

Excess Metabolic Syndrome Risks Among Women Health Workers Compared With Men

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Metabolic syndrome is associated with higher rates of cardiovascular morbidity and mortality. Although significant disparities in the risks of metabolic syndrome by occupation type and sex are well documented, the factors associated with metabolic syndrome in low- to middle-income countries remain unclear. These gaps in evidence identify the need for patterns of metabolic syndrome among hospital personnel of both sexes in Nigeria. A total of 256 hospital workers comprising 32.8% men were studied. The mean age of the participants was 42.03±9.4 years. Using International Diabetic Federation

criteria, the prevalence of metabolic syndrome was 24.2%. Women were substantially and significantly more likely to be identified with metabolic syndrome compared with men (34.9% vs 2.4%, respectively; $P=.0001$). This study identified metabolic syndrome among health workers with over one third of women with metabolic syndrome compared with <10% of men. These results support the implementation of lifestyle modification programs for management of metabolic syndrome in the health care workplace. *J Clin Hypertens (Greenwich)*. 2015;17:880–884. © 2015 Wiley Periodicals, Inc.

Cardiovascular diseases account for 17.3 million deaths per year globally, and by 2030 this is expected to rise to 23 million.¹ The factors associated with increased cardiovascular disease tend to cluster in peculiar biological traits such as increased blood pressure (BP), fasting blood glucose, triglycerides, low high-density lipoprotein cholesterol, and abdominal obesity. The constellation of these factors is identified as metabolic syndrome (MetS) and is associated with an approximate doubling of the risk of cardiovascular morbidity and mortality.² MetS is an increasingly important public health issue and is deserving of more clinical attention.

The worldwide prevalence of MetS varies from 13.6% to 46%,^{3–6} depending on the diagnostic criteria used and the population.⁷ The prevalence of MetS in Nigeria has been documented in recent studies as ranging between 12.1% and 54.3%, highest in people with diabetes mellitus.^{5,8–10} The prevalence of MetS has been found to be affected by factors such as age, ethnicity, sex, and occupation.^{11–15} Previous studies have reported differences between sex, with some reporting a higher incidence of MetS in men^{12,13} and some reporting the opposite.³

Recent studies have also shown that the prevalence of MetS varies between occupational groups. Job description and duty time schedules have been shown to affect

the risk of developing MetS.¹⁴ For mechanisms not clear, shift duty workers were more prone to metabolic disturbances.^{16,17} Mismatching of circadian rhythm, social disturbances, and behavioral changes associated with shift duties have been suggested as an independent pathway model for developing MetS.¹⁷ Increasing incidence of coronary heart disease among night duty workers may be explained by a higher prevalence of MetS. MetS is an independent risk factor for coronary events.¹⁸ Studies performed in Spanish¹⁴ and US¹⁵ workers have corroborated this finding. While vast studies exist regarding the sex and occupational effect on MetS, the same cannot be said of developing countries, with rising trends in cardiovascular events. In Nigeria, for example, the factors associated with MetS remain unclear as few data exist on its prevalence. These gaps in evidence identify the need for patterns of MetS among hospital personnel of both sexes in Nigeria. Therefore, this current study aimed to evaluate the prevalence of MetS among Nigerian health personnel and determine the influence of occupation and sex on its prevalence.

METHODS

A total of 256 core hospital workers comprising 172 (67.2%) women were recruited from the University College Hospital. The participants who consented to the study were randomly selected from five clinical departments of the hospital. Baseline clinical and demographic characteristics were obtained from the study participants using a structured questionnaire. Clinical examination for height, weight, hip and waist circumferences was performed. Height was measured in meters (without shoes) and weight in kilograms (with heavy clothing removed and 1 kg deducted for remaining garments).

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Manuscript received: February 3, 2015; **revised:** April 1, 2015;
accepted: April 2, 2015
DOI: 10.1111/jch.12595

Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters. We measured waist circumference on standing patients with a soft tape midway between the lowest rib and the iliac crest. Hip circumference was measured over the widest part of the gluteal region, and the waist-to-hip ratio was calculated as a measure of central obesity. Two BP recordings were obtained from the right arm of patients in a sitting position after 30 minutes of rest. Measurements were taken in 5-minute intervals and the average of the two measurements was used in the analysis.

Laboratory assessment included obtaining venous blood samples in a fasted state for the determination of components of the lipid panel (total cholesterol, high-density cholesterol, low-density cholesterol, and triglycerides), and blood glucose. Serum glucose was measured using glucose oxidase method and lipid profile by enzymatic colorimetric method.

MetS was defined according to International Diabetic Federation (IDF) criteria by the presence of waist circumference ≥ 94 cm in men and ≥ 80 cm in women and any two of the following characteristics: triglycerides ≥ 150 mg/dL; high-density lipoprotein cholesterol < 40 mg/dL in men and < 50 mg/dL in women; BP $\geq 130/85$ mm Hg; and fasting glucose ≥ 100 mg/dL. Ethical approval was obtained from the institutional research ethical review committee, and informed consent was sought from participants before embarking on the study.

Data Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS Inc, Chicago, IL) version 15. Results were expressed as either mean \pm standard deviation or proportions (percentages). Comparisons for statistical significance was by independent Student *t* test for continuous variables or chi-square analysis for categorical variables.

RESULTS

Table I shows the baseline characteristics of the study population. The mean age of participants was 43.0 ± 9.38 years and the overall prevalence of MetS was 24.2%. Women were older and heavier with wider waist circumference and had higher mean diastolic BP, fasting plasma glucose, and low-density lipoprotein cholesterol compared with their male counterparts. Compared with men, women had a higher frequency of MetS (34.9% vs 2.4%, $P < .0001$). As shown in Table II, participants with MetS were older and heavier with higher mean systolic BP and fasting plasma glucose when compared with patients without MetS. Table III shows that women with MetS had significant traditional cardiovascular risk factors compared with women without MetS. As shown in the Figure, nurses were found to have greater frequency of MetS when compared with other participants (40.2% vs 4.8%, $P < .0001$). Age and sex were shown as the independent correlates of MetS (Table IV).

DISCUSSION

The current findings show that the overall prevalence of MetS was 24.2%, with women having excess prevalence of MetS (34.9% vs 2.4%). While participants with MetS were older, with higher mean systolic BP and fasting plasma glucose, women with MetS had greater cardiovascular risk compared with women without MetS.

Compared with other definition criteria, studies that used the IDF criteria tend to find a higher prevalence of MetS in their study population. Despite this observation, IDF criteria being made ethnic-specific has been found to be useful in any population.¹⁹ Also pending the availability of more specific data, the Europid waist circumference cutoff, which was implored in this study, has been advocated for the sub-Saharan African population.²⁰ The prevalence of MetS in the general population ranges between 17% and 25%.²¹ In our study, the frequency of MetS compared with that of a previous study by Ijeh and colleagues²² in Nigeria, who reported a prevalence rate of 30.7%, was at variant with the study by Ulasi and colleagues,²³ who reported a lower prevalence of 15.9% in a Nigerian community. The lower value they observed may be accounted for by the fact that the location of the study was in both rural and semi-urban areas compared with our study, which was located in an urban setting. The prevalence of MetS in an urban setting would be expected to be higher because of the influence of western lifestyle and diet. The prevalence of MetS in developed countries is much higher because of these same reasons. The influence of affluence and intake of atherogenic diets predispose to abdominal obesity, which is a mainspring for MetS. Barrios and colleagues in Spain,²⁴ Ford and colleagues⁷ in the United States, and Yassein and colleagues²⁵ in Jordan reported prevalence rates of 52%, 62.9%, and 52%, respectively.

In the current study, the participants who had MetS were older and had higher BMI, mean systolic BP, and fasting plasma glucose. These findings confirm the constellation nature of metabolic risk factors in MetS. A constant finding in the prevalence of MetS is age dependence, with various studies showing a linear association between age increase and incidence of MetS.^{19,26–28} The present work confirms this thought by demonstrating a significant linear association between age and MetS; the odds of a participant having MetS increased by 8% for every 1-year increase in age. This is probably because aging is associated with the development of insulin resistance, hormonal alterations, and increase in visceral adipose tissue fat—all of which are important in the development of MetS.²⁹ The finding of higher body mass in the participants with MetS may not be surprising since it has been shown that overweight and obesity are associated with insulin resistance and MetS.²⁶ Obesity contributes to hypertension, high serum cholesterol, low high-density lipoprotein, and hyperglycemia. Excess adipose tissue

TABLE I. General Characteristics of the Study Population

| | Men (n=84) | Women (n=172) | Total (N=256) | P Value |
|---|-------------|---------------|---------------|---------|
| Age, y | 36.8±7.60 | 45.8±8.76 | 43.0±9.38 | <.0001 |
| Weight, kg | 73.6±12.57 | 73.5±13.22 | 73.5±12.98 | .954 |
| Height, cm | 171±8.59 | 161.3±7.80 | 164.55±9.26 | <.0001 |
| Body mass index, kg/m ² | 25.2±4.03 | 28.4±5.29 | 27.3±5.13 | <.0001 |
| Hip circumference, cm | 98.2±8.59 | 106.5±11.01 | 103.8±10.98 | <.0001 |
| Waist circumference, cm | 86.3±9.85 | 91.8±10.66 | 90.0±10.70 | <.0001 |
| Waist-hip ratio | 0.89±0.08 | 0.87±0.08 | 0.87±0.08 | .040 |
| Systolic blood pressure, mm Hg | 120.1±14.69 | 116.5±13.73 | 117.7±14.13 | .063 |
| Diastolic blood pressure, mm Hg | 80.4±10.53 | 75.7±10.53 | 77.2±10.73 | <.0001 |
| Mean arterial blood pressure, mm Hg | 91.8±10.01 | 87.8±9.53 | 90.7±9.97 | .142 |
| Fasting plasma glucose, mg/dL | 103.8±19.37 | 97±13.41 | 98.4±15.09 | .031 |
| Total cholesterol, mg/dL | 176.3±18.16 | 172.8±17.37 | 173.6±17.55 | .264 |
| Triglycerides, mg/dL | 96.3±10.59 | 98.4±14.19 | 97.9±13.51 | .272 |
| Low-density lipoprotein cholesterol, mg/dL | 98.2±9.55 | 104.6±11.53 | 103.2±11.42 | <.0001 |
| High-density lipoprotein cholesterol, mg/dL | 42.8±3.53 | 43.4±7.17 | 43.3±6.56 | .417 |
| Prevalence of metabolic syndrome, % | | | | |
| Metabolic syndrome | 2 (2.4) | 60 (34.9) | 62 (24.2) | <.0001 |
| No metabolic syndrome | 82 (97.6) | 112 (65.1) | 194 (75.8) | |

TABLE II. Characteristics of Patients With and Without Metabolic Syndrome

| | Metabolic Syndrome (n=62) | No Metabolic Syndrome (n=194) | P Value |
|--|---------------------------|-------------------------------|---------|
| Age, y | 48.74±8.25 | 41.05±8.96 | .0001 |
| Weight, cm | 79.21±13.17 | 71.73±12.43 | .0001 |
| Body mass index, kg/dL | 30.65±5.69 | 26.26±4.48 | .0001 |
| Height, cm | 160.85±8.32 | 165.70±9.26 | .0001 |
| Hip circumference, cm | 110.90±9.76 | 101.51±10.39 | .0001 |
| Waist circumference, cm | 96.33±9.24 | 87.94±10.35 | .0001 |
| Waist-hip ratio | 0.87±0.06 | 0.87±0.09 | .929 |
| Systolic blood pressure, mm Hg | 120.95±13.00 | 116.72±14.35 | .046 |
| Diastolic blood pressure, mm Hg | 79.05±10.1 | 76.69±10.9 | .143 |
| Fasting plasma glucose, mg/dL | 108.8±12.2 | 94.0±14.0 | .000 |
| Plasma creatinine, mg/dL | 0.94±0.16 | 0.95±0.19 | .767 |
| Plasma urea, mg/dL | 25.76±5.35 | 25.88±5.60 | .888 |
| Total blood cholesterol, mg/dL | 172.84±14.0 | 173.87±18.9 | .700 |
| Triglycerides, mg/dL | 95.39±13.45 | 99.04±13.44 | .076 |
| Low-density lipoprotein cholesterol, mg/dL | 105.26±10.6 | 102.36±11.7 | .094 |
| Highdensity lipoprotein cholesterol, mg/dL | 42.48±3.33 | 43.67±7.51 | .235 |
| Occupation, % | | | |
| Physicians | 91 (96.8) | 3 (3.2) | .0001 |
| Nursing staff | 76 (59.8) | 51 (40.2) | |
| Others | 27 (77.1) | 8 (22.9) | |

releases several products such as nonesterified fatty acids, cytokines, and adiponectin that exacerbate these metabolic risk factors.²⁶ Although anthropometric

measures of adiposity for epidemiological studies were obtained in this current work, these may not be as accurate correlates of MetS when compared with viscera and subcutaneous fat.³⁰⁻³² To strengthen these observations, studies have shown that reduction in the viscera fat by increased physical exercise or surgical removal reduces the major components of MetS, thereby preventing untoward cardiovascular morbidity and mortality.³³⁻³⁵

The female participants had a higher prevalence of MetS (34.9%) compared with the male participants (2.4%). Our finding is consistent with similar findings of studies performed in Nigeria by Osuji and colleagues (23.6% vs 7.6%).³⁶ This similarity is a call for concern since their study participants were known hypertensive patients compared with the current study population who were health personnel and appeared healthy. Several studies performed in other parts of the world have also reported a female preponderance in the prevalence of MetS.^{25,37-39} Additional concern in the current study finding is the excess prevalence of MetS in women, who were shown to have 30 times the risk of MetS when compared with their male counterparts. The reason may be the result of a higher prevalence of obesity in women, which may be caused by sociocultural factors that favor a more sedentary lifestyle for women in this part of the world. There is an urgent need for sex-focused intervention programs in the study group to prevent epidemics of cardiovascular morbidity and mortality in the community.

Occupation types have been shown to affect the frequency of MetS.^{14,15} In this study, nurses had the highest prevalence of MetS among all the occupational groups that were studied. This finding may be a result of the influence of sex on prevalence rate because the nursing profession in Nigeria is dominated by women.

TABLE III. Characteristics of Study Women With Metabolic Syndrome

| | Metabolic Syndrome (n=60) | No Metabolic Syndrome (n=112) | P Value |
|---|---------------------------|-------------------------------|---------|
| Age, y | 48.77±8.0 | 44.18±8.8 | .001 |
| Weight, kg | 78.62±12.3 | 70.78±12.8 | .000 |
| Body mass index, kg/m ² | 30.55±5.58 | 27.25±4.78 | .000 |
| Height, cm | 160.53±8.27 | 161.74±7.54 | .340 |
| Hip circumference, cm | 110.78±9.89 | 104.25±10.94 | .000 |
| Waist circumference, cm | 95.89±8.72 | 89.55±11.0 | .000 |
| Waist-hip ratio | 0.87±0.06 | 0.86±0.09 | .530 |
| Systolic blood pressure, mm Hg | 120.80±12.9 | 114.30±13.7 | .004 |
| Diastolic blood pressure, mm Hg | 78.84±10.1 | 74.07±10.4 | .006 |
| Fasting plasma glucose, mg/dL | 108.47±12.3 | 90.25±8.7 | .000 |
| Plasma creatinine, mg/dL | 0.94±0.16 | 0.97±0.18 | .307 |
| Plasma urea, mg/dL | 25.78±5.43 | 26.06±5.72 | .763 |
| Total blood cholesterol, mg/dL | 172.65±14.2 | 172.93±19.0 | .921 |
| Triglycerides, mg/dL | 95.12±13.3 | 100.31±14.4 | .024 |
| Low-density lipoprotein cholesterol, mg/dL | 105.7±10.4 | 103.9±12.2 | .354 |
| High-density lipoprotein cholesterol, mg/dL | 42.43±3.24 | 44.04±8.63 | .168 |

TABLE IV. Independent Correlates of Metabolic Syndrome in the Study Population

| | Odds Ratio | 95% Confidence Interval | P Value |
|--|------------|-------------------------|---------|
| Age, y | 1.083 | 1.04–1.13 | .000 |
| Women | 27.599 | 2.98–255.6 | .003 |
| Family history of diabetes | 1.236 | 0.52–2.91 | .628 |
| Family history of hypertension | 1.222 | 0.59–2.51 | .585 |
| Cigarette smoking | 0.303 | 0.06–1.60 | .160 |
| Alcohol consumption | 2.299 | 0.56–9.52 | .251 |
| Nagelkerke R ² =0.297, P<.0001. | | | |

Study Limitations

While the relatively small sample size is representative of the hospital community studied, it is a limitation to the generalization of the findings for the entire Nigeria population. The study’s cross-sectional design makes the causality effect inferences difficult. Furthermore, assessment of general adiposity was done in our study. It would have been remarkable to explore the association of visceral fat and biomarkers of inflammations with MetS; however, some studies⁴⁰ showed a strong relationship between waist circumference and visceral fat and more so that the current findings have identified the burden of MetS. There is a need for a prospective and larger population study where all direct correlates of MetS will be considered.

CONCLUSIONS

This study revealed a high prevalence of MetS among female health workers. This calls for deployment of policies to support the implementation of lifestyle modification programs for prevention, control, and management of MetS in the health care workplace. In extrapolating, the prevalence of MetS in non-health workers/general population may be higher.

Disclosure: None.

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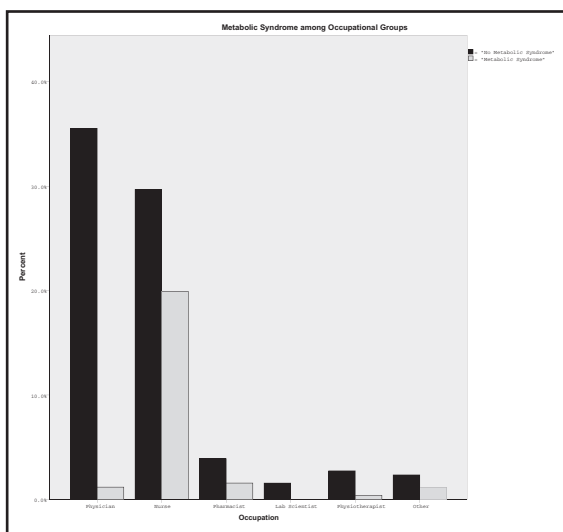


FIGURE. Metabolic syndrome among occupational groups.

Age could also have contributed to this since the nurses were older in comparison with those in the other occupational groups. In the current study, there was a preponderance for shift duties in all participants, although more defined for nurses, which may also explain the higher frequency of MetS among nurses.

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