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Prevalence of Metabolic Syndrome in a Rural and Urban Community in South-West Nigeria Using Three Different Definitions

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Authors' contributions

This work was carried out in collaboration between all authors. Author ENA conceived the study, was involved in data collection, laboratory analysis of blood samples and proof reading of the manuscript. Author OAO supervised the research. Author OAA did the statistical analysis, writing of the methodology and discussion while authors OJ and JS were involved in data collection. All authors read and approved the final manuscript.

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ABSTRACT

Background: The prevalence of Metabolic syndrome (MetS) is increasing in sub-Saharan Africa because of rapid demographic and epidemiologic transitions. There are several criteria for diagnosing MetS. This study compared the prevalence of MetS in a rural and urban community in

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South-west Nigeria using three different definitions.
Methods: A descriptive cross sectional study was conducted. Multi-stage sampling method was used to select a rural and urban community from two contiguous states in South-west Nigeria. Five hundred and thirty-five apparently healthy subjects aged 18 years and above were consecutively recruited from selected communities. Rural-urban comparison of prevalence of Metabolic syndrome using the International Diabetes Federation (IDF), National Cholesterol Education Program—Third Adult Treatment Panel (NCEP ATP III) and the Joint Interim Statement (JIS) definitions was done.
Results: The general prevalence of MetS according to the JIS, IDF and NCEP definitions was 23%, 21.7% and 21.1% respectively. The prevalence of MetS was higher in the urban than rural community irrespective of the definition used (28.2% vs 13.7% NCEP, 30.8% vs 12.2% IDF, 33.3% vs 12.2% JIS) (*P*< .001). MetS prevalence was higher in females using the JIS (15.8% vs 25.7%) (*P* =.02) and IDF (13.0% vs 24.9%) (*P* = .003) definitions. The proportion of males and females with MetS was not significantly different using the NCEP ATP III definition (*P* = .17).
Conclusion: Prevalence of MetS was high in rural and urban communities in South-west Nigeria regardless of the criteria used. The need for public health measures to reduce the prevalence of MetS in Nigeria cannot be over emphasized.

Keywords: Metabolic syndrome; prevalence; rural; urban; Nigeria.

1. INTRODUCTION

Metabolic syndrome (MetS) also considered an abnormality of energy utilization and storage is a complex disorder composed of interconnected risk factors [1]. The characterizing features include hypertension, hyperglycaemia, hypertriglyceridaemia, decreased high density lipoprotein cholesterol (HDL-C) and excess adiposity most especially abdominal obesity [2]. Clustering of these interlinked metabolic abnormalities in a single individual has been reported to considerably increase the risk for developing several non-communicable diseases such as Type 2 diabetes mellitus (T2DM) cardiovascular diseases (CVD), and cancers [1,3]. Additionally, the risk of all-cause mortality is increased in the presence of the syndrome [4].

Several formal definitions consisting of specified diagnostic parameters for identifying individuals with the syndrome have been made available by the World Health Organization (WHO) [5], the International Diabetes Federation (IDF) [6], National Cholesterol Education Program—Third Adult Treatment Panel (NCEP ATPIII) [7] and the Joint Interim Statement (JIS) was proposed by IDF and AHA/NHLBI to harmonize the definition of MetS [1]. Although all the most commonly utilized definitions encompass similar characteristics, they differ somewhat in assessment parameters such as measures of obesity, cut off values for anthropometric indices and degree of priority attached to certain components.

A study has shown that between 20 – 25% of the global adult population have MetS. Furthermore, the likelihood of dying from and developing cardiovascular events are two-fold and three-fold higher compared with people without the syndrome respectively [8]. In addition, the odds of developing T2DM is five times higher in people with MetS [8].

The prevalence of MetS varies depending on the definition used. A 12-year systematic review from Nigeria reported that based on the WHO, NCEP ATP III and IDF definitions, the overall prevalence of MetS in Nigeria is 31.7%, 27.9%, and 28.1% respectively. However, the mean prevalence of MetS from hospital base studies was 40.8%, 41.8% and 38.4% using WHO, NCEP-ATPIII and IDF criteria respectively [9].

The role of urbanization in the development of Cardiovascular (CV) risk factors such as hypertension, obesity and dyslipidemia has been established [10]. Nigeria like other sub-Saharan African countries is experiencing rapid demographic and epidemiologic transitions responsible for the fast rate of urbanization [11]. This development has led to changes in feeding habits and physical activity patterns and consequently increased the prevalence of lifestyle related chronic diseases projected to be higher than infectious diseases by 2030 [12,13].

Previous studies from Benin [14], Ghana [15], Nigeria [16,17] and Cameroon [18,19] showed that the prevalence of MetS in rural communities vary from 0 – 4.1%. Other studies from urban cities in Nigeria showed that the prevalence of MetS ranged between 13% - 17.4% [16,17]. This present study compared the prevalence of MetS

in a rural and an urban community in South-west Nigeria using three different definitions.

2. METHODS

2.1 Study Design

A cross-sectional study was conducted to determine the prevalence of MetS in an urban and rural community in South-west Nigeria.

2.2 Study Background

Ikeja is a cosmopolitan city and the capital of Lagos state. It is one of the most populous commercial cities in Nigeria. It is an urban setting with an area of about 46.20 sqKm and a population of 313,196 (National Population Commission, 2006) [20]. It is one of the 20 Local Government Areas in the state and now has 3 Local Council Development Areas. The inhabitants of Ikeja include corporate executives, Civil servants, Business men/women and artisans.

Ilara/ Akaka - Remo lie along the forest belt in Remo-North in Ogun State. It is a rural setting with an area of about 199 km² and a population of 59,911 (National Population Commission, 2006) [20]. This area is characterized by moderately hot and humid tropical climate with features of a tropical forest and is about 150 km away from Lagos. The inhabitants usually engage in subsistent farming, hunting or petty trading for a living. Dwellings are either traditional houses totally plastered with mud or cement or houses constructed with corrugated iron sheets.

2.3 Population and Sample

Lagos and Ogun state were purposively selected for logistic reasons being two contiguous states in South-west Nigeria. Multistage sampling technique method was used to select one community each in Lagos and Ogun States.

Using the sample size formula for comparing proportions of independent samples, prevalence of MetS in urban (25.2%) [21] and rural (12.1%) [22] communities in Nigeria from previous studies, power of 95%, level of significance of 0.05 and attrition rate 10%, the minimum sample size of 255 each was calculated for the urban and rural community. However, 273 and 262 subjects were recruited form the selected urban and rural communities.

2.4 Recruitment and Study Procedure

The Community Development Association (CDA), ward committee chairmen and the landlord associations in Ikeja and the Baale in Ilara and Akaka- Remo were contacted and informed of the purpose of the study. After obtaining their permission for the study, residents were informed and invited for the study through hand bills (in Ikeja) and a local town crier (in Ilara and Akaka- Remo to participate in the study at designated places and time. Consecutive recruitment was used to enroll apparently healthy subjects 18 years and above who had resided in the community for at least 2 years prior to the study. Subjects with history of diabetes and hypertension were excluded from the study.

On recruitment into the study, an interviewer administered questionnaire was used to obtain subjects' sociodemographic details, thereafter waist circumference and blood pressure were taken using standard methods. Venous blood was collected after overnight fast from the subjects in sitting position by a trained phlebotomist. Samples were collected into appropriate Vacutainer tubes (flouride oxalate and potassium ethylene diamine tetra acetic acid (K3EDTA). Fasting blood glucose and lipid profile analysis were conducted.

2.5 Measurement of Outcome Variables

2.5.1 Anthropometric variables and measurements

Waist circumference (WC) was measured to the nearest 0.1 centimeter (cm) using a flexible tape, by locating the top of the right iliac crest and measuring in a horizontal plane around the abdomen immediately above the level of the iliac crest.

2.5.2 Measurement of blood pressure

Blood pressures were measured on the right arm of the subjects in a sitting position using an appropriate cuff size electronic sphygmomanometer after about 5 minutes of rest. Of the three measurements taken, an average of the last two readings was used.

2.5.3 Definition of metabolic syndrome

Three definitions of MetS (NCEP ATPIII, IDF and JIS) were used to identify participants with MetS in this study [1,6,7] (Table 1).

Table 1. Definitions of MetS based on NCEP ATPIII, IDF and JIS criteria

Definition	Harmonized definition (JIS) [1]	NCEP ATPIII [7]	IDF [6]
Criteria	≥ 3 out of these parameters:	≥ 3 out of these parameters:	Central obesity and any 2 out of these 4 other factors:
Fasting plasma glucose	≥ 100 mg/dL	≥ 100 mg/dL	≥ 100 mg/dL
Blood pressure	Systolic BP (≥130 mmHg) or diastolic BP (≥85 mmHg)	Blood pressure ≥130/85 mmHg	Systolic BP (≥130 mmHg) or diastolic BP (≥85 mmHg)
Triglyceride (TG)	>150 mg/dL	>150 mg/dL	>150 mg/dL
High Density Lipoprotein-Cholesterol (HDL-C)	HDL-C < 40 mg/dL in men or <50 mg/dL in women.	HDL-C < 40 mg/dL in men or <50 mg/dL in women	HDL-C < 40 mg/dL in men or <50 mg/dL in women
Central obesity	WC ≥94 cm in men or ≥80 cm in women (as recommended for Europeans)	WC ≥102 cm in men or ≥80 cm in women (as recommended for Europeans)	Waist circumference ≥ 94 cm in men or ≥ 80 cm in women (as recommended for Europeans).

2.6 Ethical Considerations

The approval for this study was obtained from the Health and Research Ethical Committee of the Lagos State University Teaching Hospital (LASUTH) and the Babcock University Health Research Ethical Committee (BUHREC) Ilishan, Remo, Ogun State. Subjects were assured of confidentiality and a written informed consent was obtained prior to enrollment into the study.

2.7 Statistical Analysis

Data was analyzed using the Statistical Package for Social Sciences (SPSS) IBM version 22.0 software. The mean and standard deviation of numerical variables were determined. Numerical and categorical variables were compared using Student 't' and Chi-square respectively. All statistical test was considered significant if $p < .05$.

3. RESULTS

Of the 535 recruited subjects, 51% were from an urban area while 49% were from a rural community. The age range was 18 – 89 years and mean age was 47.1±14.7. The majority of subjects were females (72.7%), Yorubas (74.2%), married (74.4%), non-smokers (90.5%) and don't take alcohol (82.2%). About 60% of subjects had at least secondary education as shown in Table 2.

Fig. 1 shows the prevalence of MetS in the study population. The prevalence of the MetS according to the JIS, IDF and NCEP definitions were 23%, 21.7% and 21.1% respectively. The prevalence of the MetS was significantly higher in females using the JIS (P =.02) and IDF (P = .003) definitions. There was no gender difference in the prevalence of the MetS using the NCEP ATP III definition (P = .17) as shown in Table 3. The prevalence of MetS was higher in the urban than rural community irrespective of the definition used (P<.001) (Table 4).

4. DISCUSSION

The majority of studies from Nigeria used NCEP ATPIII definition probably because of its ease in clinical application. There is no clear consensus with regards which of the definitions gives the highest prevalence of the MetS. In this study, the JIS definition gave the highest prevalence of MetS which is similar to findings from a systematic review from Iran [23]. However similar to findings from Iran [23], this study showed no significant difference between the prevalence of MetS using JIS, IDF and NCEP ATPIII definitions. Two researchers in Nigeria documented that there was no significant difference between the prevalence of MetS using NCEP ATPIII, IDF and WHO definitions [24,25]. A European study that compared NCEP-ATPIII and IDF opined that the prevalence of MetS was higher using the IDF definition [26].

Metabolic syndrome has been studied among diabetics, hypertensives, and people living with HIV/AIDS, thyroid and asthma patients as well as apparently healthy people in rural and urban settings in Nigeria using different definitions [21, 27-30]. In this study, the prevalence of MetS among the apparently healthy, non - diabetic subjects was 23%, 21.7% and 21.1% using the JIS, IDF and NCEP ATP III definitions respectively. This is contrary to what was reported in a systematic review of MetS in Nigeria which showed a higher prevalence of MetS based on NCEP ATPIII (27.9%), IDF (28.1%) and WHO (31.7%) definitions [9]. The different population groups considered in the systematic review maybe a possible explanation. Meta-analysis and systematic reviews of prevalence of MetS in apparently healthy subjects from Iran and Brazil also reported a higher prevalence of MetS than what was found in this study using the JIS (41.5%), NCEP ATPIII (28.9% - 36.9%) and IDF definitions (34.6%) [23,31].

Studies from the United States and Peru reported prevalence similar to the findings of this study [32,33]. The prevalence of MetS varies according to the criteria or definitions used and other variables such as gender, age, race, socio-economic status, work – related activities, ethnicity, location and disease condition of the population studied [34,35].

Studies carried out in urban, suburban and rural settings, reported different prevalence of MetS based on location. A study showed that the prevalence of MetS in Nigeria is one of the highest in Sub-Saharan Africa [9], studies comparing rural and urban prevalence of MetS have suggested that the prevalence is higher in the urban than rural areas possibly because of increase in urbanization, adoption of western lifestyle and low level of physical activity [24,36]. In this study, the prevalence of MetS was significantly higher in urban than rural subjects using the JIS, IDF and NCEP- ATPIII definitions.

There is gender difference in the prevalence of MetS in this study with the women having a higher prevalence than men regardless of the definition used. These findings are similar to what was reported in studies among hypertensives, diabetes, apparently healthy people and rural/urban comparisons in Nigeria [24,25,37]. This increased frequency is possibly driven by the high prevalence of visceral obesity among females. In addition, there is also a cultural perception about obesity in women being regarded as a sign of affluence and satisfaction in many cultures in Nigeria [24]. However, the gender-specific differences in the prevalence of MetS are not consistent across studies. Studies from China showed that the prevalence of MetS and its components were higher among males [38]. Age [39], genetic traits [40] dietary habits [41] level of physical activity [42] and socio-economic status [43] are possible explanation for the gender differences in the prevalence of MetS.

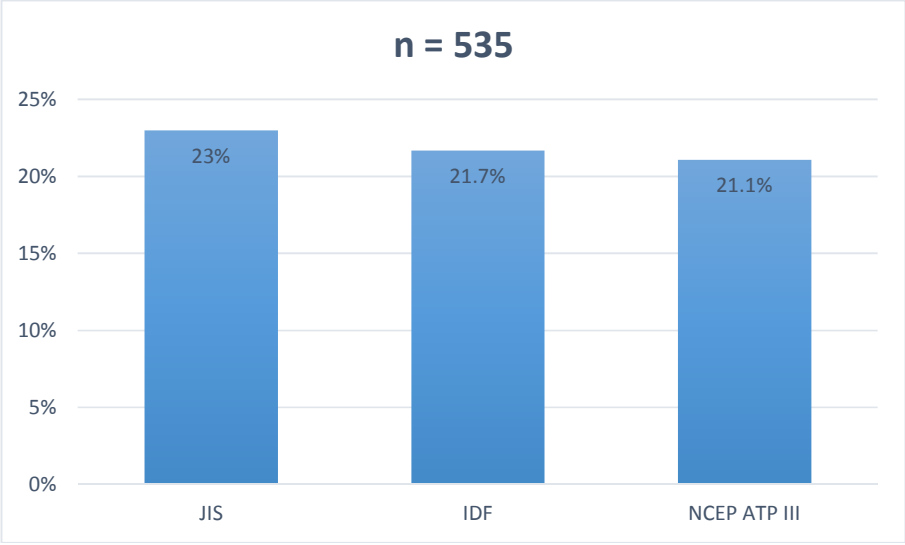

Fig. 1. Prevalence of MetS using the harmonized (JIS), IDF, NCEP ATPIII definitions in the study population

Table 2. Socio demographic characteristics of subjects

Variables`	Frequency n = 535	%
Age group (years)		
<30	90	11.2
30 – 39	105	19.6
40 – 49	145	27.1
50 – 59	102	19.1
≥60	123	23.0
Mean±SD	47.1±14.7	
Gender		
Male	146	27.3
Female	389	72.7
Ethnic group		
Yoruba	397	74.2
Hausa	11	2.1
Igbo	87	16.3
Others	40	7.5
Marital status		
Single	61	11.4
Married	398	74.4
Divorced/Separated	24	4.5
Widowed/widower	52	9.7
Level of education		
No formal education	70	13.1
Primary	138	25.8
Secondary	199	37.2
Tertiary	128	23.9
Place of residence		
Urban	273	51.0
Rural	262	49.0
Smoke cigarette		
Yes	51	9.5
No	484	90.5
Alcohol intake		
Yes	95	17.8
No	440	82.2

Table 3. Prevalence of metabolic syndrome based on 3 different definitions in men and women

Variable	Total	Men	Women	p
	n = 535 (%)	n = 146 (%)	n = 389 (%)	
NCEP ATP III	113 (21.1)	25 (17.1)	88 (22.6)	0.165
JIS	123 (23.0)	23 (15.8)	100 (25.7)	0.015
IDF	116 (21.7)	19 (13.0)	97 (24.9)	0.003

Table 4. Prevalence (%) of MetS based on different definitions and their individual components in urban and rural subjects

Definition of metabolic syndrome	Total	Urban	Rural	p
NCEP ATP III	113 (21.1)	77 (28.2)	36 (13.7)	<0.001
JIS	123 (23.0)	91 (33.3)	32 (12.2)	<0.001
IDF	116 (21.7)	84 (30.8)	32 (12.2)	<0.001

5. CONCLUSION

Although the prevalence of Metabolic syndrome was high in rural and urban Nigeria, the prevalence was significantly higher in female and urban community. There is need for clinicians to have high index of suspicion and public enlightenment campaign that will educate the populace on the need to reduce the prevalence of MetS in Nigeria.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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