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RESEARCH ARTICLE

Health behavior and perceptions among African American women with metabolic syndrome

Srikrishna Varun Malayala, MD, MPH, FACP* and Ambreen Raza, MD

Department of Internal Medicine, University at Buffalo/Sisters of Charity Hospital – Catholic Health System, Buffalo, NY, USA

Background: Metabolic syndrome is a cluster of different risk factors (abdominal obesity, insulin resistance, high blood pressure, and high cholesterol) that predispose to the development of cardiovascular diseases. African American women (AAW) are easily predisposed to metabolic syndrome due to higher levels of insulin resistance. Various sociodemographic factors further contribute to higher prevalence.
Aim: This study evaluates the current prevalence of metabolic syndrome in AAW and identifies the related sociodemographic risk factors.
Methods: The study utilized 2007–11 National Health and Nutrition Examination Survey (NHANES) data sets from the Centers for Disease Control (CDC). The sample was divided into two groups: AAW with and without metabolic syndrome. Sociodemographic, physical examination, laboratory parameters, and health perceptions were compared between the two groups.
Results: Out of the available sample of 30,442 individuals, 1918 (6.4%) met the inclusion criteria (AAW, age >20, non-pregnant women). The prevalence of metabolic syndrome was 47%. Older age, lower education level, low socioeconomic status, unmarried status, low physical activity level, and smoking were associated with higher prevalence of metabolic syndrome ($p<0.001$). The prevalence of borderline hypertension, hypertension, diabetes, stroke, and cardiovascular diseases was significantly higher in AAW with metabolic syndrome ($p<0.001$).
Conclusion: In spite of the focus on prevention of cardiovascular risk factors and elimination of ethnic and gender disparities, metabolic syndrome is still widely prevalent in AAW and poses a threat to the goals of Healthy People 2020.

Keywords: *African American women*; *heath disparities*; *health education*; *risk factors*; *cardiovascular health*

*Correspondence to: Srikrishna Varun Malayala, 7600 Central Avenue, Philadelphia, PA 19111, USA, Email: Srikrishna.Malayala@tuhs.temple.edu

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Prevention of cardiovascular diseases was a significant challenge to achieve the goals and objectives listed in Healthy People 2000 and 2010. The objective to decrease the mortality from stroke and cardiovascular diseases was accomplished, but gender and ethnic disparities still persist and continue to be a challenge to Healthy People 2020 (1).

Metabolic syndrome is a combination of factors that increase the prevalence and mortality of cardiovascular diseases (2–4). The genetic basis of metabolic syndrome is insulin resistance (5). African Americans are genetically predisposed to metabolic syndrome because of higher insulin resistance than other ethnic groups (6). Ethnic and gender-based differences also exist in the prevalence of acquired factors (dietary habits, higher prevalence of obesity, and inadequate physical inactivity) that elicit higher levels of insulin resistance in African American women (AAW) (7–9).

Objectives of this study

1. Identify the current prevalence of metabolic syndrome in this high-risk population of AAW
2. Identify the prevalence of cardiovascular diseases in AAW with metabolic syndrome
3. Identify the sociodemographic risk factors in the AAW with metabolic syndrome.

Methods

We used the definition formulated by the National Cholesterol Education Program (NCEP) expert panel's third report on detection, evaluation, and treatment of

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cholesterol in adults (Adult Treatment Panel (ATP) III) that defined metabolic syndrome by using five criteria (Table 1). The presence of three out of five clinical criteria defines metabolic syndrome (10).

Data source

We retrieved the data from National Center for Health Statistics (NCHS) data sets of the Centers for Disease Control and Prevention (CDC) (11). The survey combines interviews and physical examinations. The examination consists of medical, dental, physiological measurements, and some laboratory tests conducted in a mobile examination clinic (MEC). The fasting blood draws are taken after an overnight fast of at least 9 h (11). We used the data sets from 2007 to 2011.

Demographic variables

Demographic variables such as age (recategorized into age groups: 20–40, 41–60, and 61–79 years), pregnancy and marital status, educational level, and annual household income were recorded. Data of physical examination variables such as body mass index (BMI), waist circumference (cm), and blood pressure (mmHg) were recorded. The average of the available blood pressure measurements was computed to define current blood pressure measurement.

All the participants were asked about their level of physical activity. Health and Human Services defined the physical activity in four categories (inactivity, low, medium, and high activity levels), and the available data were computed into these categories by a vigorous statistical analysis (12).

Laboratory variables

Data of laboratory variables like fasting blood glucose (mg/dl), HDL cholesterol (mg/dl), LDL cholesterol (mg/dl), total cholesterol (mg/dl), triglyceride level (mg/dl), and hemoglobin A1c (%) were recorded from the data set.

Table 1. Definition of metabolic syndrome

Criteria	Defining level
Abdominal obesity (waist circumference)	
Men	>102 cm (>40 in)
Women	>88 cm (>35 in)
Triglycerides	≥150 mg/dl
HDL cholesterol	
Men	<40 mg/dl
Women	<50 mg/dl
Blood pressure	≥130/ ≥85 mm Hg
Fasting blood glucose	≥110 mg/dl

Note: The presence of three out of five criteria defines metabolic syndrome. The definition was formulated by the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III).
HDL, high-density lipoproteins.

Definition of metabolic syndrome

A combination of different variables as listed below was used to define the presence of metabolic syndrome as per the ATP III definition (10).

a. Abdominal obesity, defined as waist circumference ≥88 cm
b. Triglycerides ≥150 mg/dL, or under medication for high cholesterol
c. HDL cholesterol <50 mg/dL
d. Blood pressure ≥130/≥85 mmHg or under medication for high blood pressure or a preexisting diagnosis of hypertension
e. Fasting glucose ≥110 mg/dL or currently on insulin or other medications for diabetes or a preexisting diagnosis of diabetes or hemoglobin A1c level >5.5% (13)

The number of criteria in each participant was recorded and the sample was divided into two groups: with three or more criteria (with metabolic syndrome) and less than three criteria (without metabolic syndrome).

Health variables

The participants' health status was identified from their history of stroke, coronary artery disease, heart attack, hypertension, prehypertension, diabetes mellitus, prediabetes, and high cholesterol, and if they have a place to go for routine health care. They were asked if they were currently trying to lose weight, decreasing salt and fatty foods and trying to increase physical activity. They were labeled as smokers if they smoked at least 100 cigarettes in their lifetime.

We used SPSS version 21.0 to analyze this complex NHANES data. We analyzed between-group differences on baseline characteristics by using chi-square test for categorical variables and *t* tests for continuous variables. We took the *p*-value as less than 0.05 for statistical significance.

Results

A total of 30,442 people participated in the survey. Out of them, 1965 met the inclusion criteria (African Americans, non-pregnant, and age >19). Pregnant women (44) and participants with extremely high BMI were excluded because waist circumference is one of the criteria to define metabolic syndrome (Fig. 1).

The NHANES had a total sample of 30,442. Out of them, 1965 met the inclusion criteria (African Americans, non-pregnant and age >19). Pregnant women (44) and three participants with extreme values of BMI were excluded from the sample.

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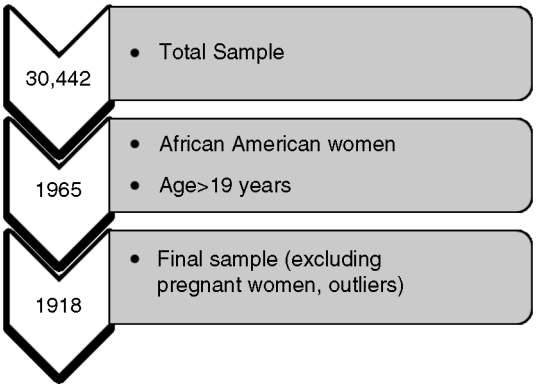

Fig. 1. Final sample used for analysis.

Prevalence of metabolic syndrome

Overall, the prevalence of metabolic syndrome in AAW is 47% (901 out of 1918). All the five components of metabolic syndrome are present in 14% of them and at least four are present in 28.7% of AAW.

Table 2 illustrates the prevalence of components of metabolic syndrome in AAW. We noticed a statistically significant difference in the prevalence of all the five components (or its equivalents) of metabolic syndrome ($p < 0.001$) between the two groups.

Sociodemographic characters

Table 3 describes the demographic characteristics of the selected population. There seems to be a significant difference in age of the AAW with metabolic syndrome (mean = 57.2, SD = 14.3) and without metabolic syndrome (mean = 43.1, SD = 16.8), $p < 0.001$. The prevalence of metabolic syndrome increases with an increasing age (45.6% in >60 years age group compared with 14.2% in 20–40 years age group). The prevalence of metabolic syndrome varied by marital status, $p < 0.001$. The syndrome was more prevalent in AAW whose highest educational level is high school or lesser, $p < 0.001$. A lower household income (<$20,000) was significantly associated with higher prevalence of metabolic syndrome (36.3%), $p = 0.009$. Women with low physical activity had higher prevalence of metabolic syndrome as compared to medium and high physical activity levels, $p < 0.001$. Out of the study population, 69.1% of the women without metabolic syndrome never smoked as compared with 58.6% of the women with the syndrome.

Almost 95.7% of the women with metabolic syndrome had access to health care as compared to 90.0% without metabolic syndrome, $p < 0.001$. About 89.3% of AAW with syndrome used an outpatient clinic or a health center for routine visits; which was significantly more than the women with metabolic syndrome (81.5%).

Table 2. Prevalence of the metabolic syndrome components in AAW

Metabolic syndrome component or its equivalent	AAW without metabolic syndrome (*N* = 1,017) *N* (%)	AAW with metabolic syndrome (*N* = 901) *N* (%)	*p*
Waist circumference	502 (49.4)	808 (89.7)	<0.001
BP ≥130/85 mmHg	350 (34.4)	780 (86.6)	<0.001
Triglycerides ≥150 mg/dL	19 (1.9)	526 (58.4)	<0.001
Fasting blood sugar ≥110 mg/dL	202 (19.9)	748 (83)	<0.001
HDL ≤50 mg/dL	159 (15.6)	659 (73.1)	<0.001

AAW, African American women; BP, blood pressure; HDL, high-density lipoproteins.

Prevalence of medical conditions

The physical examination, laboratory parameters, and medical comorbidities of the sample are described in Table 4. BMI, waist circumference, systolic blood pressure, diastolic blood pressure, fasting glucose level, total cholesterol, hemoglobin A1c level, triglyceride, and LDL cholesterol levels were significantly higher in the AAW with metabolic syndrome ($p < 0.001$). HDL or good cholesterol level was significantly lower in AAW with metabolic syndrome ($p < 0.001$). We observed a significant difference in the prevalence of borderline hypertension, essential hypertension, prediabetes, dyslipidemia, diabetes mellitus, coronary artery disease (angina, history of heart attacks, etc.), and stroke in AAW with and without the syndrome ($p < 0.001$).

Discussion

The NHANES data from 1988 to 1994 showed that the prevalence of metabolic syndrome was about 20.9% (14) and it increased to 39.4% as per the 2003–2006 NHANES census (15). Our study, which utilizes NHANES data from 2007 to 2011, shows that the prevalence has, in fact, increased to 47%. We had a sample of 1918 AAW as compared to the reference studies that had sample of 600–700.

In December 2010, Department of Health and Human Services launched the Healthy People 2020 with four overarching goals. Cardiovascular disease prevention will continue to be a significant challenge to achieve these goals (16).

This increasing prevalence could be explained by the epidemic of obesity. Among African Americans, women had about 57% higher prevalence of obesity than men (17). Some studies report that missing data in health records had led to an underdiagnosis of metabolic syndrome (18). Issues with health insurance and inadequate access to health care were listed as other reasons for this diagnosis (19).

The contribution of metabolic syndrome to cardiovascular mortality is very complex. There is a strong influence

Table 3. Physical examination, laboratory parameters, and comorbidities of the sample

Parameters	AAW without metabolic syndrome mean (SD) or *n* (%)	AAW with metabolic syndrome mean (SD) or *n* (%)	*p*
Physical examination variables			
BMI	29.6 (7.6)	34.4 (8.3)	<0.001
Waist circumference (cm)	94.3 (16.1)	108.3 (15.2)	<0.001
Systolic BP (mm Hg)	120.2 (19.1)	132.5 (21.5)	<0.001
Diastolic BP (mm Hg)	120.2 (19.1)	132.5 (21.5)	<0.001
Laboratory parameters			
Fasting glucose (mg/dl)	88.7 (20.2)	118.4 (65.1)	<0.001
HDL cholesterol (mg/dl)	63.3 (16.7)	54.2 (15.6)	<0.001
LDL cholesterol (mg/dl)	108.9 (33.9)	120.3 (37.9)	<0.001
Total cholesterol (mg/dl)	186.3 (36.7)	196.3 (44.6)	<0.001
Triglycerides (mg/dl)	76.2 (34.8)	138.4 (88.6)	<0.001
Medical conditions, *n* (%)			
Borderline hypertension	111 (11.1)	220 (25.5)	<0.001
Hypertension	252 (24.8)	677 (75.1)	<0.001
Prediabetes	37 (3.9)	61 (10.8)	<0.001
Diabetes mellitus	45 (4.4)	307 (34.1)	<0.001
High cholesterol	139 (17.3)	482 (58.2)	<0.001
Angina	9 (0.9)	35 (3.9)	<0.001
Heart attack	17 (1.7)	42 (4.7)	<0.001
Coronary artery disease	5 (0.5)	26 (2.9)	<0.001
Stroke	32 (3.1)	73 (8.1)	<0.001

AAW, African American women; BMI, body mass index; BP, blood pressure; HDL, high-density lipoprotein; LDL, low-density lipoproteins.

Table 4. Sociodemographic characteristics of AAW with and without metabolic syndrome

Sociodemographic variable	AAW without metabolic syndrome N (%) or mean (SD)	AAW with metabolic syndrome N (%) or mean (SD)	*p*
Age categories			
20–40 years	494 (48.6)	128 (14.2)	<0.001
40–60 years	339 (33.3)	362 (40.2)	
>60 years	184 (18.1)	411 (45.6)	
Age, mean (SD)	43.1 (16.8)	57.2 (14.3)	<0.001
Marital status			
Single	275 (27)	289 (32.1)	0.016
Married	742 (73)	612 (67.9)	
Education level			
Less than high school	214 (21.1)	267 (29.6)	<0.001
High school	581 (57.2)	523 (58.1)	
College or above	219 (21.6)	111 (12.3)	
Annual household income ($)			
< 20,000	165 (28.2)	181 (36.3)	0.009
20,000 to 45,000	189 (32.1)	160 (32.0)	
> 45,000	233 (39.7)	158 (31.7)	
Physical activity			
Low activity	183 (27.2)	218 (41.9)	<0.001
Medium activity	146 (21.7)	100 (19.2)	<0.001
High activity	343 (51.0)	202 (38.8)	<0.001
Access to health care	920 (90.0)	867 (95.7)	
Yes	97 (9.5)	34 (3.8)	
No	829 (81.5)	805 (89.3)	
Routine health-care place	188 (18.5)	96 (10.7)	
Health-care center			
Others			
Smoking			
Never smoker	703 (69.1)	528 (58.6)	<0.001
Ex-smoker	79 (7.8)	170 (18.9)	
Current smoker	235 (23.1)	203 (22.5)	

AAW, African American women.

of many variables on obesity like lifestyle; quality of care, access to care, social constraints, etc (20). The mean age of diagnosis in our study was 57.2 years. Prevalence of metabolic syndrome increases with age as aging per se increases insulin resistance, hormonal alterations, and body fat (21). These innate genetic factors are inevitable, and focus on prevention of metabolic syndrome should rely on modification of sociodemographic factors from a very early age. Like in our study, there are earlier reports saying that marital status seems to influence the prevalence, and high-quality marriages are at lower risk of developing the syndrome (22). Out of the study population, 29.6% of AAW with metabolic syndrome had less than high school education in our study. Lower educational levels are associated with decreased levels of self-efficacy to physical activity (23). Our study also shows that prevalence is higher in AAW with annual household income less than $20,000. Lower income and unsafe environment may limit access to structured exercise facilities and discourage exercise in AAW (24). Cigarette smoking has been described as both a causal and associated factor of metabolic syndrome, and the overall cardiovascular risk increases with cigarette smoking (23).

Many studies have described BMI as a strong predictor of metabolic syndrome (25). There is a greater stigma toward obesity among white women as compared with black women and being thin was not an indicator of health for black women (26). In a study, AAW lost less weight during an intensive weight loss phase as compared to white women (26). This presents the difficulty in weight loss and maintenance in AAW by behavioral lifestyle interventions.

Our study shows that the prevalence of hypertension, diabetes, cardiovascular diseases, and cerebrovascular

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diseases is significantly high in AAW with metabolic syndrome. The increasing prevalence of metabolic syndrome will further increase the prevalence of these diseases.

Surprisingly, 95.7% of AAW with metabolic syndrome had access to health care and 89.3% of them regularly visit an outpatient clinic or health-care center. Most of the AAW who do carry any medical diagnosis that warrants a treatment and 'who are otherwise healthy' might have never been told that they have a syndrome that is of significant concern. They do have a diagnosis of metabolic syndrome and this is the group that needs more focus on the lifestyle modifications. Women who are not 'diagnosed' with metabolic syndrome will obviously not carry a 'risk perception' for the disease.

The designation of metabolic syndrome as a 'syndrome' was a controversial topic as some experts felt that focusing on the individual constituents is more important than lumping those metabolic abnormalities into a syndrome (3, 27, 28). But in a study by Jumean et al., a randomized controlled trial in which 74 people were randomized to receive either a diagnosis of metabolic syndrome or individual cardiovascular risk factors, the patients who received the diagnosis of metabolic syndrome were more likely to modify their health behavior (29).

Strengths

The strength of this study is using a national level data and a large sample size. Very few studies have been done in the past exclusively on AAW health perceptions in relation to the metabolic syndrome. Using a wide number of variables increased the sensitivity of identifying its prevalence.

Limitations

The data is completely based on self-reporting. The data collection was not done in a blinded pattern. The study did not take dietary patterns into consideration because the 2011–2012 data was still not released by NHANES at the time of the study.

Conclusions

In spite of the focus on prevention of cardiovascular risk factors and elimination of ethnic and gender disparities, this study shows that metabolic syndrome is still widely prevalent in AAW. This pattern can be clearly attributed to the sociodemographic risk factors, which are otherwise completely preventable by increasing the early identification and risk perception of the syndrome.

Conflict of interest and funding

The authors have not received any funding or benefits from industry or elsewhere to conduct this study.

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