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Research Article

METABOLIC SYNDROME IN AN APPARENTLY HEALTHY POPULATION IN THE NIGER DELTA REGION OF SOUTHERN NIGERIA

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ABSTRACT

Background: Metabolic syndrome was relatively unknown in sub-Saharan Africa in the past. The disease burden, then was mainly attributable to infections and infestations. However, due to Westernisation and urbanization, there is a shift from communicable to non-communicable diseases hence the rise in metabolic syndrome and its attendant cardiovascular complications. This study assessed the prevalence of metabolicsyndrome and its risk factors in a sub-urban community in the Niger Delta region of Southern Nigeria.
Method: A cross-sectional study carried out among 107 participants (80 females and 27 males) aged between 23 and 80 years. They were first administered a structured questionnaire to obtain their socio-demographic data and lifestyle characteristics after which anthropometric assessment was performed. Thereafter, their blood pressure was taken and blood samples collected for blood sugar and lipid analysis.
Results: The prevalence of metabolic syndrome was high in this study (41.1%). Although, the prevalence was higher in the females, this was not statistically significant. The only statistically significant demographic variable associated with metabolic syndrome is marital status. Metabolic syndrome is statistically higher in the separated and divorced individuals. None of the lifestyle factors studied has any statistically significant association with metabolic syndrome.
Conclusion: The prevalence of metabolic syndrome was quite high in this study. This calls for an appropriate intervention to address the relevant risk factors so as to prevent future cardiovascular complications and mortality in the populace

INTRODUCTION

Metabolic Syndrome is defined as a cluster of metabolic abnormalities characterized by insulin resistance, hyperinsulinemia, Type 2 Diabetes mellitus, obesity, hypertension, hypertriglyceridemia, dyslipidemia and hypercoagulability.

It is thought to be due to insulin resistance following an abnormality in adipose tissue deposition and function. It is associated with an increase in cardiac events and early mortality. Metabolic syndrome is diagnosed when at least 3 of the following criteria are present:

- blood sugar of 100mg/dl or receiving drug treatment for hyperglycemia Fasting
- Blood pressure of 130/85 mm/Hg or receiving drug treatment for elevated blood pressure.
- Triglyceridemia of 150mg/dl or receiving drug treatment for hypertriglyceridemia

HDL- cholesterol level of ≤40mg/dl in men or ≤50mg/dl in women or receiving drug treatment for a low HDL-Cholesterol level.

- Waist circumference of ≥102cm in men or ≥88cm in women.

The International Diabetes Federation (IDF) allows the use Body Mass Index (BMI) of ≥30kg/m^{2}in lieu of the waist circumference criteria.

Metabolic syndrome was previously uncommon in developing countries like ours, however, due to the unhealthy lifestyle that is brought about by modernization, its prevalence is increasing, hence this study. Unhealthy lifestyle practices include, over-nutrition, sedentary lifestyle, increased consumption of alcohol and tobacco.

Moreover, there is a paucity of data on metabolic syndrome and other non-communicable diseases in this part of the country.

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A few studies done in Nigeria estimated the prevalence of metabolic syndrome to be between 2.4 and 26.4 %[1]5

As with other developing countries worldwide, Nigeria is experiencing an epidemiological transition in the health of its adult populace. This is mainly due to the adoption of western lifestyle as well as genetic and socio-economic factors and this has led to an increase in the prevalence of metabolic syndrome [6,7,8]

This study aims to asses the prevalence of metabolic syndrome and its risk factors in a rural community in the Niger Delta region of Southern Nigeria.

MATERIALS AND METHOD

This is a cross-sectional, descriptive, community-based study is to be carried out using a total of 107 adults; in Amadi-ama and Fimie communities in Port-Harcourt City Local Government Area of Rivers state, in Southern Nigeria. Approval for this study was obtained from the Ethics Committee of the Rivers State Ministry of Health, Port-Harcourt.

The participants were all apparently healthy adults aged between 20-80 years and were chosen via convenience sampling. The communities were initially sensitized about this study via town criers and church announcements and those that met the inclusion criteria were told to meet in the to meet in church halls for screening. All the individuals who gave their consent were included in the study. Pregnant and lactating women as well as those who are obviously ill or wheel-chair bound were excluded from the study. Strict Covid-19 prevention protocols were adhered to.

A screenng questionnaire, was given to participants and no monetary or any form of inducement was required of them.

The requirements for participation include being >18yearsof age with no previous history of hypertension ordiabetes.

Anthropometric evaluation- Well trained examiners measured the anthropometric indices and participants were required to wear light, thin clothing and no shoes.

The indices are:

1. BMI (Body mass index is body weight/square of height, and the unit is kg/metre square.
2. Blood pressure
3. Blood sugar
4. Lipid profile

The body weight was measured using an analogue medical scale while the height was measured with a standardstadiometer. They were measured to the nearest 0.1kg and 0.1cm respectively.

The classes of BMI reported by WHO are;
18.5-24.9kg/m^2-normal
25.0-29.9kg/m^2-overweight
>30kg/m^2–obesity
Classes of obesity include: class I -30-34kg/m^2
class II- 35-39.9kg/m^2
class III- >40Kg/m^2

Blood pressure was measured with a clinically validated electronic sphygmomanometer - OMRON digital fully automated blood pressure monitor. Values were obtained after resting for 5mins in a seated position, with 30 seconds interval between cuff inflation.

An average of 3 measurements were taken, and care was taken to select the cuff size according to the participant's arm circumference.

Assessments were performed in a dedicated room, with optimum temperature and lightning while respecting privacy. Blood pressure values were categorised as follows:

1. Normal: <120/80mm/hg
2. Pre-hypertension: 120-139/80-89mm/hg
3. Stage 1: 140-159/90-99mm/hg
4. Stage 2: > 160/100mm/hg

Blood measurements- Blood sugar was assessed using a glucometer and strip, after the participant's thumb is pricked in order to get a drop of blood on the strip. While the lipid level was obtained using a 5ml syringe and needle to collect at least 5mls of venous blood into a heparin containing bottle and samples sent to the chemical pathology laboratory for analysis. Some form of education on life style modification was also given to the participants accordingly.

Data were analysed using the IBM SPSS Version 23.0.

RESULTS

Socio-demographics

A total of 107 respondents between the ages of 23 and 80 years were screened for metabolic syndrome components. Majority were females (74.8%; n=80), married (58.9%; n=63) and between 41 and 50 (37.4%; n=40). The mean age was 49.4±13.7 years. The results also revealed that 43 (40.2%) of the respondents had tertiary education, 50 (46.7%) were self-employed and 67 (62.6%) earned less than N100,000 as monthly income, which is considered low (table 1)

Table 1 Socio-demographic Characteristics

	Frequency (n=107)	Percent
Age		
21-30 years	9	8.4
31-40 years	19	17.8
41-50 years	40	37.4
51-60 years	15	14.0
Over 60 years	24	22.4
Mean Age (SD)	49.4 (13.7)	
Sex		
Male	27	25.2
Female	80	74.8
Marital Status		
Single	20	18.7
Married	63	58.9
Divorced	1	0.9
Separated	3	2.8
Widowed	20	18.7
Level of Education		
Primary	27	25.2
Secondary	32	29.9
Tertiary	43	40.2
Non-formal	5	4.7
Occupation		
Self-employed	50	46.7
Unemployed	19	17.8
Student	7	6.5
Others	24	22.4
Civil Servant	5	4.7
Retired	2	1.9
Monthly Income		
Low	67	62.6
Medium	20	18.7
High	20	18.7

SD=Standard deviation

Prevalence of Metabolic Syndrome

Metabolic syndrome was noted in 44 (41.1%) of the respondents (figure 1). The prevalence of the various components of metabolic syndrome was also accessed and it was found that 70 (65.4%) of the respondents had high blood pressure, 54 (50.5%) had raised blood sugar, 48(44.9%) had abdominal obesity, 31(29.0%) had central obesity, 18 (16.8%) had reduced high density lipoprotein cholesterol, 6 (5.6%) had raised triglyceride (table 2).

Table 2 Prevalence of Various Components of Metabolic Syndrome

	Frequency (n=107)	Percent
High blood pressure	70	65.4
Raised blood sugar	54	50.5
Abdominal obesity	48	44.9
Central obesity	31	29.0
Reduced high density lipoprotein cholesterol	18	16.8
Raised triglyceride	6	5.6

Figure 1: Prevalence of metabolic syndrome

Metabolic syndrome prevalence was accessed across socio-demographic features of respondents. The prevalence of metabolicsyndrome was significantly increased acrossed respondents marital status. The prevalence was 10% among singles, 44.4% among married, 55.0% among widows 66.7% among separarted, and 100.0% for the divorced (x2=12.885, p=0.009). Other sociodemoraphics factors sassesssed did not show statsistical difference (p<0.05). See table 3 below.

Table 3 Prevalence of Metabolic Syndrome by Respondents' Socio-demographics

	Metabolic syndrome		X^2	p-value
	Present (n=44)	Absent (n=63)		
Age group				
21-30	1 (11.1%)	8 (88.9%)	8.783	0.067
31-40	4 (21.1%)	15 (78.9%)		
41-50	20 (50.0%)	20 (50.0%)		
51-60	7 (46.7%)	8 (53.3%)		
Over 60	12 (50.0%)	12 (50.0%)		
Gender				
Male	7 (25.9%)	20 (74.1%)	3.444	0.063
Female	37 (46.3%)	43 (53.8%)		
Marital status				
Single	2 (10.0%)	18 (90.0%)	12.885#	**0.009***
Married	28 (44.4%)	35 (55.6%)		
Separated	2 (66.7%)	1(33.3%)		
Widowed	11 (55.0%)	9 (45.0%)		
Divorced	1 (100.0)	0 (0.0%)		
Level of education				
Non-formal	2(40.0%)	3 (60.0%)	1.967#	0.617
Primary	9 (33.3%)	18 (66.7%)		
Secondary	12 (37.5%)	20 (62.5%)		
Tertiary	21 (48.8%)	22 (51.2%)		
Occupation				
Self-employed	23 (46.0%)	27 (54.0%)	9.422#	0.084
Unemployed	8 (42.1%)	11 (57.9%)		
Student	0 (0.0%)	7 (100.0%)		
Others	8 (33.3%)	16 (66.7%)		
Civil servant	3 (60.0%)	2(40.0%)		
Retired	2 (100.0%)	0 (0.0%)		
Monthly income				
Low	27(40.3%)	40 (58.7%)	0.153	0.926
Medium	9 (45.0%)	11 (55.0%)		
High	8 (40.0%)	12 (60.0%)		

*=Statistically significant; #=Fisher's Exact Test

The multinomial logistic regression was used to identify significant predictors of metabolic syndrome. None of the socio-demographic variables included in model was found to significantly predict metabolic syndrome with the crude odds ratio, however, when the odds ratio was adjusted for confounders, it was found that age significantly predicted metabolic syndrome. The result showed that the odds of developing metabolic syndrome was about 7.5% less unlikely in persons between 21-30 years of age compared to those above 60 years of age (AOR=0.075, 95% CI for AOR=0.007-0.785, p=0.0

Table 4 Association of Socio-demographics and Metabolic Syndrome

	COR	95% Confidence Interval for COR		p-value	AOR	95% Confidence Interval for AOR		p-value
		Lower Bound	Upper Bound			Lower Bound	Upper Bound	
Age group								
21-30	0.125	0.013	1.160	0.067	0.075	0.007	0.785	**0.031***
31-40	0.267	0.068	1.042	0.057	0.313	0.069	1.423	0.133
41-50	1.000	0.363	2.751	1.000	1.077	0.342	3.398	0.899
51-60	0.875	0.240	3.185	0.839	0.695	0.168	2.872	0.615
Over 60	1				1			
Gender								
Male	0.407	0.155	1.069	0.068	0.371	0.123	1.119	0.078
Female	1				1			
Level of education								
Non-formal	0.698	0.106	4.607	0.709	0.617	0.075	5.088	0.654
Primary	0.524	0.193	1.422	0.205	0.358	0.118	1.087	0.070
Secondary	0.629	0.247	1.597	0.329	0.564	0.194	1.646	0.295
Tertiary	1				1			
Monthly income								
Low	1.012	0.365	2.805	0.981	0.845	0.242	2.956	0.792
Medium	1.227	0.350	4.307	0.749	1.276	0.296	5.493	0.743
High	1				1			

COR=Crude Odds Ratio; AOR=Adjusted Odds Ratio

Table 5 Gender distribution of metabolic syndrome components

	Gender			
	Male (n=27)	Female (n=80)	χ^2	p-value
Blood pressure				
Normal	14 (51.9%)	23 (28.8%)	4.762	**0.029***
High	13 (48.1%)	57 (71.2%)		
Fasting blood glucose				
Normal	14 (51.9%)	39 (48.8%)	0.078	0.780
High	13 (48.1%)	41 (51.2%)		
Waist circumference				
Normal	26 (96.3%)	33 (41.2%)	24.729	**<0.001***
High	1 (3.7%)	47 (58.8%)		
BMI				
Normal	23 (85.2%)	53 (66.2%)	3.517	0.061
High	4 (14.8%)	27 (33.8%)		
High density lipoprotein cholesterol				
Normal	16 (59.3%)	73 (91.2%)	14.765	**<0.001***
Reduced	11 (40.7%)	7 (8.8%)		
Triglyceride				
Normal	25 (92.6%)	76 (95.0%)	0.221	0.641
High	2 (7.4%)	4 (5.0%)		

*=Statistically significant

Table 6 Association between metabolic syndrome and lifestyle characteristics

	Prevalence of metabolic syndrome				
	Present (n=44)	**Absent (n=63)**	**OR**	**95% CI (Lower-Upper Limit)**	**p-value**
Tobacco use					
Never smoked	41 (93.2%)	55 (87.3%)	2.235	0.533-9.370	0.272
Previous smoker	3 (6.8%)	8 (12.7%)			
Alcohol consumption					
Current drinker	10 (22.7%)	18 (28.6%)	0.957	0.354-2.591	0.931
Previous drinker	15 (34.1%)	16 (25.4%)	1.464	0.574-3.737	0.425
Never drank	19 (43.2%)	29 (46.0%)			
Fruit and vegetable consumption					
Adequate	7 (15.9%)	16 (25.4%)	0.547	0.200-1.498	0.241
Inadequate	37 (84.1%)	47 (74.6%)			
Salt consumption					
Add extra salt to meal	6 (13.6%)	10 (15.9%)	0.791	0.257-2.436	0.682
Do not add extra salt to meal	38 (86.4%)	53 (84.1%)			
Engage in physical activity					
Yes	22 (50.0%)	34 (54.0%)	0.881	0.400-1.941	0.753
No	22 (50.0%)	29 (46.0%)			

OR=Odds Ratio; *=Statistically significant

DISCUSSION

The prevalence of metabolic syndrome in this study was found to be 41.1% which is quite high when compared to other studies done in Nigeria and other parts of Africa[3,4,9-12].This high figure may be attributed to the epidemiological transition currently being experienced in this country as well as other developing countries in Africa and beyond. There is an increase in the adoption of Western lifestyle and urbanisation characterised by physical inactivity, inadequate consumption of the traditional African diet that is rich in fruits and vegetables and high consumption of Western styled energy-rich food. This leads to obesity, hyperglycemia ,hypertension (the most common components identified in this study) and subsequent developments of other components of metabolic syndrome.

The socio-demographic factors associated with metabolic syndrome include age(41-50 and over 60 years), female sex, marital status (divorced and separated), civil servants,retirees, those with tertiary education has well as medium income earners. However, the only statistically significant variable associated with metabolic syndrome in this study is marital status. Divorced and separated participants have a statistically significant occurrence of metabolic syndrome. This is comparable to another study done elsewhere where it was reported that being in a high quality marriage is associated with a lower risk of metabolic syndrome [13]. This may be due to the fact that married people are more likely to engage in positive health behaviours than widowed, separated or divorced people[14,15]. It was also noted in this study that metabolic syndrome has a low prevalence in unmarried participants. Similar studies done among African Americans and also in this part of the country revealed a similar finding[16,17]. This is most likely because single, unmarried persons tend to be young and metabolic syndrome prevalence increases with age[18]. However, it may also be due to the fact that unmarried persons tend to have low prevalence of obesity which is an important component and predictor of metabolic syndrome [19].

When the odds ratio was adjusted for confounders, it was found that age significantly predicted metabolic syndrome i.e. the odds of developing metabolic syndrome was 7.5% unlikely in persons between ages 21-30 years when compared to those above 60 years of age. This finding is similar to other studies done previously[11,20,16]. This is likely due to the fact that there is a higher propensity towards hypertension, dyslipidemia and obesity in the elderly[21,22,23]. Also the function of the islet cells tends to decline with age[24]. There is also a reduction in the level of physical activity with age[21]. These factors contribute to the increased prevalence of metabolic syndrome in the elderly.

In this study, the prevalence of metabolic syndrome is higher in females (46.3%) compared to the males (25.9%). Although this difference is not statistically significant, this difference may be attributed to the greater percentage of women with high blood pressure and increased waist circumference seen in this study which is statistically significant. Abdominal obesity is a major component and predictor of future metabolic syndrome[25,26]. The high prevalence of hypertension in the females may be attributed to the fact that most of the participants are >40 years of age and hypertension is said to be more prevalent in females after menopause[27].

The higher prevalence of reduced HDL cholesterol found in males in this study is similar to that done in this part of the country some years back which also revealed a similar high prevalence of reduced HDL cholesterol in males[24]. However, this difference is not enough to offset the higher female preponderance of metabolic syndrome in this study. Women are said to have a higher HDL cholesterol in comparison to men partly due to the fact that they (women) respond to dietary ingestion of cholesterol and fats with a greater increase in HDL cholesterol than men[28].

relationship between physical activity and hypertension, waist circumference and HDL cholesterol[29,30,31]. This is of The various lifestyle characteristics studied include alcohol ingestion, tobacco usage, fruit and vegetable consumption, excessive salt intake and physical activity all of which have no statistically significant association with metabolic syndrome. This is similar to another study carried out among African Americans which also reported no association between lifestyle factors and metabolic syndrome[23]. Moreover, some other studies have ironically reported an inverse course contrary to what is known to be the risk factors for metabolic syndrome. In view of this, there is a need to carry out more research as to ascertain and clarify the effect of these lifestyle risk factors on the development of metabolic syndrome.

CONCLUSION

This study revealed a rather high prevalence of metabolic syndrome (41.1%) in the population studied. Marital status and age were found to be associated with metabolic syndrome. The commonest components of metabolic syndrome identified study this are hypertension, hyperglycaemia and abdominal obesity. No lifestyle risk factor was statistically associated with metabolic syndrome.

Limitations

The small sample size in this study is a major limitation factor. The findings, therefore should be confirmed with a much larger sample size.

Conflict of Interest: The authors declare no conflict of interest.

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