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Obesity, hypertension and hyperglycaemia prevalence and associated factors among adults in Abuja Municipal Area Council, Abuja, Nigeria: A descriptive cross-sectional study.

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Abstract
Objectives: Despite the increased prevalence, high morbidity, and mortality associated with obesity, hypertension, and hyperglycaemia in developing countries, there is limited knowledge about these conditions in Abuja Municipal Area Central (AMAC), Abuja, Nigeria. This study was conducted to determine the prevalence of obesity, hypertension, and hyperglycaemia, as well as their associated factors, in this population, as the prevalence is higher in Metropolitan areas.
Methods: This study employs a descriptive and cross-sectional design. A multistage sampling technique was used to select 309 adults in the Abuja Municipal Area. Body mass index, blood pressure and glucose level were assessed following standard procedures. Stata version 12 was used for data entry and analysis. The chi-square test was used to determine associations between categorical variables. Multivariable logistic regression was performed to determine the predictors. $P \leq 0.05$ was considered statistically significant.
Results: The prevalence of obesity, hypertension, and hyperglycaemia was 16.5%, 22.8%, and 5.6%, respectively. Age (>50 years) and gender (Male) were significant predictors of obesity. Age (>50 years) and obesity were predictors of hypertension ($p<0.001$), (OR= 28.84: (95% CI: 3.05 -272.82).
Conclusion: The prevalence of obesity, hypertension and hyperglycaemia in Abuja was similar to other parts of Nigeria. Age and gender were predictors of obesity, while age and obesity were predictors of hypertension. Targeted aggressive educational campaigns and other wellness programs should be employed to reduce the prevalence of non-communicable diseases among adults in Abuja.

Keywords: Overweight, obesity, hypertension, hyperglycaemia, predictors of NCDs

Plain English summary

Despite the swift rise in obesity, hypertension, and hyperglycaemia in developing countries, little is understood concerning these conditions in the Abuja Municipal Area Council, Abuja, Nigeria. This study aimed to determine the magnitude of obesity, hypertension, hyperglycaemia, and associated factors among adults within this metropolitan population.

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The study is descriptive. A multistage sampling technique was used to select 307 adults in the Abuja Municipal Area. Weight, height, blood pressure and glucose level were assessed following standard procedures. Data was analysed, and associations were determined using appropriate methods.
The magnitudes of obesity, hypertension, and hyperglycaemia were 16.5%, 22.8%, and 5.6%, respectively. Age (>50 years) and gender (Male) were significant determinants of obesity. Age (>50 years) and obesity were determinants of hypertension. The magnitudes of obesity, hypertension, and hyperglycaemia in Abuja were similar to those in other parts of Nigeria. Age and gender were determinants of obesity, while age and obesity were determinants of hypertension. Educational campaigns and additional wellness programmes that target adults in Abuja metropolis should be employed to reduce non-communicable diseases.

Background

Non-communicable diseases (NCDs) have become a major public health concern worldwide, prematurely taking 16 million lives annually (1). The prevalence of obesity, hypertension and hyperglycaemia, in particular, is increasing rapidly in developing countries.

In Nigeria, the prevalence of obesity among adults has been estimated to range from 6.4 to 24.7% (2). Another study in southwestern Nigeria found the prevalence of obesity among market men and women to be 29.4% and that of abdominal obesity as high as 52.0%, while in urban and rural Abuja, Nigeria, it was 22.3%. Prevalence rates were higher in metropolitan areas, among females, and were significantly associated with little or no education (3).

Other critical points revealed from the study are the co-relationship between obesity and chronic diseases, and that obesity remains an area of significant public health importance to Africans, particularly in urban areas, as there is little evidence of proper diagnosis, treatment and prevention (4).

Obesity has been associated with co-morbidities like hypertension, hyperglycaemia, cancer, stroke, coronary artery disease, congestive heart failure, asthma, chronic back pain, pulmonary embolism and increased risk of disability. Yearly, all these lead to more than three million deaths globally (5). Its strong association with chronic medical conditions has led to substantial healthcare costs totalling about $342.2 billion in the US in 2013 (6).

In Edo state, Nigeria, a study reported the prevalence of hypertension to be 37.6%; the predictors of hypertension were age ≥ 40 years and overweight/obesity, while females were less likely to develop hypertension (7). A nationwide survey reported the prevalence of hypertension as 38.1% (8). The mean cost of managing hypertension was high among urban residents and crippling among the least earners in a study carried out in Abuja, Nigeria (9). Several complications that increase the cost of management include stroke, target organ damage (TOD), established cardiovascular disease, heart failure, retinopathy, Ischaemic heart disease, and peripheral vascular disease (10).

Studying hospital-based mortality in Federal Capital Territory hospitals, hypertension was the second leading cause of death among those aged 45-54 (11%) and 55-64 (13%). Among adults aged 65 years and above, hypertension was the number one cause of death (17%) (11). Most of the descendants lived in the FCT, and slightly over half (50.6%) resided in AMAC at their time of death.

The same study above reported the prevalence of hyperglycaemia as 4.6% and the significant predictor of hyperglycaemia as overweight/obesity (7). Chronic hyperglycaemia is associated with long-term damage and dysfunction of various body organs. Adults with hyperglycaemia have a two-to-four-times increased risk of heart attacks and strokes (12). The prevalence of diabetic retinopathy, a cause of 2.6% of global blindness, was found to be 21.3% in Nigeria and was associated with hypertension (13, 14). In addition to reduced blood flow, neuropathy in the feet increases the chance of foot ulcers, infection and eventual need for limb amputation, reducing their quality of life and necessitating the need for this study.

Unfortunately, little is known about the prevalence of obesity, hyperglycaemia, and hypertension and their predictors in urban central Nigeria, and NCDs are not yet given the full attention they deserve. This paucity of data further magnifies this problem since it can mislead people about their importance. Moreover, an association between these NCDs and dietary habits has not been explored in the AMAC population. This population was selected because it is an urban area with many working-class residents. Most offices, organisations and ministries are domiciled in this area council. More so, main trends such as globalisation, supermarket growth, rapid urbanisation and increasingly sedentary lifestyles can be largely associated with NCDs.

Assembling evidence available from this study would stimulate increased efforts by policymakers to control the emerging health burden. Therefore, this study aims to assess the prevalence of obesity,

hypertension and hyperglycaemia and their associated factors among adults in Abuja Municipal Area Council, Federal Capital Territory (FCT), Abuja.

Materials and Method

Design of the study

A descriptive cross-sectional study design was employed.

Setting

The study was conducted among adults living in the Abuja Municipal Area Council, FCT, in Abuja. Abuja is the capital city of Nigeria, situated in the centre of Nigeria, within the Federal Capital Territory (FCT). It has a population of well over three million and forms the fourth-largest metropolitan area in Nigeria, surpassed only by Lagos, Kano, and Ibadan.

Participants

Adults eighteen years of age or older, including individuals with confirmed NCD diagnoses or those at high risk, were eligible for the study.

Pregnant women and persons with disabilities whose weight or height could not be measured were excluded from the study.

Study Size

The minimum sample size was calculated using Cochran's formula. The prevalence of hypertension from a previous study (28.9%) resulted in the highest sample size compared to the prevalence of obesity and hyperglycaemia; hence, it was used for the minimum sample size calculation (15). The calculated study size was 264; however, it was increased to 307 to take care of non-response.

Sampling Methodology: A multistage sampling technique was used to select the participants. Four of the twelve wards in the Abuja Municipal Area Council (AMAC) of the FCT were selected using simple random sampling (balloting), and four streets were chosen from each of the four wards by simple random sampling to obtain a total of sixteen streets. Using a sample interval of two, a systematic random sampling technique was used to select houses from the streets. One household was selected in dwellings with more than two households, and one adult was chosen from each household using simple random sampling.

At least fifty per cent of those who participated in the questionnaire survey were selected using systematic random sampling to determine the participants for blood glucose measurement.

Variables

The independent variable was Body Mass Index, while the outcome variables were hypertension and hyperglycaemia.

Data Sources and Measurement

A pre-tested, structured interviewer-administered questionnaire was used to obtain data on the respondents' socio-demographic characteristics and dietary habits. Anthropometric data, blood pressure and blood sugar were measured following standard procedures. A stadiometer (calibrated to the nearest 0.1m) was used to measure the heights of respondents in meters, while their weights were measured using a weighing scale (Calibrated to the nearest 0.1 kg) in kilograms. Their BMI was computed from these measurements. While measuring height, the individuals were asked to stand straight, looking ahead, with their shoulder blades, buttocks and heels touching the stadiometer, their arms at their sides, legs straight, with their knees together and feet flat without shoes.

A sphygmomanometer was used to measure the blood pressure of respondents for at least five minutes after sitting down with their back supported and feet on the floor, not crossed, but resting comfortably. Their arms were supported such that their upper arms were at heart level. Their Sleeves were rolled up, and the cuff was at the same level as the heart. The respondents were still and silent to avoid any form of tension when the cuff was inflated. Three blood-pressure readings were taken at different times over two days, and the average was recorded. A glucometer (ACCU CHEK Active) was used to check the blood glucose level, and respondents' thumbs were swabbed with cotton wool soaked in methylated spirit. The lancet was used to prick their thumbs at the side, the blood sample was placed on the strips, and the blood glucose level was taken. Individuals who had neither taken water nor food for at least 8-12 hours before the time of testing were tested using Fasting Blood Sugar (FBS), while others (who had eaten at least 2 hours before) were tested using Random Blood Sugar (RBS) test. (A diagnosis of hyperglycaemia is made at random blood glucose ≥ 200 mg/dl in the presence of classic symptoms of hyperglycaemia). All FBS tests ended every day at 12 noon.

Variables

Data entry, collation, and analysis were done using Stata version 12. The socio-demographic data variables were analysed using descriptive statistics such as frequencies, means, and percentages. Descriptive statistics for all variables were generated. The results obtained were presented in

tables. Percentages were used to describe categorical variables.
Obesity was classified as a Body mass index (BMI) greater than or equal to 30kg/m^2. Hypertension was defined as Systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg according to the Joint National Committee on Hypertension (JNC) 7 classification (Following at least two tests done on different days) (16).
In contrast, hyperglycaemia was defined as a fasting blood sugar ≥ 126 mg/dL (7.0 mmol/L) or random blood glucose ≥ 200 mg/dl (11.1 mmol/L) in the presence of classic symptoms of hyperglycemia (17).

Statistical methods
The association between categorical variables and key outcomes was assessed using the chi-square test. Additionally, multivariable logistic regression was performed to identify predictors of obesity, hypertension, and hyperglycaemia. The odds ratio was reported along with its 95% confidence interval (CI); p-value < 0.05 was considered statistically significant.

Results
The mean age of participants was 32.9 ± 8.9 years. Almost half (48.9%) of them were married. Most participants (52.8%) held a tertiary education as their highest educational level, and the majority (68.6%) were male.
The prevalence of obesity was 16.5% (95% CI: 12.26 -20.64), the overall prevalence rate of hypertension was 22.8% (95% CI: 18.0 -27.5), while hyperglycaemia was 5.6% (95% CI: 3.0 – 8.2). (Figure 1)

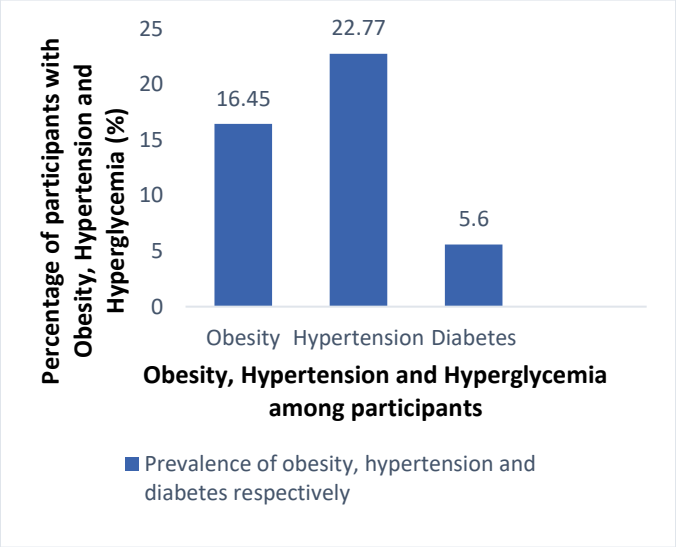


Figure 1: Prevalence of Obesity, Hypertension and Hyperglycaemia in AMAC Abuja

Factors Associated with Obesity
Obesity was significantly higher among females (27.84%) than among males (11.1%) (p < 0.001), as well as among older adults (25-49 years age group) and married adults compared to younger and single adults (p = 0.004). Eating at night just before bedtime was also associated with a higher BMI (indicating obesity) (p = 0.002) (Table 1).

Table 1. Factors Associated with Obesity

Variables	Normal Frequency (%) (N=158)	Overweight Frequency (%) (N= 96)	Obese Frequency (%) (N = 50)	p-value
Gender				
Male	127 (61.35)	57(27.54%)	23(11.11%)	<0.001
Female	31(31.96%)	39(40.21%)	27(27.84%)	
Age (Years)				
18-24	34(75.56%)	9(20.00%)	2(4.44%)	
25-49	117(48.75%)	81(33.75%)	42(17.50%)	0.004
>=50	7(36.84%)	6(31.58%)	6(31.58%)	
Marital Status				

Widowed	2(40.00%)	2(40.00%)	1(20.00%)	0.004
Married	64(43.24%)	49(33.11%)	35(23.65%)	
Single	92(60.93%)	45(29.80%)	14(9.27%)	
Education				
No Formal Education	4(66.67%)	1(16.67%)	116.67%)	0.634
Others	5(33.33%)	7(46.67%)	3(20.00%)	
Primary	13(54.17%)	7(29.17%)	4(16.67%)	
Secondary	54(54.55%)	34(34.34%)	11(11.11%)	
Tertiary	82(51.25%)	47(29.38%)	31(19.38%)	
Occupation				
Student	49(68.06%)	20(27.78%)	3(4.17%)	0.016
Farming	8(66.67%)	3(25.00%)	1(8.33%)	
Petty Trading	20(47.62%)	14(33.33%)	8(19.05%)	
Civil Servant	35(52.24%)	20(29.85%)	12(17.91%)	
Highly Skilled	14(31.11%)	18(40.00%)	13(28.89%)	
Others	31(47.69%)	21(32.31%)	13(20.00%)	
Ethnic Group				
Hausa	25(55.56%)	10(22.22%)	10(22.22%)	0.381
Igbo	32(42.67%)	30(40.00%)	13(17.33%)	
Yoruba	31(51.67%)	20(33.33%)	9(15.00%)	
Others	70(56.45%)	36(29.03%)	18(14.52%)	
Family History of Obesity				
Yes	10(37.04%)	8(29.63%)	9(33.33%)	0.051
No	128(52.24%)	80(32.65%)	37(15.10%)	
Eating at night just before bedtime	(N=143)	(N=94)	(N=49)	
Yes	132(53.4)	78(31.6)	37(15.0)	
Occasionally	8(25.8)	14(45.2)	9(29.0)	0.023
No	3(37.5)	2(25.0)	3(37.5)	

Predictors of obesity among adults in AMAC, Abuja

Male respondents were 0.30 times less likely to have obesity than their female counterparts (OR= 0.30: 95% CI: 0.14 -0.61). Respondents aged 50 years and above were 17 times (OR=17.35 (95% CI: 1.61-187.46) more likely to be obese than respondents aged <25 years (Table 2).

Table 2: Predictors of obesity among adults in AMAC, Abuja

Variable	Unadjusted odds ratio (95% CI)	P-value	Adjusted odds ratio (95% CI)	P-value
Gender				
Female	1			
Male	0.32 (0.17 – 0.60)	<0.001	0.30 (0.14-0.61)	0.001
Age group (years)				
18 - 24	1		1	0.044
25-49	4.56 (1.06 – 19.57)	0.041	8.16 (1.05 – 63.13)	0.019
>=50	9.92 (1.78 -55.21)	0.009	17.35(1.61-187.46)	
Education				
Secondary	1		1	
Tertiary	1.92 (0.92 –4.03)	0.701	1.34(0.57-3.19)	0.503
Others	1.99 (0.49 – 8.21)	0.647	1.14(0.23-5.57)	0.876
Primary	1.59 (0.508 –5.04)	<0.001	0.89(0.21-3.83)	0.873
Regular Alcohol Intake				
Yes	1	1	1	

No	0.32(0.17-0.60)	0.026	0.33(0.65-1.64)	0.176

Predictors of Hypertension among Adults in AMAC, Abuja

Gender (male), marital status, educational level, and age were significantly associated with the risk of hypertension among the participants (p<0.001). Obesity was also significantly associated with hypertension (p=0.04). People aged 50 and above were 28 times more likely to have hypertension than respondents aged < 25 years (OR= 28.84: (95% CI: 3.05 -272.82) (Table 3)

Table 3: Predictors of Hypertension among Adults in AMAC, Abuja

Variable	Unadjusted odds ratio (95% CI)	P-value	Adjusted odds ratio (95% CI)	P-value
Gender				
Male	1			
Female	1.27 (0.70 – 2.29)	0.437	1.21 (0.57-2.56)	0.623
Age group (years)				
18 - 24	1		1	
25-49	6.28 (1.47 – 26.76)	0.013	9.00 (1.18 – 68.88)	0.034
>=50	31.5 (5.89 -168.5)	<0.001	28.84(3.04-272.81)	0.003
Education				
Secondary	1		1	
Tertiary	1.14 (0.59 –2.15)	0.701	1.07(0.49-2.32)	0.869
Others	0.69 (0.14 – 3.34)	0.647	0.99(0.17-5.525)	0.990
Primary	5.88 (2.43 –14.25)	<0.001	4.29(1.40-13.18)	0.11
Regular Alcohol Intake				
Yes	1	1	1	
No	2.42(1.11-5.26)	0.026	1.97(0.769-5.04)	0.158
Nutritional Status				
Non-obese	1	1	1	
Obese	2.67(1.38-5.13)	0.003	2.35(1.03-5.31)	0.040
Prevalence of Hyperglycemia				
Normal	1	1	1	
Diabetic	1.19(0.56-2.52)	0.640	1.13(0.46-2.74)	0.787

Association between sociodemographic characteristics and hyperglycaemia

The only factor significantly associated with the risk of hyperglycaemia in the study (p=0.004) was the participants' occupation; highly skilled workers were more at risk than those from another occupational category (Table 4).

Table 4: Association between sociodemographic characteristics and hyperglycaemia

Variables	Non-Diabetic Frequency (%)	Hyperglycaemia Frequency (%)	p-value
Gender			
Male	127 (61.4)	14(6.7)	0.213
Female	31(32.0)	3(3.2)	
Age			
18-24	34(75.6)	1(2.3)	0.117
25-49	117(48.8)	13(5.4)	
>=50	7(36.8)	3(15.0)	
Marital Status			
Widowed	2(40.0)	0(00.0)	0.369
Married	64(43.2)	11(7.4)	
Single	92(60.9)	6(4.0)	
Occupation			
Student	49(68.1)	2(27.8)	0.047

Farming	8(66.7)	0(0.0)	
Petty Trading	20(47.6)	4(10.0)	
Civil Servant	35(52.2)	8(11.9)	
Highly Skilled	14(31.1)	18(40.0)	
Others	31(47.7)	3(4.6)	
Family History			
Yes	10(37.0)	2(2.6)	
No	128(52.2)	13(6.5)	0.203
TOTAL	158	17	

Discussion.

Obesity was 16.45%, which aligned with the prevalence range of 6% -22%, as reported in the systematic review conducted by Chuwuonye. [2] This shows that obesity is not just a cosmetic issue but a growing epidemic.

Obesity was found to be higher among females than among males. The higher female prevalence corroborates findings reported by previous studies (7, 14, 18). This association may be partly attributed to the gender disparities in food consumption, as women reportedly consume less healthy foods like sugar-laden foods and beverages than men (19). Moreover, African culture has been said to predispose more women to increased body weight as body fatness is associated with beauty, fame and evidence of good living (18).

Respondents within the age group ≥50 years had the highest prevalence of obesity and were 17 times more likely to be obese than respondents aged < 25 years. This may be attributed to less physical activity and unhealthy dietary habits adopted over the years, such as eating late at night due to the long distance from the workplace to residential apartments, which is evident in most urban settlements and metropolises nationwide.

The participants' occupation was statistically associated with obesity in this current study, in tandem with past studies. Highly skilled professionals had the highest prevalence of obesity (28.89%), followed by petty traders (19.05%). While the latter may be attributed to unhealthy food consumption, the former may be strongly due to physical inactivity and a generally unhealthy lifestyle. Adults spend about one-third of their day at work as civil servants, either in the public or private sector, making occupation a probable risk factor for obesity (20).

Marital status was found to be a predictor of obesity in this study. This aligns with other research indicating that married individuals tend to have a higher prevalence of obesity compared to those in other marital categories. This association may be attributed to the support received from spouses or the weight gained during pregnancy (21, 22).

The overall prevalence rate of hypertension, 22.77%, observed in this study, is similar to other reports from Southeastern Nigeria and a Nigerian nationwide survey (11, 23, 24). The upward trend in the prevalence compared to some decades ago is due to urbanisation, nutrition transition, and Western acculturation of these NCDs (25).

The prevalence of hypertension was higher in males (24.0%) compared with females (20.0%), following findings from previous studies [7,15]. This has been attributed to biological factors such as sex hormones and chromosomal differences that are protective against hypertension in women and behavioural risk factors such as alcohol consumption, smoking and reduced strenuous physical activity (26).

Age and BMI were significant predictors of hypertension in this study, in agreement with previous studies. (15, 27). Respondents who are obese were 2 times more likely to develop hypertension. Hence, obesity is a risk factor for hypertension, as reported by previous studies. The risk of hypertension increased with age, and respondents aged 25-49 were 9 times more likely to have hypertension than those less than 25 years of age. Respondents aged 50 and above were 28 times more likely to have hypertension compared with respondents aged <25 years. Increasing blood pressure is said to be part of ageing (27). Moreover, physical activities decrease with age; hence, older adults, especially women, are less likely to be as active as middle-aged or younger people, which puts them at risk of cardiovascular diseases, as reported in this study.

The overall prevalence rate of hyperglycaemia was 5.6%, lower than the 10.1% and 9.8% reported in similar studies conducted in Tanzania (28) and Southern Nigeria (29). The prevalence of hyperglycaemia was higher in males (6.70%) than in females (3.2%); however, this was not statistically significant (p>0.05). This prevalence may be due to a disparity in the gender distribution of the participants in this study. The prevalence is higher than in Northern Nigeria (5.16%) and in the North-Central region (3.8% [95% CI 2.9–4.7]), and the overall pooled prevalence of DM in Nigeria is

5.77% (95% CI 4.3–7.1) (29, 30). However, a lower rate was reported in Edo State, Nigeria (4.6%) (7). The low rate of hyperglycaemia in Abuja may be due to the participants' high activity levels. Also, healthy living, such as low alcohol consumption, minimal snacking and increased fruit and vegetable consumption, could have contributed to the low prevalence since Abuja is nearer to the country's northern regions, where varieties of fruits and vegetables are largely cultivated, distributed, readily accessible and affordable to the masses (31).

Study Limitations

This study only used the body mass index to evaluate the prevalence of obesity and overweight, which does not consider adiposity. Hence, further studies could explore other methods, like body circumference measurement, which is a more reliable tool since it gives the distribution of body fats and bone mass and not just excess weight. In screening for hyperglycaemia among participants, a repeat test and the HbA1c test were not carried out because of cost implications. Hence, future studies could consider them.

The cross-sectional study used in the survey would allow only a measure of association. A longitudinal study design is better for ascertaining causality.

Conclusion

The prevalence of obesity, hypertension and hyperglycaemia in Abuja was similar to other parts of the country. Gender, older age and highly skilled profession were predictors of obesity; age and BMI were predictors of hypertension, but hyperglycaemia was not associated with any factor. Aggressive educational campaigns and wellness programs are urgently needed to enlighten AMAC residents about the dangers of obesity, hypertension, and hyperglycaemia, especially among adults older than 50, to improve the national life expectancy ratio and reduce disability-adjusted life years (DALYs) among the productive population. Early detection and management will reduce the overhead cost of treatment and management of complications, enhance productivity and economic growth (gross domestic product), and achieve sustainable development goals (SDGs) for the overall well-being of all.

List of Abbreviations

AMAC: Abuja Municipal Area Central
NCDS: Non-communicable Diseases

Declarations

Ethics Approval and Consent to Participate

The research was conducted according to standard ethical procedures as declared by Helsinki. Ethics approval was obtained from the Health Research and Ethics Committee of Lagos University Teaching Hospital, a Federal Government Institution (HREC No: ADM/DCT/HREC/APP/919), before conducting the research. Permission was obtained from the Chairman of AMAC and the Medical Officer of Health of the selected Local Government Area. Informed written consent was obtained from each participant, and confidentiality was maintained throughout the study. Participants who were obese or had abnormal blood pressure and blood glucose during the research were counselled by the investigator and referred to the nearest health facilities for proper management.

Consent for Publication

Not Applicable

Availability of Data and Materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing Interest

The author(s) declare that they have no competing interests.

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The authors did not receive any funding for this research.

Authors' contributions

OFA and OTZ conceptualised, designed, acquired, analysed, and interpreted the data. OTZ, OOJ, OAO, OFA and EOO drafted and revised the manuscript for intellectual content. All authors read and approved the final draft of the manuscript for publication.

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