteristics of Africans and Caucasians: ANCOVAs (95% confidence interval)

Participant variables	African men, n = 80	Caucasian men, n = 94	P-value	African women, n = 89	Caucasian women, n = 104	P-value
Lifestyle factors						
[a]Age (years)	43.18 ± 8.05	44.96 ± 11.08	0.19	45.39 ± 7.86	44.89 ± 10.7	0.70
[ab]BMI (kg/m^2)	27.57 ± 5.77	29.03 ± 5.20	0.06	**32.73 ± 7.22**	**26.26 ± 6.29**	**0.00**
[a]Cotinine (ng/ml)	**35.46 ± 65.01**	**30.89 ± 96.69**	**0.69**	18.68 ± 55.43	15.07 ± 52.99	0.63
[a,c]GGT (u/L)	**84.84 ± 91.70**	**34.72 ± 29.51**	**0.00**	**47.06 ± 66.60**	**19.61 ± 36.20**	**0.00**
[a,d]METS (kcal)	**2 714.85 ± 800.12**	**3 674.35 ± 2 059.15**	**0.00**	2 646.20 ± 789.63	2 587.36 ± 644.92	0.56
Physiological factors						
Waist circumference (cm)	**95.10 (93.96, 96.25)**	**99.99 (98.84, 101.13)**	**0.00**	88.17 (86.54, 89.81)	90.16 (88.63, 91.69)	0.11
Neck circumference (cm)	**37.99 (37.59, 38.39)**	**40.55 (40.15, 40.95)**	**0.00**	33.83 (32.21, 35.44)	34.71 (33.19, 36.22)	0.48
Glucose (mmol/L)	5.94 (5.63, 6.26)	6.02 (5.70, 6.34)	0.75	5.11 (4.77, 5.45)	5.54 (5.23, 5.85)	0.10
Albumin:creatinine ratio (mg/µmol)	3.27 (0.96, 5.58)	0.38 (-1.93, 2.69)	0.098	1.63 (1.02, 0.24)	0.92 (0.35, 0.5)	0.13
Systolic blood pressure (mmHg)	**140.32 (136.88, 143.76)**	**129.57 (126.13, 133.01)**	**0.00**	126.50 (123.08, 129.93)	125.85 (122.65, 129.06)	0.80
Diastolic blood pressure (mmHg)	**94.28 (91.92, 96.63)**	**84.96 (82.60, 87.32)**	**0.00**	83.00 (80.89, 85.11)	80.87 (78.89, 82.84)	0.19
Triglycerides (mmol/L)	1.68 (1.43, 1.93)	1.65 (1.40, 1.90)	0.88	0.99 (0.86, 1.11)	0.95 (0.83, 1.06)	0.66
High-density lipoprotein (mmol/L)	1.04 (0.97, 1.10)	1.01 (0.95, 1.07)	0.55	**1.22 (1.14, 1.30)**	**1.38 (1.30, 1.46)**	0.01
Clinically diagnosed (excluded in all analyses)						
HIV and AIDS	**13 (12.87)**	**0 (0)**	**0.00**	**6 (6.06)**	**0(0)**	**0.01**
Diabetics	**7 (6.93)**	**1 (0.50)**	0.03	3 (3.03)	1 (0.93)	0.27
Statin use	**1 (0.99)**	**6 (5.94)**	0.05	1 (1.01)	3 (2.78)	0.36

[a] = Not adjusted; adjusting for confounders (BMI, METS, GGT); mean ± SD; 95% confidence interval (CI)

[b] = Body mass index

[c] = Gamma-glutamyl transferase

[d] = Measure of energy expenditure, i.e. physical activity

NB: Values in bold differ significantly, significance: p-value ≤ 0.05. All other values are non-significant.
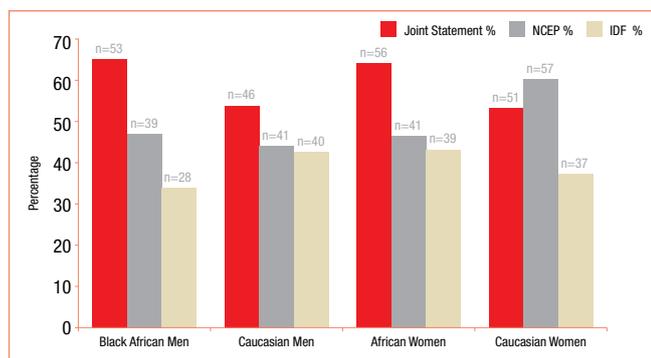

Figure 1: Prevalence of metabolic syndrome based on the new joint statement of the International Diabetes Federation (IDF) and National Cholesterol Education Program (NCEP): ATP III definitions among African and Caucasian Africans. Joint statement 3 > risk factors, IDF WC + 2 or more, NCEP 3 or more.

compared to their Caucasian counterparts. Both male groups had glucose levels above the recommended cut-point[1] with the Caucasian males presenting with the highest glucose levels. The African women demonstrated a mean BMI indicating obesity (> 30 kg/m^2) and had a WC above the recommended cut-point.[28] The only other risk factor present in the African women was their low HDL levels. Caucasian women were found to be overweight with high WCs.

No significant differences were evident between either gender or ethnic groups for the albumin:creatinine ratio. The urinary albumin:creatinine ratio showed levels indicating a health risk in the African men, while not being present in any of the other groups.

Figure 1 shows the differences in prevalence of MetS in our population according to three different definitions. The new joint statement definition included more people with
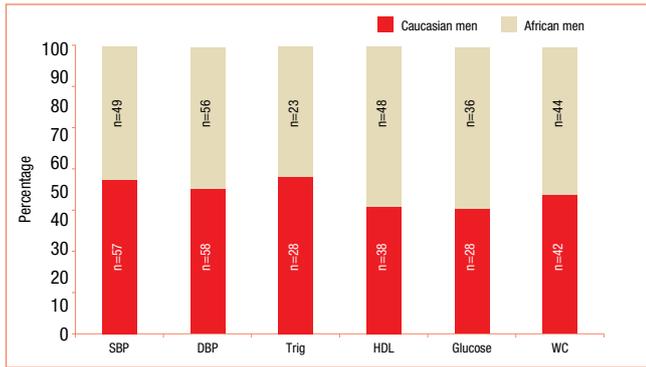
Figure 2: Prevalence of the different MetS risk factors for men, using the new joint statement criteria
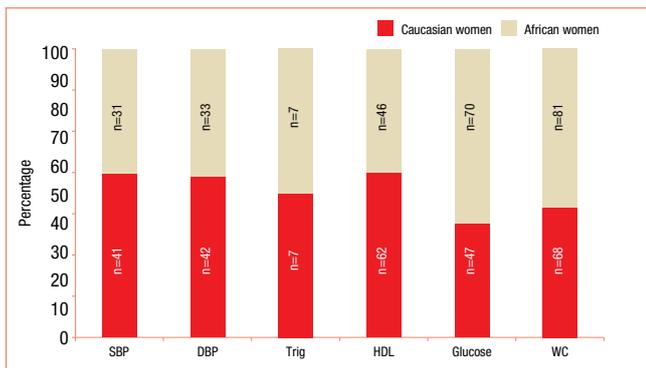

Figure 3: Prevalence of the different MetS risk factors for women, using the new joint statement criteria

the syndrome, whereas the IDF has the lowest prevalence of MetS. More Africans presented with MetS than did their Caucasian counterparts.

Frequencies of the different risk factors using the new joint statement values are shown in Figures 2 and 3 for men and women respectively. High BP was most evident among men, and more so among the Africans (SBP, 70.37%; DBP, 71.60%). The risk factors that were most prevalent among women were high WC (n = 68 African women, 75.56%;

n = 81 Caucasian women, 77.88%) and glucose levels (n = 47 African women, 52.22%; n = 70 Caucasian women, 67.31%), with the highest prevalence occurring among Caucasian women. Low HDL was highly prevalent among the African women (n = 62, 70.45%). Worth mentioning is the very low prevalence of high triglycerides among all the women (n = 14).

Forward stepwise linear regression analysis (Table II) demonstrated that the urinary albumin: creatinine ratio was explained in African men and women by glucose levels only.

Co-variates included measure of energy expenditure, i.e. physical activity (METS), GTT, and BMI. 95% CI (confidence interval)

Discussion

The main aim of this study was to determine the presence of the MetS indicators using the new joint statement definition for African and Caucasian South Africans, and to determine which of the MetS indicators predicted microalbuminuria.

Our data clearly showed that the new definition included more participants with the MetS than the previous set of definitions had done. This could be due to the lack of any prerequisite measures such as WC. Furthermore, BP levels are lower compared to some of the previous definitions' values, which would mean that prehypertensive persons are already eligible to develop the MetS. According to the new joint statement, after excluding diabetics, Africans have the highest prevalence of the MetS. This contradicts the findings of Kalk and Joffe[29] which found that Africans demonstrated a lower prevalence of MetS. This difference could possibly be ascribed to a different definition of the MetS being used, as well as the fact that Kalk and Joffe's study included diabetics.

Table II: Forward stepwise regression analysis in ethnic groups between measures of urinary albumin:creatinine ratio, MetS indicators and anthropometric measures

African men (n = 80)			Caucasian men (n = 90)		
Urinary albumin:creatinine ratio (mg/µmol)			Urinary albumin:creatinine ratio (mg/µmol)		
Adjusted R^2	0.17		Adjusted R^2	0.18	
	ß coefficient (95% CI)	P-value		ß coefficient (95% CI)	P-value
Systolic blood pressure (mmHg)	0.12 (0.28, 0.63)	0.18	Hip circumference (cm)	-0.43 (0.17, 0.75)	0.01
Glucose (µmol/l)	0.49 (0.29, 0.69)	0.00	Neck circumference (cm)	-0.54 (0.09, 0.83)	0.00
African women (n = 89)			Caucasian women (n = 104)		
Urinary albumin:creatinine ratio (mg/µmol)			Urinary albumin:creatinine ratio (mg/µmol)		
Adjusted R^2	0.54		Adjusted R^2	0.55	
	ß coefficient (95% CI)	P-value		ß coefficient (95% CI)	P-value
Neck circumference (cm)	0.33 (0.30, 0.62)	0.00	Triglycerides	0.25 (0.26, 0.66)	0.01
Glucose (µmol/l)	0.76 (0.62, 0.90)	0.00			

Lifestyle factors could have contributed to the higher MetS prevalence. Low-to-medium physical active levels were evident, which could, in part, explain the increased body weight recorded among the participants in our study. As a lifestyle risk factor, alcohol consumption was measured objectively with the use of the liver enzyme, GGT. GGT was high among all Africans, especially the men. However, the triglyceride and glucose levels did not support these GGT findings, suggesting other possible underlying mechanisms such as hepatic steatosis, insulin resistance and increased oxidative stress.[30] Both Caucasian groups had GGT levels below the cut-points,[23] although the standard deviation (SD) was high, implying the possibility of higher alcohol consumption for some participants. Substance abuse, such as alcohol and smoking, has been found to be utilised as coping strategies when challenged with increased stress in urban environments.[9,11,31] Furthermore, increased alcohol intake is known to escalate visceral obesity through an increased energy intake,[31] as well as the risk of developing the MetS components such as high BP and impaired glucose tolerance [32] through endocrine disorders.[31] Alcohol sensitises the arterial wall, increasing BP.[33] In part, the above could explain the high prevalence of both elevated SBP and DBP among the African men.

The apparent high prevalence of MetS in African women (56%) in our study could be ascribed to the suggested European WC cut-points (men, 94 cm and women, 80 cm)[1,28] which are possibly too low, especially for African women. This could mean that the pathology of the MetS will occur at a higher WC cut-point than the suggested 80 cm. If more accurate cut-points are developed, it is possible that a lower occurrence of the MetS will prevail among African women. Rural[34] and urban[35] African obese women have been found to healthier than obese men because obesity in women showed weak associations with cardiovascular risk.[35,36] Recently, contradictory results were demonstrated by Van der Merwe [37] in diabetic participants. Our data excluded clinically confirmed diabetics and HIV-infected participants, while including participants from all BMI groups. A lower cardiovascular risk was revealed, albeit an increased metabolic risk. No clearly conclusive evidence exists on this matter, and further research is needed in controlled homogenous sample groups.

Conversely, the risk of developing the MetS further increases if all groups' overweight status is taken into account. African women run the highest risk, with a mean value indicating obesity. These findings are consistent with previous studies that have also found that BMI is high among women of African descent. [38-40] African women tend to be overweight and obese because they believe "fatness" indicates

affluence and good health, as well as the absence of HIV/AIDS.[41] Faber and Kruger [42] found that African women may perceive that weight loss, rather than "thinness", indicates ill health and financial problems. These women also do not think of themselves as overweight, and this, coupled with diabetes prevalence, has been found to relate to the level of education attained.[33,41] Obesity is high among African women, regardless of economic status.[41] A recent study also revealed that a BMI of more than 29.9 kg/m^2, and less than 25.7 kg/m^2, indicated higher levels of microalbuminuria, as compared to normal weight.[42] Our data support this, as the women in the study demonstrated an overweight-obese status, with glucose levels predicting microalbuminuria. This would lead us to believe that although African woman are obese, their cardiovascular health tends to be good, but metabolically, that is not the case. Unfortunately, the duration of obesity is not known and should be addressed as the metabolic disease progresses. All the above lifestyle factors relate to a Westernised society, often associated with an increased prevalence of obesity.[39,44]

With regard to anthropometric measures, WC has been found to be a better predictor of health risk[2] than other adiposity measures. WC is an indicator of central fat distribution, rather than overall fatness, e.g, in the case of BMI[2] and waist-hip ratio.[45] Central fat, or adipose fat, is known for its metabolically active nature[2,13] which results in increased blood lipids and glucose.[2] The men whose BMI qualified them as overweight, had a WC measurement below the level which constitutes a health risk (> 102 cm), according to the American College of Sports Medicine.[24] In both female groups, WC revealed a health risk (> 88 cm), although African women with an increased BMI demonstrated a lower WC than their overweight Caucasian counterparts.

Additionally, in order to improve the prediction of health risks, NC was calculated as a possible new measurement criterion. Although cut-points do not yet exist for this measurement, it has been found that NC shows promise as a health risk indicator.[3,5] Furthermore, it has been found that NC relates to other measures of health risk such as BMI, fat distribution and insulin resistance, which are, in turn, associated with the MetS.[4,46] In our study, NC did not predict microalbuminuria in the African women as was the case with previous findings[5] in which diabetics were not excluded.

In terms of ethnicity and urine albumin levels, it has been found that albumin levels are higher amongst African Americans than among their Caucasian counterparts.[47] Findings also showed that, as a measure of renal impairment and endothelial dysfunction, microalbuminuria

is more prevalent among Africans, regardless of BP.[7] In the presence of hypertension, for example, in the case of our African male group, these men could be more prone to renal impairment.[48,49] In our current study, the urinary albumin:creatinine ratio was higher in both the African groups. However, only the African males presented with levels constituting a risk.

According to the new joint statement criteria of the MetS, the African women, as a group, were the only participants with mean glucose levels below the risk threshold (< 5.5 mmol/l), while all other groups were above this threshold. African men had the highest risk of the MetS, with BP and glucose exceeding the cut-points. Only glucose predicted the albumin:creatinine ratio which could increase endothelial dysfunction and stroke risk.[50] Africans displayed low levels of triglycerides, [30,32,33] and our study confirms these findings, especially in women. Although the triglyceride levels in African women were favourable, these women presented with low HDL levels. These findings are in contrast with other studies, which found that African women presented with higher HDL levels than their Caucasian counterparts.[32,33] The data of the aforementioned studies were obtained five years previous to the SABPA study, and the difference in HDL levels can possibly be ascribed to lapsed time between these studies, or an increase in the MetS prevalence. Normal HDL levels are more easily obtained when BMI is below 28 kg/m^2.[51] As we have mentioned, in our study, the group of African women was obese, which may relate to their low HDL levels.

A limitation of our study was the cross-sectional design, which cannot be utilised to infer causality. A follow-up study is in progress and future data dissemination should address biochemical measures, e.g. serum creatinine and uric acid as indicators of renal function. Another limitation was that the sample was not selected from the wider African population and it is therefore recommended that our findings be verified in other African communities.

Conclusion

To conclude, according to the new joint statement definition, Africans have a higher prevalence of the MetS. Individually, some African women were identified as having the MetS, but when the mean values of risk factors are taken into consideration, African women, although obese, seem to be healthy. The number of African women with the MetS may decrease once ethnic-specific cut-points have been developed. The higher glucose values, predicting microalbuminuria in both the African gender groups, are likely to contribute to endothelial dysfunction and stroke risk.

Disclosure

No conflict of interest.

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