

# Components and Risk Factors of Metabolic Syndrome Amongst Staff in Edo State University Uzairue

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## ABSTRACT

**Background:** Metabolic syndrome (MetS) is a significant risk factor of metabolic diseases and is on the rise, particularly in sub-Saharan Africa. Information on the prevalence of metabolic syndrome among university staff in Nigeria is sparse.

**Objective:** To determine the components, prevalence and risk factors of MetS among staff of Edo State University Uzairue (EDSU).

**Methods:** This cross-sectional study involved fifty-two EDSU staff, comprising 24 academic staff and 28 non-academic staff gave written informed consent. Data collection methods included questionnaire, lipid profile, fasting plasma glucose (FPG), waist circumference (WC), and blood pressure (BP) which were all measured using standard methods and procedures. Statistical analysis involved Pearson correlation and chisquare, statistical significance was accepted at  $P < 0.05$ .

**Results:** Abdominal obesity (57.7%), impaired FPG (IFPG) (5.8%), hypertriglyceridemia (30.8%), hypertension (13.8%) and reduced high-density lipoprotein cholesterol (reduced HDL-c) (21.2%) were prevalent with similarity ( $P > 0.05$ ) between occupations, sex and age. Overall MetS prevalence was 9.6%, which was more prevalent in staff with abdominal obesity (odds ratio [OR] = 1.200, 95% confidence interval [CI] = 1.023- 1.408), reduced HDL-c (OR = 22.857, 95% CI = 2.215- 235.820), elevated systolic BP (OR = 8.571, 95% CI = 1.206- 60.920), elevated diastolic BP (OR = 16.889, 95% CI = 1.679- 169.912) and hypertriglyceridemia (OR = 11.667, 95% CI = 1.185- 114.896).

**Conclusion:** Abdominal obesity was the strongest risk factor of MetS and it was more prevalent in female participants than males, while hypertension was more prevalent in male participants.

**Keywords:** Metabolic syndrome, lipid profile, hypertension, university staff, abdominal obesity.

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## INTRODUCTION

Individuals obtain the necessary energy for fundamental metabolic processes, physical exertion, and heat production via the consumption of food and beverages [1]. Haller originally introduced the term metabolic syndrome (MetS) in 1977 [2]. MetS is a clinical condition characterized by central adiposity, dyslipidemia, impaired glucose metabolism, and hypertension. These disorders have connected underlying mediators, routes, and processes [3]. The presence of MetS elevates the likelihood of getting heart disease, stroke, arthritis,

type 2 diabetes mellitus (T2DM), chronic renal sickness, heart disease, and some forms of adult cancer [4,5].

Chronic non-communicable illnesses are major hazards to world health, which from previous studies have shown to be responsible for about two-thirds of all deaths globally [2]. Many lifestyle decisions taken throughout adulthood may put a person at risk for MetS. Nigeria, like many other low- and middle-income nations, is witnessing an increase in the prevalence of non-communicable

diseases, which have become major public health issues [6].

The development of different chronic disorders is connected to MetS as previous studies on a worldwide scale have indicated [2, 7]. There is need for full information of the distribution of this disease in a specific geographical location, this would raise awareness of the origins of chronic illnesses, which are organically tied to metabolic imbalances, and lead to early identification. This study aims to provide detailed understanding of the components, prevalence and risk factors of MetS among staff of Edo State University Uzairue (EDSU) Edo State, Nigeria, offering insights into potential health implications and avenues for further biochemical research.

## **MATERIALS AND METHODS**

### **Study design and participants**

This cross-sectional study was conducted among academic staff and non-academic staff of EDSU, Edo State, Nigeria. Female participants that reported being pregnant and other participants that reported any form of ailment were excluded from the study, out of the remaining 510 staff consisting of 235 academic staff and 275 non-academic staff of EDSU, a subsample of 10.2 % (52) was selected using a two-stage sampling technique [8]: (i) proportionate sampling was used to determine the number of respondents selected from each academic staff and nonacademic staff (ii) simple random sampling technique was used to select the number of persons from academic staff and non-academic staff.

### **Ethical Clearance**

Ethical approval for the study was obtained from the Ethical and Research Review Board of Edo State University Uzairue, Edo state (EDSUREC 23/0001). The necessary information regarding the importance of the study was explained to each participant. Signed informed consent was taken from each participant. Their confidentiality and privacy were maintained based on research ethics.

### **Data collection**

After signing the consent forms, questionnaires were given to each member of the study to obtain information on socio-demographic characteristics before sample collection.

### **Waist circumference**

Waist circumference was taken according to already described standard methods [9].

### **Blood pressure**

Blood pressure was measured on the left arm, using appropriate cuff sizes with Yuwell automatic digital sphygmomanometer. Measurements were taken two times at two minutes' intervals, and the average of the two readings was recorded. Hypertension was defined as systolic BP (SBP)  $\geq 130$  and diastolic BP (DBP)  $\geq 85$  mmHg.

### **Sample preparation**

Five milliliters of venous blood was drawn from each of the 52 respondents following 8–12 hours of fast. Within one hour of blood collection, the samples were centrifuged at 3000rpm (revolutions per minute) for 5 minutes.

### **Fasting blood glucose (FBG)**

Fasting blood glucose was determined using enzymatic oxidation in the presence of glucose oxidase. Fasting blood sugar of 110 – 125 mg/dl (6.1 – 6.9 mmol/l) was considered as impaired FBG [10].

### **Serum lipids parameters**

High-density lipoprotein cholesterol (HDL- c), Triglycerides (TG) and Total cholesterol (TC) was analyzed using the enzymatic method employed by the kits. The blood sample was allowed to coagulate, the serum was extracted after centrifugation at 3000rpm for 5 minutes and stored until analysis [11, 12]. The reagents meant for each component of serum lipid from Agape laboratories Ltd. was used to obtain a characteristic coloured solution, the absorbance was measured using Jenway 6700 spectrophotometer at a wavelength of 546 nm. The concentration of each parameter was calculated from the measured absorbance and concentration of the standard according to the manufacturer's instructions. Low-density lipoprotein cholesterol (LDL-c) was calculated using Friedewald's equation [13].

### **Determination of metabolic syndrome**

In this study, the five-part approach called "harmonizing MetS." which was a consensus reached in 2009 by, The International Diabetes Federation [IDF], American Heart Association, National Institutes of Health, International Atherosclerosis Society, World Heart Federation, and International Association for the Study of Obesity were employed to define the presence of MetS [7]. A participant is said to have MetS if he or she has three of the following key features: central obesity (waist circumference [WC]  $\geq 94$  cm for men,  $\geq 80$  cm for women); elevated triglycerides (TG) >

150 mg/dL; reduced HDL cholesterol < 40 mg/dL for men, < 50 mg/dL for women); hypertension  $\geq$  130/85 mmHg; and elevated fasting glucose > 100 mg/L [7].

### Data analysis

Data was analyzed using the Statistical Package for Social Sciences (IBM SPSS) version 29.0 (IBM, Armonk, New York, USA). Chi-squared test was used to compare sex and staff categories. Pearson's correlation coefficient and binary logistic regression were used to determine the relationship among variables. All tests of significance were two-tailed with significance accepted at  $P < 0.05$ .

### RESULTS

Socio-demography characteristics of the staff In this study, there were 52 consenting participants, Table 1 shows the socio-demography of all respondents. Non-academic staff were significantly ( $P < 0.05$ ) younger than the academic staff with 64.3% aged 31- 40 years. All the Academic staff had postgraduate level of education and was statistically significant ( $P < 0.001$ ) in comparison with the educational level of non-academic staff.

### Components and prevalence of metabolic syndrome

Table 2 presents the components and prevalence of MetS among the staff by occupation. Non-academic staff had a higher prevalence of abdominal obesity (67.9%), elevated TG (32.1%), and hypertension (14.3%) and reduced HDL-c (28.6%). Impaired FPG (12.5%) was present only among academic staff. Non-academic staff had one (78.6%) and two (50.0%) and three (14.3%) components, only 4.6% of academic staff had four components of MetS: Overall, MetS prevalence was 9.6%.

The components of MetS among the staff by sex were presented in Table 3. Majority (85.0%) of the female participants had abdominal obesity ( $P < 0.001$ ); male participants had higher prevalence of hypertension (25.0%), which was statistically significant ( $P < 0.05$ ).

The correlation of the components of MetS is presented in Table 4. Positive significant relationships were found between TG and SBP ( $P < 0.05$ ), TG and HDL-c ( $P < 0.05$ ), and SBP and DBP ( $P < 0.01$ ), SBP and WC ( $P < 0.01$ ) and DBP and WC ( $P < 0.01$ ). The inverse relationship of FPG with TG was not significant ( $P > 0.05$ ).

**Table 1: Socio-demography of the respondents**

Socio-demography characteristics	Academic staff (n=24) n (%)	Non-academic staff (n=28) n (%)	Total (n= 52) n (%)	$\chi^2$	P
<b>Sex</b>				0.265	0.606
Male	12 (50.0)	12 (42.9)	24 (46.2)		
Female	12 (50.0)	16 (57.1)	28 (53.8)		
<b>Age (years)</b>				8.248	0.016*
$\leq$ 30	4 (16.7)	5 (17.9)	9 (17.3)		
31 – 40	7 (29.2)	18 (64.3)	25 (48.1)		
41 $\geq$	13 (54.2)	5 (17.9)	18 (34.6)		
<b>Highest educational attainment</b>				38.204	0.000*
Secondary	0 (0.0)	3 (10.0)	3 (5.8)		
OND/NCE	0 (0.0)	7 (25.0)	7 (13.5)		
HND/BSC	0 (0.0)	14 (50.0)	14 (26.9)		
PG	24 (100)	4 (14.3)	28 (53.8)		

P values were generated through Chi-square analysis, \* $P < 0.05$  was considered statistically significant, OND- Ordinary national diploma, NCE- National certificate examination, BSc- Bachelor of science, PG- Post-graduate.

**Table 2: Components and prevalence of metabolic syndrome among the respondents by occupation**

Components and prevalence of metabolic syndrome	Academic staff (n=24) n (%)	Non-academic staff (n= 28) n (%)	Total (n= 52) n (%)	$\chi^2$	P
Abdominal obesity	11 (45.8)	19 (67.9)	30 (57.7)	2.568	0.109
Impaired FPG	3 (12.5)	0 (0.0)	3 (5.8)	3.714	0.054
Elevated TG	7 (29.2)	9 (32.1)	16 (30.8)	0.054	0.817
Hypertension	3 (12.5)	4 (14.3)	7 (13.5)	0.035	0.851
Reduced HDL	3 (12.5)	8 (28.6)	11 (21.2)	2.001	0.157
<b>Number of components of MetS</b>					
None	7 (29.2)	6 (21.4)	13 (25.0)		
One	17 (70.8)	22 (78.6)	39 (75.0)		
Two	7 (29.2)	14 (50.0)	21 (40.4)		
Three	1 (4.2)	4 (14.3)	5 (9.6)		
Four	1 (4.2)	0 (0.0)	1 (1.9)		
MetS	1 (4.2)	4 (14.3)	5 (9.6)	1.523	0.217

P values were generated through Chi-square analysis, \*P < 0.05, MetS = Metabolic syndrome, Abdominal obesity = Waist circumference of  $\geq 94$  cm in males and  $\geq 80$  cm in females, Impaired FPG = impaired fasting plasma glucose  $\geq 100$  mg/dL, Hypertension = Elevated systolic blood pressure  $\geq 130$  mmHg and Elevated diastolic blood pressure  $\geq 85$  mmHg, Raised triglyceride = TG  $\geq 150$  mg/dL, Reduced HDL = Reduced high density lipoprotein  $< 40$  mg/dL in male and  $< 50$  mg/dL in female, Metabolic syndrome = any three of the following key features; abdominal obesity, impaired FPG, elevated triglyceride, hypertension and reduced HDL-c.

**Table 3: Components of metabolic syndrome among the respondents by sex**

Components of metabolic syndrome	Male (n=24) n (%)	Female (n=28) n (%)	$\chi^2$	P
Abdominal obesity	6 (25.00)	24 (85.7)	19.517	0.000*
Impaired FPG	3 (12.5)	0 (0.00)	3.714	0.054
Elevated TG	6 (25.0)	10 (35.7)	0.696	0.404
Hypertension	6 (25.0)	1 (3.6)	5.094	0.024*
Reduced HDL	5 (20.8)	6 (21.4)	0.003	0.958
<b>Number of components of MetS</b>				
None	9 (37.5)	4 (14.3)		
One	15 (62.5)	24 (85.7)		
Two	7 (29.2)	14 (50.0)		
Three	2 (8.3)	3 (10.7)		
Four	1 (4.2)	0 (0.00)		
MetS	2 (8.3)	3 (10.7)	0.084	0.772

P values were generated through Chi-square analysis, \*P < 0.05,, MetS = Metabolic syndrome, Abdominal obesity = Waist circumference of  $\geq 94$  cm in males and  $\geq 80$  cm in females, Impaired FPG = impaired fasting plasma glucose  $\geq 100$  mg/dL, Hypertension = Elevated systolic blood pressure  $\geq 130$  mmHg and Elevated diastolic blood pressure  $\geq 85$  mmHg, Raised triglyceride = TG  $\geq 150$  mg/dL, Reduced HDL = Reduced high density lipoprotein  $< 40$  mg/dL in male and  $< 50$  mg/dL in female, Metabolic syndrome = any three of the following key features; abdominal obesity, impaired FPG, elevated triglyceride, hypertension and reduced HDL-c.

**Table 4: Correlation of the components of metabolic syndrome**

Index	TG		SBP		DBP		WC		HDL-c	
	r	P	r	P	r	P	r	P	r	P
FPG	-0.088	0.535	0.157	0.266	0.093	0.514	0.051	0.721	0.053	0.708
TG			0.285*	0.041	0.128	0.366	0.189	0.179	0.327*	0.018
SBP					0.716**	<.001	0.388**	0.004	0.091	0.523
DBP							0.425**	0.002	0.070	0.624
WC									0.035	0.805

r= Correlation coefficient, \*= P<0.05, \*\*= P<0.01; WC – Waist circumference; HDL-C – High-density lipoprotein-cholesterol; SBP – Systolic Blood pressure, DBP – Diastolic Blood pressure; TG – Triglyceride; FPG – Fasting plasma glucose.

**Table 5: Risk factors of metabolic syndrome among the Staff**

Risk factors of metabolic syndrome	Metabolic syndrome		P	OR (95%CI)
	Present (n=5), n (%)	Absent (n=46), n (%)		
<b>HDL-c</b>			0.001*	22.857 (2.215- 235.820)
Normal	1 (20.0)	40 (85.1)		
Reduced	4 (80.0)	7 (14.9)		
<b>TG</b>			0.012*	11.667 (1.185- 114.896)
Normal	1 (20.0)	35 (74.5)		
Elevated	4 (80.0)	12 (25.5)		
<b>TC</b>			0.786	0.729 (0.074- 7.181)
Normal	4 (80.0)	35 (74.5)		
Elevated	1 (20.0)	12 (25.5)		
<b>LDL-c</b>			0.443	0.894 (0.810- 0.986)
Normal	5 (100)	42 (89.4)		
Elevated	0 (0.0)	5 (10.6)		
<b>SBP</b>			0.015*	8.571 (1.206- 60.920)
Normal	2 (40.0)	40 (85.1)		
Elevated	3 (60.0)	7 (14.9)		
<b>DBP</b>			0.003*	16.889 (1.679- 169.912)
Normal	1 (20.0)	38 (80.9)		
Elevated	4 (80.0)	9 (19.1)		
<b>Abdominal obesity</b>			0.044*	1.200 (1.023- 1.408)
Absent	0 (0.0)	22 (46.8)		
Present	5 (100.0)	25 (53.2)		
<b>Impaired FPG</b>			0.151	5.625 (0.414- 76.433)
Absent	4 (80.0)	45 (95.7)		
Present	1 (20.0)	2 (4.3)		

P values were generated through Chi-square analysis, \*P < 0.05, 95% CI – Confidence interval; OR – Odds ratio, HDL-c – High-density lipoprotein-cholesterol; SBP – Systolic blood pressure, DBP – Diastolic blood pressure; TG – Triglyceride; FPG – Fasting plasma glucose, TC- total cholesterol; LDL-c; low density lipoprotein cholesterol.

### Risk factors of metabolic syndrome

The risk factors of MetS among the workers are shown in Table 5. Respondents with abdominal obesity (odds ratio [OR] = 1.200, 95% confidence interval [CI] = 1.023- 1.408), reduced HDL-c (OR = 22.857, 95% CI = 2.215- 235.820), elevated

systolic BP (OR = 8.571, 95% CI = 1.206- 60.920), elevated diastolic BP (OR = 16.889, 95% CI = 1.679- 169.912) and hypertriglyceridemia (OR = 11.667, 95% CI = 1.185- 114.896):were more likely to develop MetS.

## DISCUSSION

This study provided detailed understanding of the components, prevalence and risk factors of MetS among staff of EDSU. Observations from this study show that most non-academic staff were younger than the academic staff with majority of them being between age 31- 40 years. Academic staff all had postgraduate level of education in contrast to the educational level of non-academic staff: This finding is consistent with the expectation that is associated with the educational qualification criterion for lecturers in Nigerian Universities.

Abdominal obesity in this study exhibited significantly higher rates in female participants than males, this is in contrast with the report of a study carried out among apparently healthy adults [14]. It was however similar to some reports [3, 8]. This trend may be attributed to factors such as low levels of physical activity, diets rich in calories, parity, and abdominal enlargement post-pregnancy [15, 16]. The overall prevalence of abdominal obesity in this study was higher than the report by da Costa et al [15] conducted among Federal University employees and less than was noticed in an adult out-patients study in a Nigerian clinic [17]. Impaired fasting plasma glucose [IFPG] was prevalent only in the male participants. The total prevalence was low in comparison to a study conducted among adults in a rural community in southwestern Nigeria [3] although, its prevalence was higher than the findings of a study carried out among school teachers in South Western Nigeria [16]. This difference may be linked to variations in lifestyle factors. Raised triglyceride was the second most prevalent component of MetS in this study. The percentage of its prevalence was higher than the report of a study on health care workers in Ekiti state [18], but lower than the report on company workers in a Brazilian study [19]. This may be linked to the difference in dietary intake of the study participants.

Reduced HDL-c prevalence in this study was higher compared to report on adults in eastern Ethiopia [20] but lower prevalence when compared with the study on staff of a Malaysian Public University [21]. This difference may be attributed to dietary preferences or genetic factors influencing lipid metabolism. Hypertension in this study was more prevalent in males than females, which is similar to the report of a study conducted on working adults in Ethiopia [22] and consistent with a report of a Nigerian study conducted on adults in an urban settlement [23]. The total prevalence of hypertension was less than the report on workers in

a company in Brazil [19], this may be due to the level of physical energy exerted in the different occupations and diet choice of participants. There was absence of hypertension among participants aged less than 30 years, which may be due to the active lifestyle of adolescents.

Among the study participants, 75% displayed at least one MetS component. Similarly, reports from young adults in Chile revealed that approximately one-third of all subjects had at least one MetS component, with hypertriglyceridemia being the most prevalent [24, 25]. The presence of one risk factor left unaddressed can lead to the development of others. These respondents are also at a high risk of developing cardiovascular disease [3]. In this study, the prevalence of MetS was 9.6%, with a higher prevalence observed in females than males. This corresponds to findings in studies reporting rates of 5% (with the majority being females) [6], 20% (with females being affected more) [8], 24.2% (with females being more affected) [26] and contradicts the study done in Lebanon with a prevalence of 30.4%, with majority being males [27]. Notably, the prevalence of MetS reported in this study exceeds that observed in a similar age group of apparently healthy adults in Ogun state, Nigeria, where the prevalence was 4.9% [28], the study on school teachers in south west Nigerian with prevalence of 7.2% and another study among adults with prevalence of 7.69% [14, 16]. These differences in prevalence rates of MetS may be attributed to variations in the definitions of MetS used in the studies. The harmonized definition was used in this research, additionally, there is a tendency for a study to report higher or lower prevalence of MetS depending on the sample size utilized. Significant relationships were discovered between the following parameters: WC, TG, SBP, DBP and HDL-c. Additionally, the study discovered a negative link between TG and FPG levels, pointing to a possible regulatory connection between lipid homeostasis and glucose metabolism [29]. Additionally, the study discovered a significant correlation between TG and SBP, pointing to a possible connection between high blood pressure and dyslipidemia.

## CONCLUSION

Observation in this study shows the presence of MetS in the study population, with higher prevalence among females and non-academic staff. Abdominal obesity was the strongest risk factor of MetS.

## RECOMMENDATION (S)

Awareness on healthy lifestyle should be intensified among University staff. Future research should explore the longitudinal effects of dietary and lifestyle factors on health outcomes and develop targeted strategies for behavior modification and disease prevention.

## LIMITATION

Fifty-two individuals with data on the components of MetS, accounting for about 10.2% of the entire study population were studied. This may limit the generalization of our result findings. Furthermore, the study was limited to the staff of EDSU. Future studies with multi-institutional design should be conducted.

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## CONFLICTING INTEREST

The authors recorded no conflict of interest in this study

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