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Metabolic Syndrome in Patients attending the Staff Clinic of a Nigerian Tertiary Hospital

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KEYWORDS

Metabolic syndrome,

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ABSTRACT

Background/objective
Metabolic syndrome (MetS) is characterised by a clustering of cardiometabolic risk factors. It contributes to morbidity and mortality in adults. The objective of the study was to identify new cases and associated factors of MetS in patients attending a tertiary hospital staff clinic.

Materials and methods
The study was conducted in the staff clinic of University of Benin Teaching Hospital, Benin City. A cross-sectional descriptive design was used. The study population consisted of adult patients (⩾ 18 years) attending the staff clinic. Respondents were selected by simple random sampling method. Diagnosis of MetS was made using the International Diabetes Federation criteria.

Results
A total of 342 patients participated in the study. Their mean age was 45.5 (SD, 9.5) years. Females were 233 (68.1%) and males 109 (31.9%). Fifty-three (15.5%) patients were diagnosed for MetS. Means and standard deviations of almost all criteria for MetS were significantly different between patients with and without MetS. A total of 46 (19.7%) females compared to 7 (6.4%) males had MetS and this difference was statistically significant ($p<0.01$). Age was also an associated factor as 48 (18.9%) participants aged ⩾40 years compared to 5 (5.7%) aged <40 years ($p<0.01$) had MetS. Increased waist circumference (WC), observed in 213 (62.3%) participants was the most frequent and statistically significant contributor to MetS ($p<0.01$).

Conclusions
MetS was present in the study population. Clinical services should be updated for early detection and prompt treatment of the syndrome. Further studies on MetS in different settings are recommended.

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Introduction

The rapid demographic and epidemiological transitions currently experienced in Sub-Saharan African countries are linked to rapid urbanisation which contributes to the rising burdens of non-communicable diseases such as hypertension and

diabetes mellitus.[1-6] This shift in disease burden justifies commensurate increase in relevant health services and research.

Some of the most characteristic disorders in this regard have come to be known as metabolic syndrome (MetS). Definitions of MetS share the common feature of clustering of metabolic and cardiovascular risk factors, such as elevated blood pressure, hyperglycaemia, dyslipidaemia (hypertriglyceridaemia, low levels of high density lipoprotein cholesterol [HDL-C]), and central obesity.[7,8] Specific criteria for MetS developed by different working groups have enabled clinical and epidemiological diagnoses of the syndrome. The commonly cited working groups include the International Diabetes Federation (IDF),[8,9] the revised National Cholesterol Education Program Adult Treatment Panel (NCEP ATP) III[10] and the World Health Organisation.[11] It has been suggested that the IDF definition is more relevant to African populations than other definitions because it uses race-specific definition for visceral obesity as a mandatory criterion for MetS.[6] MetS is widely prevalent and is estimated to be present in about a quarter of the world's adult population, doubling or tripling the likelihood of death from stroke or cardiac attack in affected persons compared to the unaffected.[12]

MetS studies are not yet widely conducted in African countries, but the literature provides some data on its prevalence. For example, using the IDF criteria, the proportion of persons with MetS in a rural community study in Ghana was 35.9%[13] and the proportion among working adults in an Ethiopian study was 43.3%.[14]The proportions reported in Nigerian communities appear to be lower. Community-based studies in Abuja and Enugu that used the IDF criteria showed the prevalence of the syndrome to be 14.9%[6] and 15.9%[15] respectively. Higher proportions of MetS based on the IDF criteria have been reported in patients that had component conditions of MetS – such as hypertension (42.9% in an Oshogbo study[16]) and diabetes (63.6% in a Jos study[17]). A study of MetS in Type 2 diabetes patients in Enugu, Nigeria demonstrated the weak control-to-goals of cardiovascular risk factors among the patients, an indication that the patients were at risk of developing preventable complications.[18] Findings in a recent study in Nnewi, Nigeria, buttressed the fact that MetS is particularly prevalent in Type 2 diabetes patients and that the patients are particularly at risk of hypertension.[19] More recently, a community-based study in Ilora, Oyo State, Nigeria, showed that persons in high socioeconomic group (assessed by a composite score of annual income, occupation and education) had significantly higher systolic blood pressure and fasting plasma glucose than the low and middle socioeconomic group.[20]

The patterns presented above illustrate the need to study MetS in diverse settings. Doing so enables recognition of different patterns of distributions and associated factors and the development of appropriate interventions for early reduction of morbidity and prevention of mortality. Patients in many public hospitals in Nigeria normally have access to routine diagnosis of hypertension and diabetes mellitus. Un-updated practice often limits diagnoses to these two conditions in the syndrome, rather than full-range clinical and laboratory assessments required for the diagnosis of MetS. This may occur even when the required resources are available. This study was thus conducted to assess patients receiving care in a tertiary hospital staff clinic for MetS, including its associated factors.

Subjects and Methods

The study was conducted in the staff clinic of University of Benin Teaching Hospital, Benin City, Nigeria. The staff clinic, which functioned only during general official working hours on outpatient

basis, offers services to staff of UBTH and their spouses. The hospital has the clinical and laboratory resources required to manage MetS.

The study population consisted of adult patients attending UBTH staff clinic. Inclusion criteria were male and female staff and their spouses aged 18 years or more presenting as patients at the staff clinic of UBTH. The following were excluded from the study: pregnant women, women within six weeks postpartum, patients with diseases associated with marked weight loss (such as AIDS and advanced cancers) or fluid retention (such as nephrotic syndrome and congestive cardiac failure), and patients who were too ill to participate.

The minimum sample size was computed using 'sampsi' subpackage in Stata/SE version 10.0 for one-sample comparison of proportion to population value.[21] The inputs were a 0.01 (two-sided) and power of 99%. Since no previous study based on IDF criteria in a similar setting is known, a population proportion of 50% was chosen. The alternative proportion chosen was the highest known IDF proportion of MetS in a previous Nigerian study – 63.6% in a Jos study.[16] This yielded a minimum sample size of 314. Stringent a and power values were used in order to have a fairly large sample size to accommodate wider assumptions of population proportions.

The staff clinic records showed that approximately 10 to 14 patients attended the clinic daily. Equal proportions (50%) of the patients presenting on each of 60 consecutive clinic days (that is, about 5 to 7 per day) were selected by simple random sampling of patients' serial numbers to obtain a sample of 342 patients.

The study design was cross-sectional analytic, involving interviews, anthropometry and biochemical investigations.

Ethical approval for the study was obtained from UBTH Research Ethics Committee. Patients who met the inclusion criteria were given full information on the procedures and those who gave verbal and written informed consent were enrolled as participants. The entire study was conducted in line with the standards and guidelines set in Nigeria's National Code of Health Research Ethics.[22] All newly diagnosed cases for each component condition of MetS were informed of the need to see their doctors at once for further care. This was easy to achieve as the diagnoses were made in the clinic.

Interviews, blood pressure measurements and anthropometry were conducted in the clinic. A questionnaire was designed and researcher-administered to collect data on participants' demographics, income and medical history of the conditions constituting MetS using the IDF criteria. Income was classified using Consolidated Tertiary Institutions Salary Scale (CONTISS), a national salary grading system for government-owned institutions. The scale was categorised into two in line with its usage in the public service where levels 1 to 5 are for junior and levels 6 to 15 for senior civil servants. Systolic (Korotkoff phase I) and diastolic (Korotkoff phase V) blood pressure readings were taken over the left brachial artery, using a mercury sphygmomanometer, by a specialist family physician according to standardised criteria with the participant at rest in a sitting position. Waist circumference (WC) was measured with the aid of a non-stretch tape measure graduated in centimetres. The measurement was done with the patient in the erect position. The tape was snugly applied to the skin without compressing it. The measurement was taken in the horizontal plane as the narrowest circumference in centimetres between the inferior costal margins and the superior borders of the iliac crests bilaterally, over the umbilicus anteriorly, with the arms by the sides but away from the trunk.

Fasting plasma lipid profile measured were high-density lipoprotein cholesterol (HDL-C) and total triglycerides (TG). Fasting plasma glucose was assessed using the glucose oxidase method. The laboratory tests were conducted in UBTH. Further details of the standard methods used in taking the measurements are found in WHO STEPS manual.[23]

MetS was diagnosed using the criteria set by the IDF:[6,9] the presence of increased WC (males: >94 cm; females: >80 cm) plus any 2 of the following

a. Systolic blood pressure 130 mmHg or more or diastolic blood pressure 85mmHg or more, or both or hypertensive on treatment.

b. Fasting plasma glucose 100 mg/dL or more or diabetes mellitus on treatment.

c. Triglycerides 150 mg/dL or more or on triglyceride treatment

d. HDL-C <40 mg/dL in men or <50 mg/dL in women or on HDL-C treatment.

Data analysis

Data was entered into SPSS version 20 for collation, storage and table generation. Sociodemographic variables were presented with categorised frequencies in simple frequency tables. They were also cross-tabulated as independent variables with categories (defined by cut-offs) of each component of the syndrome and with the presence and absence of MetS. The means and standard deviations of age and each component of the syndrome were also presented for all participants and further classified according to the presence and absence of MetS. Further analysis was done using the Comapre2 Program in WinPepi version 11.0. For categorical variables, tests for statistically significant associations and differences were conducted using Fisher's exact probability test and odds ratios with the corresponding 95% Fisher's exact confidence intervals (CIs). In computing the odds ratios, the referent categories of independent variables were assigned the value of 1.00; where a comparison between males and females were made, the former was used as the referent category. For continuous variables, means were compared using the Student *t*-test. Statistical significance was set at $p<0.05$ and CIs that excluded the null value of 1.00.

Results

A total of 342 persons gave informed consent to and participated in the study, out of 343 who were initially approached, giving a response proportion of 99.7%. The respondents' mean age was 45.5 years (SD, 9.5 years) and the age range was 23 to 65 years. As shown in Table I, the predominant categories of the study participants included females, 233 (68.1%); the married, 289 (84.5%); Christians 329 (96.2%); and lower grade income earners, 225 (65.8%). The table also shows that 98 (28.7%) of the participants reported that they were known hypertensives and 19 (5.6%) that they were known diabetics; 104 (30.4%) had at least one of the two conditions and 13 (3.8%) had both.

Table II shows the means and standard deviations of age and criteria for MetS categorised to test for statistically significant differences between patients with and without MetS. It shows that all the parameters measured, except HDL-C for males, had statistically significant differences ($p<0.01$) between both categories. The mean WC for females (90.3cm [SD, 11.2cm]) was higher than that of males (85.9cm [SD, 10.9cm]), reflecting a reversal compared to the higher cut-off values for males. The table also shows statistically significant difference between the mean ages of those with (48.9 [SD, 7.0] years) and without (44.9 [SD, 9.8] years) MetS.

Table III shows that the modal condition within MetS was increased WC, 213 (62.3%), affecting 186 (79.8%) females compared to 27 (24.8%) males. By

statistical significance, this was the only condition that differentiated males from females ($p<0.01$). The higher proportions of females with low levels of HDL-C ($p=0.07$) and the higher percentage of males with hypertriglyceridaemia ($p=0.06$) were not sufficient to reflect statistical significance.

Table I: Socio-demographic characteristics and medical history of participants (N=342)

Variables	Categories (%)	Frequencies (%)
Sex	Male	109 (31.9)
	Female	233 (68.1)
Age in years	23 – 39	88 (25.7)
	40 – 59	240 (70.2)
	‡60	14 (4.1)
Educational level	Primary	71 (20.8)
	Secondary	92 (26.9)
	Tertiary	179 (52.3)
Marital status	Single	31 (9.1)
	Married	289 (84.5)
	Divorced & widow(er)s	22 (6.4)
Income category by CONTISS salary grade level & equivalent	Junior: Levels 1–5	182 (53.2)
	Senior: Levels 6–15	160 (46.8)
Occupational group	Physicians, nurses, pharmacists & laboratory scientists	84 (24.6)
	Engineers & non-health technicians*	180 (52.6)
	Administrative staff	78 (22.8)
Religion	Christianity	329 (96.2)
	African traditional religion & Islam	13 (3.8)
Medical history	Hypertension	98 (28.7)**
	Diabetes mellitus	19 (5.6)**

CONTISS, consolidated tertiary institutions salary scale
*Include the following: catering staff, carpenters, engineering technicians, linen services staff, drivers, etc.
**Multiple responses. A total of 104 (30.4%) had at least one of hypertension or diabetes mellitus.

Table II: Means and standard deviations of age and criteria for metabolic syndrome: comparison between respondents with and without metabolic syndrome
(N=342)

Age and criteria for metabolic syndrome	Total Mean [SD]	Metabolic syndrome present Mean [SD]	Metabolic syndrome absent Mean [SD]	*P*
Age (years)	45.5 [9.5]	48.9 [7.0]	44.9 [9.8]	<0.01
Systolic blood pressure (mmHg)	119.0 [18.8]	130.2 [21.1]	117.0 [17.6]	<0.01
Diastolic blood pressure (mmHg)	77.3 [12.1]	84.3 [13.2]	76.0 [11.4]	<0.01
Waist circumference (cm): Males	85.9 [10.9]	103.3 [3.5]	84.7 [10.2]	<0.01
Waist circumference (cm): Females	90.3 [11.2]	96.6 [10.6]	88.8 [10.8]	<0.01
Fasting plasma glucose (mg/dL)	90.5 [24.8]	101.3 [34.3]	88.5 [22.1]	<0.01
Triglyceride (mg/dL)	96.0 [38.1]	117.8 [47.0]	92.0 [34.9]	<0.01
High density lipoprotein cholesterol (mg/dL): Males	59.9 [25.9]	50.1 [20.8]	60.6 [26.1]	0.31
High density lipoprotein cholesterol (mg/dL): Females	64.9 [26.8]	54.1 [25.4]	67.5 [26.6]	<0.01

Table IV shows that 53 (15.5%) of the participants were diagnosed for MetS. The table further shows that sex, age, and educational level had statistically significant associations with MetS.

A total of 46 (19.7%) females compared to 7 (6.4%) males had MetS ($p<0.01$). Similarly, 48 (18.9%) persons aged 40 years and above compared to 5 (5.7%) of the referent category of persons less than 40 years old had MetS ($p<0.01$).

Only 6 (6.5%) participants with secondary education compared to 16 (22.5%) with primary education (representing the lowest and highest proportions respectively) had MetS.

This difference was statistically significant and explains the overall statistically significant association between both variables ($p<0.01$).

Occupation, marital status and income were not significantly associated with MetS.

Table III: Association between sex and individual criteria for metabolic syndrome (N=342)

Criteria for metabolic syndrome (%)		Sex		*p*	OR (95% CI)
		Male (%) n=109 (31.9)	Female (%) n=233 (68.1)		
Increased waist circumference	Present n=213 (62.3)	27 (24.8)	186 (79.8)	<0.01	12.02 (6.78-21.45)
	Absent n=129 (37.7)	82 (75.2)	47 (20.2)		
Elevated blood pressure & hypertensive on treatment	Present n=135 (39.5)	43 (39.4)	92 (39.5)	1.00	1.00 (0.61-1.64)
	Absent n=207 (60.5)	66 (60.6)	141 (60.5)		
Low levels of high density lipoprotein or on treatment	Present n=82 (24.0)	19 (17.4)	63 (27.0)	0.06	1.76 (0.96-3.30)
	Absent n=260 (76.0)	90 (82.6)	170 (73.0)		
Hyperglycaemia & Type 2 diabetes mellitus on treatment	Present n=45 (13.2)	14 (12.8)	31 (13.3)	1.00	1.04 (0.51-2.22)
	Absent n=297 (86.8)	95 (87.2)	202 (86.7)		
Elevated triglyceride levels or on triglyceride treatment	Present n=24 (7.0)	12 (11.0)	12 (5.2)	0.07	0.44 (0.17-1.11)
	Absent n=318 (93.0)	97 (89.0)	221 (94.8)		

OR, Odds ratio; CI, Confidence interval; referent category, Male

Table IV: Association between socio-demographic variables and metabolic syndrome (N=342)

Variables	Categories (%)	Metabolic syndrome		*p*	OR (95% CI)
		Present (%) n=53 (15.5)	Absent (%) n=289 (84.5)		
Sex	Male	7 (6.4)	102 (93.6)	<0.01	1.00
	Female	46 (19.7)	187 (80.3)		3.58 (1.53-9.73)
Age in years	<40	5 (5.7)	83 (94.3)		1.00
	=40	48 (18.9)	206 (81.1)	<0.01	3.87 (1.47-12.85)
Educational level	Primary	16 (22.5)	55 (77.5)		1.00
	Secondary	6 (6.5)	86 (93.5)	0.01	0.24 (0.07-0.70)
	Tertiary	31 (17.3)	148 (82.7)		0.72 (0.35-1.53)
Marital status	Single	3 (9.7)	28 (90.3)		1.00
	Married, divorced, widow(er)	50 (16.1)	261 (83.9)	0.44	1.79 (0.52-9.53)
Income category by CONTISS salary grade level & equivalent	Junior: Levels 1–5	25 (13.7)	157 (86.3)		1.00
	Senior: Levels 6-15	28 (17.5)	132 (82.5)	0.37	1.33 (0.71-2.51)
Occupational group	Administrative staff, engineers & non-health technicians	36 (14.0)	222 (86.0)		1.00
	Physicians, nurses, pharmacists & lab scientists	17 (20.2)	67 (79.8)	0.17	1.56 (0.77-3.07)

OR, Odds ratio; CI, Confidence interval; lab, laboratory

Discussion

The increasing attention currently being given to MetS in the medical literature from different settings offers an opportunity for improved understanding of the clinical and epidemiological features of the disease. The findings of this study contribute to this understanding and provide clearer insights into its risk factors.

The proportion of patients diagnosed for MetS in this study is to be understood against the background of four features of the participants. First, some of the participants were already being managed for disease components of the syndrome such as hypertension and diabetes mellitus. Secondly, the population was predominantly female, consistent with the roughly 1:2 male-to-female ratio of outpatient hospital attendance usual in Nigeria.[24,25] Thirdly, their level of education was relatively high, as expected of staff of a tertiary hospital (and their spouses), compared to the general population. Fourthly, it is possible that the participants, because of their relationship with a teaching hospital, had better access to health information and health services than the general population. These features also place some restrictions on the comparison of the findings of this study with those of others, most of which are either community-based or targeted at patients who all have either hypertension or diabetes.

Increased WC emerged as a major contributory factor to MetS in this study in two ways: it was the modal criterion of MetS in the population and the only statistically significant differentiating criterion between males and females. This variable is important as it measures abdominal visceral adiposity which has been associated with cardiometabolic morbidity and mortality.[26,27] A Cameroonian study similarly suggests that central obesity (measured by increased WC) is the key determinant of the prevalence of the MetS in sub Saharan Africa.[5] It is therefore a major condition to target for control at clinical and public health levels.

The higher proportion of females than males diagnosed for MetS in this study is well recognised in the literature as a pattern that exists regardless of the MetS criteria used.[13,28] Whereas the IDF cut-off for WC is lower for females than males, the mean WC for females in this study was higher than that of males. This explains the much higher proportion of females having increased WCs and MetS than males by IDF criteria. The larger WC of females being an explanation for their higher prevalence of MetS has similarly been adduced in other studies.[6,13,15,28]

The rise in the prevalence of MetS with age in this study is consistent with findings from several other studies. Some studies have shown the prevalence to be particularly high in the middle-aged (40 to 59 years)[13,25-27] and others in the elderly ($\geq$60 years).[29,30]

The decreasing order of proportions of patients with MetS from primary through tertiary to secondary is somewhat complicated. The non-linearity necessitates further studies which are also required to clarify the association. It is, nevertheless, possible that persons with primary educational level had relatively less access to or were not interested in health information or were less willing to adopt healthful lifestyles, such as healthful diets, that would prevent or control MetS than those at secondary educational level. In comparison, studies in developed countries suggest that high educational status is protective against MetS.[31,32]

Still within the context of socioeconomic status, and unlike the significant association found with educational level, neither income nor occupation was significantly associated with MetS. This situation suggests that the relationship between socioeconomic status and MetS is not straightforward and that its understanding requires the unbundling of the specific variables usually aggregated as socioeconomic status.

The strengths of this study mainly derive from its setting. To the best of the knowledge of the authors, this is the first study in Nigeria measuring the prevalence of MetS in a population of patients not restricted to a particular disease. The use of patients being managed or seeking treatment for conditions other than MetS in this study exemplifies the use of opportunistic case finding strategy to detect new cases of MetS. This strategy is important because it can readily be extended into routine clinical services. Beyond the detection of new cases of MetS, the measurement of the proportion of the study population possessing each criterion and the identification of factors associated with MetS, provide opportunities for developing and prioritising appropriate interventions. In particular, the use of the IDF criteria, which makes increased WC mandatory, enabled the identification of MetS in more patients than other criteria would have permitted. This is important because, as earlier stated, increased WC is an important metabolic pathology in sub-Saharan Africans.

This study has implications for the patients, continued health service delivery and medical research. The study demonstrates the fact that the patients had various levels of previously undetected cardiometabolic risks. As MetS and its component conditions are increasingly contributing to deaths in adults in developing countries, its detection in this study indicates an opportunity to reduce morbidity and mortality from cardiovascular and metabolic causes. With the findings in this study, newly diagnosed cases may place increased demand on clinical resources and skills to broaden the scope of health service delivery to include the routine management of MetS at the study site and at similar settings. The dearth of previous studies with which to suitably discuss various findings in this study also implies a gap in research in the type of setting used in this study, thus also implying an opportunity for further research.

Despite the strengths of this study, its setting imposes limitations on the extent to which findings may be generalised, not only to the general population but also to patients in Nigerian clinics.

Conclusion

This study identified MetS and its constituent conditions in a setting of available clinical and laboratory resources. Relatively high proportions of females, older persons and persons with primary education had MetS, and WC was the major contributory condition. The findings necessitate the upgrade of clinical services for early detection and prompt treatment of the syndrome and its components as a routine service. The finding of any of the components should heighten the index of suspicion for the syndrome. Large-scale health education programmes focussing on dietary control, physical exercises, and health checkups for MetS and its components are recommended as lifestyle modification measures. Update training programmes for physicians and other health workers and for health researchers are necessary in this regard. The National Expert Committee on Non-Communicable Diseases should play a leadership role in these regards. Periodic national and local surveys are required in different settings to better understand the varied epidemiology of MetS and to establish and strengthen multilevel control programmes for it.

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