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Metabolic Syndrome among Obese Primary Care Patients of a Tertiary Hospital in Uyo, South-South, Nigeria

Idung, Alphonsus Udo, MBBS, FWACP, (FAM. MED)

Iyanam, Victory Edet, MBBch, FWACP (FAM. MED)

Department of Family Medicine, Faculty of Clinical Sciences, College of Health Sciences, University of Uyo, Uyo, Akwa Ibom State, Nigeria

Jombo, Henry Effiong, MBBS, FWACPschy

Department of Mental Health, Faculty of Clinical Sciences, College of Health Science, University of Uyo, Uyo, Akwa Ibom State, Nigeria

Ekanem, Anyiekere Morgan, MBBS, FMCPH

Department of Community Health, Faculty of Clinical Sciences, College of Health Sciences, University of Uyo, Uyo, Akwa Ibom State, Nigeria

Umoh, Victor Aniedi, MBBch, FWACP (INT- MED)

Department of Internal Medicine, Faculty of Clinical Sciences, College of Health Sciences, University of Uyo, Uyo, Akwa Ibom State, Nigeria

ABSTRACT: *Metabolic syndrome is responsible for much of the excess cardiovascular disease morbidity and mortality among overweight and obese patients.This was a hospital-based cross-sectional descriptive study conducted between February and April 2018. Three hundred and thirty obese patients seen at the general outpatient clinic (GOPC) of University of Uyo Teaching Hospital (UUTH) were recruited using systematic random sampling method.Using an interviewer-administered and pre-tested questionnaire, data collected included age, marital status, place of residence, ethnic group, highest level of education attained, physical examination included height, weight, blood pressure and waist circumference. Laboratory indices included fasting blood glucose and lipid profile.Metabolic syndrome was diagnosed based on USA National Cholesterol Education Program Adult treatment panel III (NCEP ATP III) definition. Approval for the study was obtained from the University of Uyo Teaching Hospital Institutional review committee.A total of 330 respondents were recruited for the study. Of these, 128 (38.8%) were male while 202 (61.2%) were female with a mean age of 41.4 [SD = 12.4] years. The prevalence of metabolic syndrome was 40.6%. There was a statistically significant difference between the mean waist circumference of male respondents compared to that of the female in this study (100.6 [SD= 12/8] male versus 88.4 [SD = 13.4] female $p \leq 0.001$).The commonest pattern of metabolic syndrome in this study was abdominal obesity, hypertension and hypertriglyceridaemia. Metabolic syndrome is a major health issue among primary care patients seen in the general out-patient clinic of University of Uyo Teaching Hospital. Primary care physicians are encouraged to work at assisting their patients to engage in healthy lifestyle practices.*

KEYWORDS: Abdominal obesity, primary care, metabolic syndrome, South-South Nigeria

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INTRODUCTION

The increasing prevalence of overweight and obesity among citizens of many countries in sub-saharan Africa (SSA) including Nigeria is a cause for concern among health experts both local and international [1] Obesity is a public health problem that is associated with multiple risk factors which place individuals in a significantly high risk group for cardiovascular, hypertensive diseases, type-2 diabetes mellitus and musculoskeletal diseases as well certain cancers. [2,3]. Obesity is a risk factor for functional decline in both genders and the risk increases with body mass [2]
Overweight and obesity comprise the fifth leading risk factor for mortality resulting in 2.8 million deaths annually [1]

The metabolic syndrome which is also referred to as syndrome X is a cluster of risk factors that is responsible for much of the excess cardiovascular disease morbidity and mortality among overweight and obese patients as well as those with type - 2 diabetes mellitus [2].

Metabolic syndrome is defined when three or more of the following are present: Abdominal obesity with waist circumference for men of >102cm and >88cm for women; serum triglyceride >1.7 mmol/L; High density lipoprotein (HDL-C) cholesterol of < 0.9 mmol/L for men and <1.0 mmol/L for women; blood pressure level of >130/85 mmHg and fasting plasma glucose of >6.1 mmol/L based on the USA National cholesterol education program adult treatment panel III (NCEP – ATP III) [4,5]

The prevalence of metabolic syndrome is increasing globally because of factors such as increasing urbanization, lifestyle and dietary changes as well as gender and cultural issues. [4, 6]

The importance of the metabolic syndrome is the fact that the individual component carries a grave risk for vascular events and the combination has a synergistic effect [7,8]

Metabolic syndrome was initially thought to be rare among Africans but this has changed drastically following reports from many workers [4,9,10,11]

The reported prevalence of metabolic syndrome among resident of urban city of North-western Nigerian was 42.8% among females and 27.3% among males with overall prevalence of 35.1% among the study subjects [4].
A report from the South Western part of Nigeria showed that the prevalence of metabolic syndrome was 30.8% among urban dwellers compared to 12.2% among rural dwellers using the National Cholesterol Education Programme – Third Adult Treatment Panel (NCEP ATP II) definition. [11]

The prevalence of metabolic syndrome among health workers in a tertiary hospital in South Western Nigeria was 24.2% and women were more vulnerable than the men. [12]

The reported prevalence of metabolic syndrome among hypertensive patients attending the general out-patient clinic of a tertiary hospital in North Central Nigeria was 32.4% [10] [13]

Several factors account for the upsurge in the present trend of metabolic syndrome among various occupation and population groups in Nigeria. [11, 12, 13]

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Such factors include rapid demographic and epidemiologic transitions taking place in several countries in sub-saharan Africa including Nigeria resulting in fast rate of urbanization leading to changes in feeding habits and physical activity patterns.

Published reports on the prevalence of metabolic syndrome among primary care clinic patients in Uyo, South-South Nigeria are, however, scarce in the scientific literature.
This study is therefore aimed at describing the prevalence of metabolic syndrome among family medicine out-patient clinic attendees in Uyo.

It is hoped that findings from this study will add to the pool of available knowledge, for the purpose of increasing awareness on the lifestyle issues associated with metabolic syndrome.

RESEARCH METHODS AND DESIGN

Location of the study

This study was carried out at the Family Medicine out-patient clinic of the University of Uyo Teaching Hospital (UUTH)

UUTH is located on the outskirts of Uyo, the capital of Akwa Ibom State of Nigeria. Nigeria is divided into Six geo-political zones as follows. North-East, North-West, North-Central, South –East, South-West and South, South.
Uyo is located in the South-South geo-political zone which is often referred to as the Niger Delta Region of Nigeria.
UUTH is one of the tertiary and referral health institutions in Akwa Ibom State and serve a population of about 4.0 million people. [14]

Subjects:

A total of 330 consenting adult male and female subjects aged from 18years and above attending the family medicine clinic for various medical problems participated in the study.

The sample size (n) was calculated using the formula $n = Z^2 pq/d^2$, at 95% confidence interval and a precision level of 5%, Z = 1.96 and d = 0.05. The proportion of out-patients with metabolic syndrome was 32.4% from previous study [13]

Therefore p= 0.324 and q = 1-0.324 = 0.676, Then (n) = 1.96^2 x 0.324 x $0.676/0.05^2$ = 336
Since the number of patients (N) that attended the Family medicine out-patient clinic during the same period of February to April in 2018 was 2740 (less than 10,000), the sample size was adjusted by the formula. nf = n/1+n/N. Thus nf = 336/1+336/2740 = 300.

The minimum sample size was 300. However, 10% of the total sample size was added to the minimum sample size to take care of possible attrition. This gave a sample size of 330 respondents.
Two thousand seven hundred and forty participants were sampled during the study period. They were recruited using a systematic sampling method with a sampling interval of eight. Numbers raging from one to eight were assigned to the first eight respondents who met the inclusion criteria. The first respondent was chosen by simple balloting which was done by randomly picking one of the numbers from a basket containing the assigned numbers.

Thereafter every eighth respondent was recruited for the study. Where, however, such a respondent did not meet the inclusion criteria or did not consent to take part in the study, such a respondent was dropped, then the next respondent that met the inclusion criteria was recruited.

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Inclusion criteria included respondents aged 18 years and above with no emergency medical problem that required urgent intervention.

Exclusion criteria included patients with severe illness that could make it difficult to follow the study protocol as well as all non-consenting respondents.

Method:
This was a hospital based, cross sectional descriptive study conducted on 330 adults aged 18 years and above who attended the General out-patient clinic (GOPC) of UUTH, Uyo between February and April, 2018.
Data were collected using semi-structured interviewer administered questionnaire, physical examinations as well as laboratory investigations were also performed. Information contained in the questionnaire included respondent's age, marital status, place of residence, social history (alcohol consumption, cigarette smoking), ethnic group, highest level of education attained, anthropometric examination findings as well as medical history of respondents.

Weight was measured in kilograms to the nearest 0.5kg using a Hanna-calibrated bathroom scale, (model BR 9011). Each subject was weighed wearing light clothing without shoes or stockings. The height of the subjects was measured using an improvised wooden stadiometer mounted on a vertical wall with the respondent standing erect against the wall on a horizontal floor without shoes. The head was placed so as to ensure that the external auditory meatus and the angle of the eye were on a horizontal line. The height was measured in metres to the nearest 0.1cm. BMI was calculated as the weight (kg)/ height $[m]^2$ (i.e. kg/m^2)

The weighing scale and the stadiometer were calibrated every morning before use to ensure accuracy of measurement.

The waist circumference was measured with a tape measure as the horizontal circumference midway between the lowest rib and the iliac crest at the end of a normal respiration.

The measurement was repeated twice and the average of the two measurements obtained was calculated if they were within one centimeter of one another.
When the difference between the two measurements exceeded 1cm, the two measurements were repeated. A waist circumference of more than 40 inches (102 centimetres) in men and greater than 35 inches (88 centimetres) for women was considered abnormal [5,16]

The hip circumference was measured to the nearest 0.1cm at the maximum posterior protuberance of the buttocks while the subject was standing upright with feet together. Normal waist –hip ratio (WHR) for males is less than 0.90 and less than 0.85 for females.

Blood pressure for each respondent was taken in the clinic using an Accoson Mercury Splygmomanometer (AC Cossor & Son (Surgical) Ltd. London, England) after respondents had rested for five minutes. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured at Korotkoff phases I and V respectively [17]

Physical activity was defined as any bodily movement produced by skeletal muscle that resulted in energy expenditure. It includes activities such as farming, street hawking, brisk walking, jogging, running, rope skipping (vigorous and moderate physical activity) as well as sweeping bathing, strolling, cooking and washing (mild physical activity) [18].

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A complete fasting lipid profile was done on all respondents. The parameters measured included total cholesterol (TC), low density lipoprotein cholesterol (LDL-C), high density lipoprotein (HDL-C) cholesterol and triglyceride (TG). The method of Levin and Zak was used for the estimation of TC and HDL-C [19]
Triglyceride (TG) values were estimated by the method of levy and LDL-C by the Friedewald formula respectively [20].

Prior to the collection of blood sample, respondents were told to fast for at least eight hours overnight (from 10.00pm). Blood was taken by venupuncture into a fluoride oxalate bottle after the procedure had been explained to them and informed – consent obtained. The collected samples were well labeled, centrifuged and plasma separated and incubated at 37^0c for one hour. The plasma was then auto-analyzed using the glucose oxidase mediated perioxidase method [21]

The diagnosis of metabolic syndrome in this study was based on the USA National cholesterol, Education program Adult Treatment panel III (NCEP-ATP III) definition [5]. This is the presence of any three of the following: abdominal obesity (waist circumference) $\geq$ 102cm in men and $\geq$ 88cm in women, triglyceridaemia 150mg/dl (1.7 mmol/L), HDL cholesterol $\leq$ 40mg/dl (0.9mmol/L) in men and $\leq$ 50mg/dl (1.0 mmol/L) in women, blood pressure of $\geq$ 130/85 mmttg, fasting blood glucose $\geq$ 110 mg/dl (6.1 mmol/L) [5]

DATA ANALYSIS
Data obtained were analyzed using statistical package for social sciences (SPSS) version 18.0 Software (SPSS Inc. Chicago, IL, USA)
The t-test was used to compare means and chi-square was used to compare proportions. A p-value of less than 0.05 was considered to be statistically significant.

ETHICAL CONSIDERATION
Ethical approval for the study was sought and obtained from the University of Uyo Teaching Hospital ethical committee. A pretest of the research questionnaire was performed in order to determine its applicability, experience and logistic problems.

RESULT

A total of three hundred and thirty (330) respondents were recruited into the study. Of these 128 (38.8%) were male while 202 (61.2%) were female.
Table I shows the socio-demographic and life-style characteristics of respondents.
The mean age of respondents was 41.4 (SD = 12.4) years. One hundred and three (31.2%) respondents were between 50 and 59 years of age.
One hundred and sixty two (49.1%) respondents were married compared to eighteen (5.5%) who were single.

Two hundred and eleven (63.9%) respondents lived in the urban area while 119 (36.1%) lived in the rural. One hundred and thirty four (40.6%) respondents completed secondary school level of education compared to 94(28.5%) who attained tertiary level of education.
A total of 170 (51.5%) respondents engaged in mild form of physical activity while 160 (48.5%) respondents took part in strenuous form of physical activity.

Table 2 shows the Anthropometric, metabolic and blood pressure profile of respondents.
There was a statistically significant difference between the mean waist circumference of male (100.6 [SD =12.8]) and female (88.4[SD=13.4]) respondents in this study (p=0.001).The mean serum low

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density lipoprotein (LDL-C) cholesterol of respondents in this study was 3.6 [SD=1.5] for males compared to 4.2 [SD=1.1] for females. This was statistically significant (p=0.04)

The mean serum triglyceride of male respondents was (1.1 [SD = 0.60]) compared to (3.6 [SD = 0.8]) of the female. This was statistically significant (p = 0.02).
Table 3 shows the pattern of metabolic syndrome among the affected respondents in this study.

Metabolic syndrome was diagnosed in the respondents based on the presence of abdominal obesity and two or more metabolic syndrome components. Abdominal obesity was present in the male if the waist circumference was > 102cm and in the female if the waist circumference was > 88.0cm

The overall prevalence of metabolic syndrome among respondents in this study was 40.6% made up of 30(9.1%) males and 104 (31.5%) females. Of the 134 respondents diagnosed with metabolic syndrome, forty four (32.8%) had abdominal obesity, hypertension and hypertriglyceridaemia. This was the commonest pattern of metabolic syndrome among respondents in this study.

DISCUSSION

Findings from this study show that metabolic syndrome was common among obese primary care patients attending the general out-patient clinic (GOPC) of University of Uyo Teaching Hospital, (UUTH), Uyo, South-South, Nigeria. The prevalence of metabolic syndrome in this study was 40.6%
A community based cross-sectional study involving urban residents in North-Western Nigeria reported the prevalence of metabolic syndrome to be 35.1% [4]. The reported prevalence of metabolic syndrome among rural and urban dwellers in South-Western Nigeria was 12.2% and 30.8% respectively. [12]

In another cross-sectional study involving health workers in a tertiary hospital in South-Western Nigeria, the reported prevalence of metabolic syndrome was 24.2% [12]
The reported prevalence of metabolic syndrome among hypertensive patients attending the general out-patient clinic of a tertiary hospital in North-Central Nigeria was 32.4% [13].

The differences seen in the reported prevalence rates among different workers can be attributed to the study design, population studied as well as the definition of metabolic syndrome used by the authors. While the present study used the NCEP-ATP III criteria just like the reports from North-western and North-central Nigeria [4,13], the study from South-Western Nigeria used the international diabetes federation (IDF) criteria for the diagnosis of metabolic syndrome [12].
Moreover, while the present study was hospital based, the report by Sabir AH etal was community based [4].
In spite of the definitions used as well as the study design, the increasing prevalence of metabolic syndrome among different population and patient groups is proof that metabolic syndrome is common among obese primary care patients seen in the GOPC of UUTH, Uyo. This might not be unconnected with the changing lifestyle pattern of residents of Uyo, a rapidly evolving metropolitan city.
Uyo, South –South Nigeria which is the location of this study used to be predominantly an agrarian subsistent farming community less than a decade ago. But with its current status as a state capital and a major crude oil producing state in Nigeria, it is fast changing into a modern metropolis with rapid unplanned urbanization coupled with possible change in local dietary as well as physical activity patterns of the respondents.

The prevalence of metabolic syndrome was higher among female respondents in this study compared to the male (31.5% [female]) versus 9.1% (males)]

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The predominance of metabolic syndrome in females over males has also been reported in previous studies regardless of the definition used. [4,11,22-24]
Although this might indicate that females were more available to participate in the study, it may also show the gender profile of metabolic syndrome in Uyo, a city that is rapidly evolving from rural to Urban setting.

Ten different combinations of metabolic syndrome components were seen in this study. The commonest pattern was a cluster of abdominal obesity, hypertension and hypertriglyceridaemia which was present in 32.8% of the respondents. This is similar to the finding among hypertensive patients attending the general out-patients clinic of a tertiary hospital in North-Central Nigeria [13].
There are, however, sixteen possible combination patterns of metabolic syndrome with variable impact on cardiovascular disease and mortality risk [25]

The predominance of abdominal obesity seem in this study is in agreement with a previous report where it has been established that all combinations of metabolic syndrome in which women are in the majority than men contain abdominal obesity as compared to variable combinations when the men are in the majority. [26] The association of large body weight with affluence among women in Africa could also be responsible for this trend [13,26-28]

CONCLUSION

In conclusion findings from this study show that metabolic syndrome is a major health issue among primary care patients seen in the general out-patient clinic of UUTH.
Abdominal obesity was a constant feature among the respondents diagnosed with metabolic syndrome in this study. This means that the scourge can be managed through good lifestyle choices. Primary care physicians are encouraged to work at assisting their patients to engage in healthy lifestyle practices.

LIMITATION

Because this is a cross-sectional, study, it may not allow definitive conclusion between abdominal obesity and metabolic syndrome.
Moreover since this is a hospital-based study the respondents recruited for this study may be different from the general population in unpredictable ways, as such the result obtained from this study may not be generalized to the general population.

Table 1: Socio-demographic and lifestyle characteristics of respondents

Variable	Frequency (n)	Percentage [%]
Age (in years)		
< 30	29	8.8
30 -39	89	27.0
40 – 49	94	28.5
50 – 59	103	31.2
≥ 60	15	4.5
Gender		
Male	128	38.8
Female	202	61.2
Marital Status		
Single	18	5.5
Married	162	49.1
Divorced/ Separated	62	18.8

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Co-habiting	49	14.8
Widowed/Widower	39	11.8
Place of Residence		
Urban	211	63.9
Rural	119	36.1
Ethnic Group		
Ibibio	103	31.2
Annang	91	27.6
Oron	47	14.2
Others	89	27.0
Highest Level of Education attained		
No Formal Education	32	9.7
Primary School	70	21.2
Secondary School	134	40.6
Tertiary	94	28.5
Alcohol Consumption		
Yes	139	42.1
No	191	57.9
Cigarette Smoking		
Yes	69	20.9
No	261	79.1
Physical Activity		
Mild	170	51.5
Strenuous	160	48.5

Table 2: Anthropometric, metabolic and blood pressure profile of respondents

Variable	**Respondents**		
	Male (n=128) [mean ±SD]	**Female (n = 202) [mean ±SD]**	**p-value**
Weight (kg)	68.2 [11.6]	69.1 [12.4]	0.151
Height (m)	1.63 [0.74]	1.59 [0.77]	0.238
BMI (kg/m^2)	24.8 [48]	26.3 [3.9]	0.470
WC (cm)	100.6 [12.8]	88.4 [13.4]	0.001*
FBS (mmol/L)	6.9 [3.6]	5.9 [2.7]	0.20
TC (mmol/L)	5.7 [1.7]	5.3 [1.2]	0.060
HDL-C (mmol/L)	1.1 [0.29]	1.31 [0.3]	0.194
LDL-C (mmol/L)	3.6 [1.5]	4.2 [1.1]	0.04*
TG (mmol/L)	1.1 [0.60]	3.6 [0.8]	0.02*
SBP (mmttg)	137.4 [16.1]	138.6 [27.4]	0.960
DBP (mmttg)	79.4 [14.2]	78.5 [17.5]	0.924

* statistically significant

BMI - Body mass index; WC – Waist Circumference; FBS- Fasting Blood Glucose; TC – Total Cholesterol; HDL-C High Density lipoprotein Cholesterol; LDL-C- Low density Lipoprotein Cholesterol, TG - Triglyceride, SBP – Systolic blood pressure; DBP – Diastolic blood pressure

Print ISSN: ISSN 2053-406X, Online ISSN: ISSN 2053-4078

Table 3: Pattern of metabolic syndrome among respondents

Variable	Male n[%]	Female n[%]	Total n[%]	P-value
Pattern of Metabolic syndrome	30 [22.4]	104 [77.6]	134 [100.0]	
1. Abdominal obesity and two components (n:86)	**17[12.7]**	**69 [51.5]**	**86 [64.2]**	**0.0132***
a. Abd. Obesity, HTN, High FBG	4 [3.0]	6 [4.5]	10 [7.5]	
b. Abd. Obesity HTN, High TG	4 [3.0]	40 [29.9]	44 [32.8]	
c. Abd. Obesity, HTN, Low HDL	2 [1.5]	5 [3.7]	7 5.2]	
d. Abd, obesity, High FBG, High TG	2 [1.5]	7 [5.2]	9 [6.7]	
e. Abd. Obesity, High FBG, Low HDL	2 [1.5]	6 [4.5]	8 [6.0]	
f. Abd. Obesity, Low HDL, High TA	3 [2.2]	5 [3.7]	8 [6.0]	
2. Abdominal obesity and three components (n:48)	**13 [9.7]**	**35 [26.1]**	**48 [35.8]**	**0.767**
a. Abd. Obesity high FBG, high TG, low HDL	4 [3.0]	7 [5.2]	11 [8.2]	
b. Abd. Obesity, HTN, high TG, Low HDL	2 [1.5]	8 [6.0]	10 [7.5]	
c. Abd. Obesity, HTN, high FBG, Low HDL	2 [1.5]	9 [6.7]	11 [8.2]	
d. Abd. Obesity, HTN, high FBG, high TG	5 [3.7]	11 [8.2]	16 [11.9]	

Abd. Obesity- Abdominal obesity; HTN – Hypertension; FBG – Fasting Blood Glucose; TG – Triglyceride; HDL – High Density Lipoprotein;
* statistically significant (Fischer's exact)

REFERENCES

1. World Health Organization Obesity (2000). Preventing and managing the global epidemic. Geneva. WHO Technical Report Series, 894. Geneva, Switzerland.
2. Asfaw A. (2006) *The effects of obesity on doctor-diagnosed chronic disease in Africa:* Empirical results from Senegal and South Africa. Journal Public health Policy*;* 27(3): 250-264
3. Campbell T, Campbell A (2007*). Emerging burdens and the poor in cities of the developing world.* J. Urban Health; 84 (3 Suppl.) 54 -64
4. Sabir AH, Jimoh A, Iwuala SO, Izezuo SA, Bilbis LS, Umar K etal (2016). *Metabolic Syndrome in Urban city of North-Western Nigeria: prevalence and determinants.* Pan African Medical Journal; 23, 19

Print ISSN: ISSN 2053-406X, Online ISSN: ISSN 2053-4078

5. Third Report of the National Cholesterol education program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in Adults (Adult Treatment Panel III) Final report. NIH publication No.02 – 5215. 2002. Available from www.nhlbi.nih.gov/guidelines/cholesterol/atp3full.pdf. Accessed on 6/2/2019
6. Okafor CI. (2012) *The metabolic syndrome in Africa: Current Trends.* Indian Journal of Endoc. Metab.; 16(1): 56-66.
7. Ulasi II, Ijoma CK, Onodugo OD (2010). *A Community-based study of hypertension and cardio-metabolic syndrome in semi-urban and rural communities in Nigeria*. BMC health Serv. Res.; 10:71.
8. Osuji CU, Omejua EG (2012). *Prevalence and Characteristics of the metabolic syndrome among newly diagnosed hypertensive patients.* Indian Journal of Endoc. Metab.; 16 (suppl I): S104.
9. Akintunde AA, Ayodele OE, Akinwusi PO, Opadijo GO (2011). *Metabolic Syndrome: Comparison of occurrence using three definitions in hypertensive patients.* Clin. Med. Res.; 9:26-31
10. Ogbera A (2010). *Prevalence and gender distribution of the metabolic syndrome.* Diabet. metab. Syndrome; 2:1
11. Adejumo EN, Ogundahunsi OA. Adejumo OA, Sotunsa J, Jagun O. (2017) *Prevalence of metabolic syndrome in a rural and urban community in South-West Nigeria using three different definitions.* International Journal of tropical Disease and health; 24(2) : 1-9
12. Adeoye Am, Adewoye IA, Dairo DM, Adebiyi A, Lacklnad DT, Ogedegbe G etal (2015). *Excess metabolic syndrome risks among women health workers compared with men.* The journal of clinical hypertension; 17 [11]: 880 -884.
13. Ezeala AC, Yohanna S., Obilom RE (2019) *Prevalence and Risk factors for metabolic syndrome among hypertensive patients attending the general out-patient clinic of a tertiary hospital in North-Central Nigeria.* West African Journal of Medicine; 36(1): 5-10
14. National population commission (2006): *National population census,* Abuja: National population commission.
15. Araoye MO (2003). *Subject selection: Sample size determination:* In: MO Araoye, (editor) Research Methodolgy with statistics for health and social sciences, 1st ed. Ilorin Nathadex;. P117 -18
16. World Health Organization (2008). *Waist Circumference and waist hip-ratio: report of a WHO expert consultation.* Geneva: World Health Organization (WHO);
17. Pickering TA, Hall JE, Appel LJ, Falkner BE, Graves J, Hill MN etal (2005). *Recommendations for blood pressure measurement in humans and experimental animals Part I: blood pressure measurement in humans: a statement for professionals from the subcommittee of professional and public education of the American Heart Association Council on High Blood Pressure Research.* Hypertension; 45:142-61
18. Haskell WL, Lee IM, Pate RR, Powel KE, Blair SN, Franklin BA etal (2007). *Physical activity and public health: updated recommendation for adults from the American college of Sports Medicine and the American Heart Association.* Circulation; 116: 1081-93
19. Levine JB, Zak B (1964). *Automated determination of serum total cholesterol.* Clin. Chim. Acta.; 10:381-4
20. Levy AL. (1972) *Measurement of triglycerides by nonane extraction and colorimetric, manual and automated methods.* Ann. Clin. Lab. Sci.; 18:499
21. Sacks DB, Arnold M, Barkris GL, Bruns DE, Horvath AR, Kirkman MS etal (2014). *Guidelines and Recommendations for laboratory analysis in the diagnosis and management of diabetes mellitus:* Diabetes care; 27: 18-80.

Print ISSN: ISSN 2053-406X, Online ISSN: ISSN 2053-4078

22. Puepet FH, Uloko A, Akogu IY, Aniekwensi E (2009). *Prevalence of the metabolic syndrome among patients with type 2 diabetes mellitus in urban North-Central Nigeria.* Afr. J. Endocrinol. Metab.; 8(1): 10-12.
23. Isezuo SA, Ezunu E (2005). *Demographic and Clinical Correlates of metabolic syndrome in Native African Type 2 diabetic patients.* J. Natl. Med. Assoc.; 97(4): 557 -63
24. Sodjinou R, Aqueh V, Fayomi B, Delisle H (2008). *Obesity and cardiometabolic risk factors in urban adults of Benin: Relationship with Socio-economic status, urbanization, and lifestyle patterns.* BMC public Health; 8(1): 84
25. Pimenta AM, Felisbino-Mendes MS, Melendez GV (2013). *Clustering and combining pattern of metabolic syndrome components in a rural Brazillian Adult population.* Sao Paulo Med. J.; 131(4): 213-9
26. Kuk IL, Arden CL. (2010) *Age and Sex differences in the clustering of metabolic syndrome factors: association with mortality risk.* Diabetes care; 33(11): 2457 – 61
27. Idung, AU, Abasiubong FA, Udeh SB, Ekanem US (2014). *Overweight and obesity profiles in Niger Delta Region. Nigeria*. Afri. J. Primary Health Care and Family Medicine; 6(1):1-5.
28. Mvo Z, Dick J, Steyn K (1999). *Perception of overweight African Women about acceptable body size of women and children.* Curationis; 22(2): 27-31.

Print ISSN: ISSN 2053-406X, Online ISSN: ISSN 2053-4078