

# Metabolic Syndrome Does Not Detect Metabolic Risk in African Men Living in the U.S.

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**OBJECTIVE**—Metabolic risk and metabolic syndrome (MetSyn) prevalence were compared in Africans who immigrated to the U.S. and African Americans. If MetSyn were an effective predictor of cardiometabolic risk, then the group with a worse metabolic risk profile would have a higher rate of MetSyn.

**RESEARCH DESIGN AND METHODS**—Cross-sectional analyses were performed on 95 men (39 Africans, 56 African Americans, age  $38 \pm 6$  years [mean  $\pm$  SD]). Glucose tolerance was determined by oral glucose tolerance test, visceral adipose tissue (VAT) was determined by computerized tomography, and MetSyn was determined by the presence of three of five factors: central obesity, hypertriglyceridemia, low levels of HDL cholesterol, hypertension, and fasting hyperglycemia.

**RESULTS**—MetSyn prevalence was similar in Africans and African Americans (10 vs. 13%,  $P = 0.74$ ), but hypertension, glycemia (fasting and 2-h glucose), and VAT were higher in Africans.

**CONCLUSIONS**—African immigrants have a worse metabolic profile than African Americans but a similar prevalence of MetSyn. Therefore, MetSyn may underpredict metabolic risk in Africans.

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Cardiovascular disease (CVD) and type 2 diabetes (T2D) affect millions worldwide. Metabolic syndrome (MetSyn) has received global attention as a tool for identifying risk for CVD and T2D (1). Yet the value and the precise definition of MetSyn are debated (2). To reconcile the various definitions for MetSyn, five key organizations agreed in 2009 on a single definition and wrote a joint statement titled *Harmonizing the Metabolic Syndrome* (1). This definition requires three of five factors to be present: central obesity, hypertriglyceridemia (triglyceride [TG]  $\geq 150$  mg/dL), low HDL cholesterol (HDL-C;  $< 40$  for men,  $< 50$  for women), hypertension (blood pressure [BP]  $\geq 130/85$ ), and fasting hyperglycemia (glucose  $\geq 100$ ).

Furthermore, there have been specific issues regarding the efficacy of MetSyn in people of African descent. Many investigators have independently suggested that MetSyn may not be effective in African Americans because one of the five criteria, hypertriglyceridemia, is rarely present, even when metabolic risk is high (3–5). To determine if MetSyn can detect metabolic risk in black men, we compared Africans living in the U.S. with African Americans to determine if the group with higher metabolic risk—defined by blood pressure, glycemia, and visceral adiposity—also had a higher prevalence of MetSyn.

## RESEARCH DESIGN AND METHODS

All African American men ( $n = 56$ , age range 30–50 years) enrolled in

the cohort Triglyceride and Cardiovascular Risk in African Americans (TARA) were included, as were all African men ( $n = 39$ , age range 30–50 years) enrolled in the cohort Black Africans Living in USA and Cardiovascular Risk from Triglyceride (BART). Recruitment was achieved by newspaper advertisements, flyers, and the National Institutes of Health Web site. The study was approved by the institutional review board of the National Institute of Diabetes and Digestive and Kidney Diseases. Subjects gave informed consent. Participants self-identified as healthy, denied HIV infection, and had no evidence of anemia, liver, kidney, or thyroid disease. No subjects were taking hypoglycemics or hypolipidemics. Alcohol intake, smoking, and family income were similar in Africans and African Americans. Africans were less likely to have health insurance (56 vs. 84%,  $P < 0.01$ ) and more likely to be married (64 vs. 32%,  $P < 0.01$ ). African regions of origin were 59% West, 31% Central, and 10% East. Of Africans, 92% immigrated as adults (age  $\geq 18$  years). Age at immigration for Africans who came to the U.S. as adults was  $29 \pm 7$  years (mean  $\pm$  SD), range 18–45 years, with number of years in the U.S.  $10 \pm 7$  years, range 0.2–27 years. The Africans who emigrated as adults report a 3 kg/year weight gain. Weight change data were not available for African Americans.

The subjects came to the National Institutes of Health Clinical Center after a 12-h fast. After sitting quietly for 30 min, BP was determined three times 5–10 min apart. The mean of the last two determinations were analyzed. Next, participants had a 75-g oral glucose tolerance test, a lipid profile, and their waist circumference (WC) measured at the iliac crest. To measure visceral and subcutaneous adipose tissue (VAT and SAT, respectively), computerized tomographic scans at L2–3 were performed (6).

Comparisons of continuous variables were by unpaired  $t$  test, and categorical variables were compared by  $\chi^2$  test. Analyses were performed with STATA version 11.0 (College Station, TX).

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**RESULTS**—As shown in Table 1, the prevalence of MetSyn was similar in Africans and African Americans (10 vs. 13%,  $P = 0.74$ ). Africans had lower BMI and lower WC. Adjusting for BMI, Africans had higher VAT and VAT-to-SAT ratio. In addition, BP, fasting glucose, 2-h glucose, and prevalence of abnormal glucose tolerance were higher in Africans than African Americans. Three Africans had diabetes diagnosed by 2-h glucose levels between 200 and 210. Even when these three men were excluded, VAT, BP, and glucose levels remained higher in Africans than African Americans. TG and HDL-C levels did not differ by ethnicity. The three most common MetSyn variables in Africans were hypertension, low HDL-C, and fasting hyperglycemia. In African Americans, the three most common MetSyn variables were central obesity, hypertension, and low HDL-C. Hypertriglyceridemia was the least common, occurring in 5% of Africans and 7% of African Americans.

**CONCLUSIONS**—This investigation has two key findings; first, cardiometabolic health was worse in Africans living in the U.S. than in African Americans, and second, MetSyn was unable to detect that Africans had poorer metabolic health than African Americans.

In past decades, Africans entering the U.S. had better cardiometabolic health

than African Americans, often referred to as “the healthy immigrant” effect (7–9). But after arrival in the U.S., metabolic health of Africans appeared to decline secondary to increased consumption of high calorie, low nutritive foods; greater rates of smoking; higher alcohol intake; and less exercise (8–10). However, there has been an epidemiological transition in Africa so that chronic diseases such as T2D, hypertension, CVD, and stroke are now common (11,12). We did not examine the African participants at the time of immigration, so our study presents the combined effect of health at entry to the U.S. and Americanization. However, we speculate that the worse metabolic profile observed in Africans than in African Americans may be a result of a new trend. Specifically, newly arrived Africans may have both suboptimal cardiometabolic health at immigration and experience further deterioration once American lifestyles are adopted. Furthermore, we propose that rapid weight gain after arrival in the U.S., sufficient to transition from normal weight to overweight, contributes to the high VAT, hypertension, and abnormal glucose tolerance observed in the Africans.

Worse metabolic health in Africans than in African Americans did not translate into a higher rate of MetSyn in Africans. This was also true when the lower

WC cutoff of 94 cm was used (data not shown). A leading hypothesis for why MetSyn is not optimally effective in detecting risk for CVD and T2D in African Americans is that hypertriglyceridemia, one of the three most common MetSyn variables in whites, is rarely present in African Americans (3,5,13–15). Our data provide further support for this hypothesis because the prevalence of hypertriglyceridemia was only 5% in Africans and 7% in African Americans. It is important that the African American experience with TG levels and MetSyn predicted the African experience.

Overall, both health care providers and policy makers should be aware that even in the absence of MetSyn, Africans may have suboptimal metabolic health. Greater attention to BP and glucose tolerance, two components of MetSyn, may be a better investment of resources because they are established, independent risk factors.

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U.J.U. collected and analyzed data and wrote the manuscript. D.C.C. collected and analyzed data and edited the manuscript. M.G.K. analyzed data and edited the manuscript. M.R., B.V.M., and B.M.O. collected data and edited the manuscript. A.E.S. collected and analyzed data and wrote the manuscript.

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**Table 1—Participant characteristics**

Parameter	African (n = 39)	African American (n = 56)	P value
Age (years)	38 ± 5	38 ± 6	0.84
BMI (kg/m <sup>2</sup> )	28.0 ± 4.3	30.5 ± 6.4	0.05
VAT (cm <sup>2</sup> )	134.5 ± 7.2	111.9 ± 6.0	<0.05*
SAT (cm <sup>2</sup> )	157.9 ± 10.5	187.2 ± 8.8	<0.05*
VAT-to-SAT ratio	1.0 ± 0.1	0.7 ± 0.1	<0.05*
WC (cm)	93 ± 10	100 ± 16	<0.01
WC ≥102 cm (%)	13	36	<0.01
sBP (mmHg)	130 ± 14	121 ± 13	<0.01
sBP ≥130 mmHg (%)	54	23	<0.01
dBp (mmHg)	79 ± 10	71 ± 9	<0.01
dBp ≥85 mmHg (%)	31	5	<0.01
TG (mg/dL)	77.9 ± 38.3	89.6 ± 40.2	0.16
TG ≥150 mg/dL (%)	5	7	0.69
HDL-C (mg/dL)	43.8 ± 7.7	45.1 ± 10.3	0.51
HDL-C ≤40 mg/dL (%)	28	27	0.88
Fasting glucose (mg/dL)	94 ± 9	89 ± 8	<0.01
Glucose ≥100 mg/dL (%)	23	11	0.10
2-h glucose (mg/dL)	142 ± 29	121 ± 26	<0.01
Abnormal tolerance (%)†	49	29	<0.05
MetSyn (%)	10	13	0.74

Data are means ± SD unless otherwise indicated. sBP, systolic blood pressure; dBp, diastolic blood pressure. \*Adjusted for BMI. †Previously undiagnosed diabetes, impaired glucose tolerance, or impaired fasting glucose.

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