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Non-Communicable Diseases In A Semi Urban Riverine Community In Rivers State, Nigeria: Implications For Community-Based Interventions

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Abstract
Background. *Non-communicable diseases are responsible for significant disability and death worldwide with developing countries carrying an appreciable burden, imposing a heavy socioeconomic cost on individuals, families, and health systems. The aim of this study was to assess the prevalence of hypertension, diabetes mellitus (DM) and obesity in a semi-urban riverine community in Nigeria.*
Methods. *A descriptive cross-sectional study was conducted among 1,077 adults in Borokiri, Rivers State, Nigeria. Standard procedures were used to collect data on anthropometric indices, blood pressure and blood glucose. Data was analysed with SPSS version 26 and binary logistic regression was used to determine significant predictors of hypertension and DM.*
Results. *The mean age of the respondents was 43.6±15.4years and 823(76.4%) were female. The prevalence of hypertension was 36.6% (394 persons) while 84(7.8%) had DM. Obesity using the BMI was seen in 496(46.0%) while abdominal obesity was noted in 581(53.9%) persons. Significant predictors of hypertension included DM (aOR=6.43, p<0.005), increasing age (aOR=6.26, p<0.005), male sex (aOR=1.88, p=0.002), patients with a family history of hypertension in a first degree relative (aOR=2.46, p<0.005), and obesity defined using BMI (aOR=1.80, p=0.002) or waist circumference (aOR=1.93, p=0.002). Significant predictors of DM also included increasing age (aOR=3.59, p<0.005), in addition, family history of DM (aOR=2.94, p<0.005), central obesity (aOR=1.93, p=0.014) and hypertension (aOR=3.64, p<0.005) contributed.*
Conclusion. *The high prevalence of hypertension, diabetes, and obesity reflects the broader epidemiological transition observed across Nigeria. Successful community-based interventions will require multi-level engagement, combining health education, affordable screening, and access to basic treatment.*
Keywords: *Hypertension, Diabetes mellitus, Obesity, Riverine community, Non-communicable diseases, Nigeria*

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I. Introduction

For many decades' infectious diseases like malaria, human immunodeficiency virus (HIV), diarrheal illness, and related conditions have been the major determinants of health and health care related outcomes in Sub-Saharan Africa. From the late 20th century onwards, a significant shift occurred with a change in demographics indicating a rise in the prevalence of non-communicable diseases (NCDs). Data from the Global Burden of Diseases, Injuries and Risk Factors Study showed that NCDs prevalence in Africa increased significantly, as the disability adjusted life years determined by non-communicable diseases increased from 18.6% to 29.8% between 1990 to 2017. [1,2]

Non-communicable diseases are responsible for a staggering 41 million deaths per year worldwide. Over 40% of these deaths occur before the 7th decade of life, affecting young and middle-aged adults. Developing countries carry an appreciable burden accounting for 86% of these premature deaths. Disorders affecting the cardiovascular system are responsible for majority of deaths from NCDs approximating 18 million deaths. Other notable causes of NCD related deaths are diabetes mellitus and its complications, respiratory illnesses, cancers, tobacco use and excessive alcohol consumption. [2,3]

Hypertension is a notable global health issue and a major driver of the non-communicable disease burden. In Nigeria the prevalence of hypertension has been on a steady rise, with the recent prevalence rates in the range of 22% to 44% depending on the region. A majority of Nigerians with hypertension are undiagnosed, only 12% are on treatment with adequate blood pressure control being achieved by only 3% of hypertensive patients. The resultant effect is a surge in the incidence of adverse events like stroke, coronary artery disease, heart failure and chronic kidney disease. [2,4]

Every year the number of persons living with diabetes worldwide continues to rise. A recent systematic review reported the new pooled prevalence of type 2 diabetes in Nigeria to be 7%, with the South-South zone of Nigeria, the location of this study, having the highest prevalence of 11.35%. The continuous surge in the prevalence of diabetes is driven by poor eating habits, obesity, sedentary lifestyle and a lack of knowledge and practice of preventive measures like regular exercise. The complications of diabetes are distressing and debilitating causing about 2 million deaths annually. Preventing and managing diabetes is critical to the reduction of NCD associated mortality. [2,5,6]

Formerly obesity was a dilemma concerning predominantly the western world, however globalization and westernization of most countries on the African continent has triggered a leap in the number of overweight and obese persons. Cultural practices in parts of Nigeria also propagate the obesity pandemic. The morbidity generated by obesity increases the risk of non-communicable diseases, as conditions like obstructive sleep apnea, cancers, depression, metabolic syndrome, and osteoarthritis have been closely linked to obesity. [7,8]

In Nigeria, poor funding to cover NCDs, out of pocket payment for healthcare, weak primary health care system, limited number of specialized medical workforce, poverty, reduced awareness, and poor access to health care are challenges responsible for the upsurge in NCDs. [4]

The impact of NCDs transcends medical morbidity as it also exerts a substantial influence on the economy, especially those of developing countries with loss of revenue attributed to man-hours lost due to chronic ill-health. It is therefore important to establish the pattern of risk factors in our environment that majorly contribute to the development of NCDs, for effective intervention planning to mitigate the trend. [8,9]

This study aims determine the prevalence of hypertension, diabetes mellitus and obesity as well as to determine the demographic, lifestyle, and clinical factors associated with hypertension and DM in the study population. By identifying key correlates, the study seeks to provide insights into the prevalence, risk factors, and potential intervention strategies for the prevention and management of hypertension and DM.

II. Methodology

Study Area and Population

The study was conducted among adults residing in Borokiri, a semi-urban riverine neighbourhood in Port Harcourt, Rivers State, Nigeria. Borokiri is located in the southern part of the city, bordered by the Bonny River and known for its mix of residential, commercial, and maritime activities. The area has a diverse population, including civil servants, traders, fishermen, and artisans. Participants included men and women aged 18 years and above, recruited from households, workplaces, and community gathering points. The study focused on individuals with varying demographic backgrounds, lifestyle habits, and clinical histories.

Study Design

This study employed a descriptive cross-sectional study design to assess the prevalence of hypertension and diabetes mellitus, as well as their demographic, lifestyle, and clinical predictors among adults living in semiurban Rivers State

Sampling Technique

A two-stage sampling technique was used to select the study participants. Stage 1 involved simple random sampling to select one local government area (LGA) from the 23 LGAs in Rivers State. Stage 2 involved cluster sampling to select one ward in the LGA, to conduct the study. Every adult from the ward that presented was included in the study.

Sample Size Calculation

The sample size was determined using the formula for calculating sample size for cross sectional studies. A prevalence of 50%, confidence interval of 95%, an acceptable difference of 0.05 were applied. Assuming a design effect of 2 to account for the clustering of participants, the calculated minimum sample size was approximately 768 participants.

Data Collection

Data collection was conducted through a structured questionnaire, administered by trained research assistants. The questionnaire was developed based on a comprehensive review of existing literature on hypertension and diabetes. The questionnaire's validity and reliability were ensured through expert review, pilot testing, and revisions. The questionnaire collected information on demographic characteristics (age, sex, occupation, education, and marital status), lifestyle factors (alcohol use and tobacco use), clinical characteristics (known diabetic, family history of diabetes, known hypertensive, and family history of hypertension), and anthropometric measurements (BMI, waist circumference, and waist-hip ratio). Blood pressure and pulse rate measurements were taken using a standardized blood pressure monitor (Omron M6 Comfort), while blood glucose

measurements were taken using a glucometer (Accu-Chek Active). Data collection was conducted over a period of 2 weeks.

Operational definitions

Hypertension. Hypertension was defined as blood pressure (BP) of ≥140/90 mmHg and/or self-reported treatment of hypertension with antihypertensive medication taken in the past 2 weeks according to the WHO/International Society of Hypertension Guidelines. [10,11]

Body mass index (BMI). The BMI was determined as weight (in kg) divided by height (in m^2). The BMI results were categorized as obesity if the BMI was ≥30.0 kg/m^2, overweight if the BMI was ≥25.0 but <30 kg/m^2, and normal if the BMI was between 18.0 and 24.9 kg/m^2 and underweight if <18 kg/m^2. [12]

Waist circumference (WC). Increased waist circumference was defined as a WC > 102.0cm for men and >88.0cm for women. [13]

Waist-hip ratio (WHR). Waist-hip ratio (WHR) was estimated as waist circumference (in cm) divided by the hip circumference (in cm). Central obesity was defined as WHR >0.85 for females and >0.90 for males. [13]

Diabetes mellitus. Diabetes mellitus was defined as a random blood glucose ≥11.1 mmol/L or a fasting blood glucose ≥7.0mmol/l and/or self-reported treatment of DM with antidiabetic medication. [5,12]

Significant alcohol intake. One drink was defined as one shot of spirits (gin or local gin), one glass of wine, or half a bottle of beer. Significant alcohol intake was measured as more than 3 drinks per week for men and more than two drinks per week for women in the past 30 days. [12]

Current tobacco use. Tobacco status was determined using current smoking measured as smoking cigarettes or use of other forms of tobacco every day or some days in the past 30 days. [12]

Data analysis

The data collected were checked for completeness, coded, and analysed using the IBM SPSS version 26 statistical software (IBM Corp, Armonk, NY, USA). Continuous variables were summarized using means and standard deviations while categorical variables were summarized using proportions. The primary outcome variables were systolic BP, diastolic BP, and blood glucose levels while independent variables included age, sex, WC, WHR, and BMI. Pearson's chi square test was used to test for significant relationship between the independent and outcome variables and binary logistic regression was used to determine significant predictors of hypertension and DM. The level of statistical significance was set at p value <0.05.

III. Results

A total of one thousand and seventy-seven (1,077) adults were surveyed with a mean age of 43.6±15.4 years and a range of 18 to 80 years, with 609(56.5%) young persons aged less than 45 years of age. There was a female preponderance as only 254(23.6%) were male, giving a female to male ratio of 3.2:1. The majority of the respondents were married (64.8%), had completed their secondary education (42.2%) and the commonest occupation was trading (58.3%).

Among the subjects, 199(18.5%) had a medical history of hypertension while 63(5.8%) were living with diabetes mellitus, with 14.0% and 9.4% reporting a positive family history of hypertension or diabetes mellitus in a first degree relative respectively. Almost a quarter had significant alcohol use and only 0.6% currently used tobacco products. The sociodemographic and clinical data of the study population is shown in table 1.

Table 1. Characteristics of the study population

Population characteristics	Frequency	Percentage
Age group		
Young (<45 years old)	609	56.5
Middle aged (45-64 years old)	355	33.0
Elderly (≥65 years old)	113	10.5
Sex		
Male	254	23.6
Female	823	76.4
Occupation		
Student	122	11.3
Trader	628	58.3

Farmer	23	2.1
Civil servant	69	6.4
Professional employment	89	8.3
Retired/unemployed	71	6.6
Missing	75	7.0
Level of education		
No formal education	92	8.5
Primary	155	14.4
Secondary	455	42.2
Tertiary	360	33.4
Missing	15	1.4
Marital status		
Single	220	20.4
Married	698	64.8
Separated/divorced	15	1.4
Widow/widower	110	10.2
Missing	34	3.2
Personal medical history of		
Hypertension	199	18.5
Diabetes mellitus	63	5.8
Positive family history in a first degree relative		
Hypertension	151	14.0
Diabetes mellitus	101	9.4
Current tobacco use	6	0.6
Significant alcohol use	255	23.7
Total	**1077**	**100.0**

The mean waist circumference (WC) among the total participants was 91.2±13.3cm while 53 (20.9%) men and 528(64.2%) women had increased WC. The mean waist hip ratio (WHR) was 0.87±0.11 while 93(36.6%) men and 465(56.5%) women had increased WHR. The mean body mass index (BMI) among the respondents was 29.1±4.6kg/m^2 and the commonest BMI categories were normal weight in 343 (31.8%) and obesity class 2 in 305 (28.3%) persons. (Figure 1).

The frequency of obesity in this study population using the BMI was 46.0% as 496 persons were classified as obese while abdominal obesity was slightly more prevalent using the WC with 581(53.9%) persons than the WHR with 558(51.8%) persons.

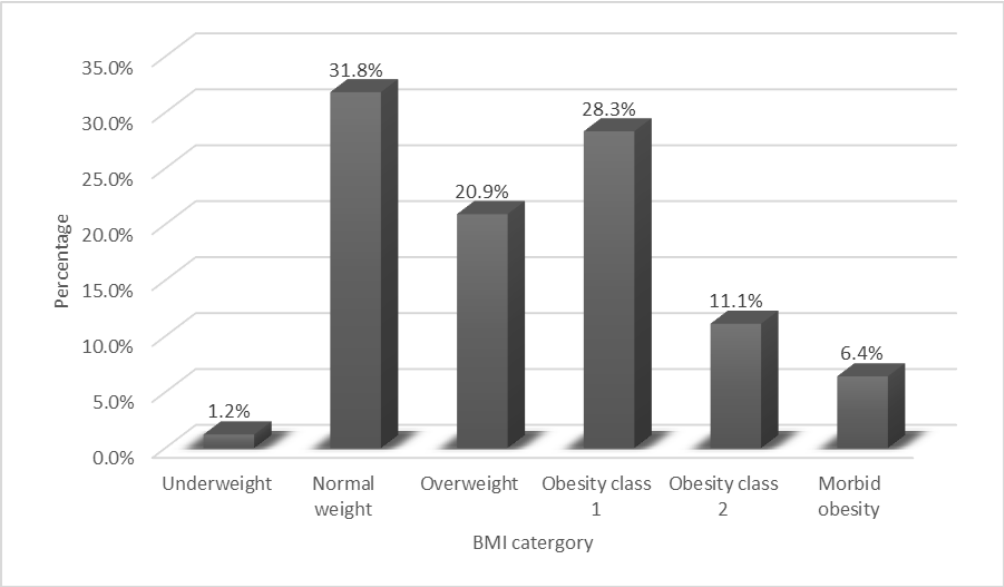

Figure 1. BMI categories of the study population

The average systolic blood pressure, diastolic blood pressure and random blood glucose were not elevated in this study population; and these mean readings of the examination findings and glucose recordings are summarized in table 2.

Table 2. Examination and laboratory characteristics of the study population

Clinical characteristic	Mean (±SD)
Body Mass Index	29.1±4.6kg/m^2
Waist circumference Study population Male Female	 91.2±13.3cm 88.8±12.7cm 91.9±13.4cm
Waist hip ratio Study population Male Female	 0.87±0.11 0.89±0.07 0.86±0.13
Obesity with increased BMI: frequency (%) Obesity with increased WC: frequency (%) Obesity with increased WHR: frequency (%)	496(46.0) 581(59.3) 558(51.8)
Systolic blood pressure	122.6±24.4mmHg
Diastolic blood pressure	74.6±16.4mmHg
Random blood glucose	6.1±2.9mmol/l

Key. BMI= body mass index, WC= waist circumference, WHR= waist hip ratio

Prevalence and predictors of hypertension

The systolic blood pressure (SBP) was increased in 268 (24.9%), the diastolic blood pressure (DBP) was increased in 208 (19.3%) respondents and the prevalence of hypertension in this cohort of patients was 36.6% (394 persons) as shown in figure 2.

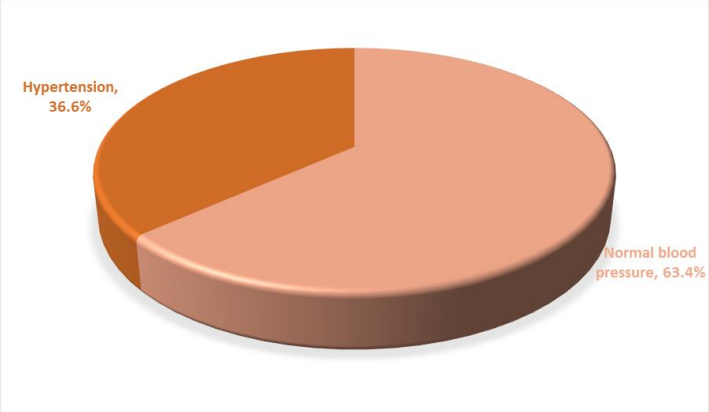

Figure 2. Frequency of hypertension in the study population

Hypertension was observed to occur more frequently in the elderly age group as 78.8% of elderly persons were hypertensive, as well as in persons with DM as 75.0% of them were hypertensive. The prevalence of hypertension was higher among the males compared to the females (47.6% vs 33.2%, p<0.005), and in subjects with obesity measured either via the BMI (46.0% vs 28.6%, p<0.005) or WC (45.3% vs 26.4%, p<0.005). Almost two thirds of the persons with a family history of hypertension in a first degree relative were hypertensive when compared to those without a family history of hypertension (60.9% vs 32.6%, p<0.005). There was no significant difference in self-reported alcohol ingestion between hypertensive and non-hypertensive subjects. (Table 3)

Table 3. Demographic and clinical characteristics of hypertensive subjects

Variable	Hypertension		χ^2	p value
	Present Frequency (%)	Absent Frequency (%)		
Age group Young Middle aged Elderly	 143(23.5) 162(45.6) 89(78.8)	 466(76.5) 193(54.4) 24(21.2)	144.26	<0.005*
Sex Male Female	 121(47.6) 273(33.2)	 133(52.4) 550(66.8)	17.509	<0.005*
Family history of hypertension Yes No	 92(60.9) 302(32.6)	 59(39.1) 624(67.4)	44.862	<0.005*
Significant alcohol use Yes No	 94(36.9) 300(36.5)	 161(63.1) 522(63.5)	2.973	0.085
Obesity (BMI)				

Present Absent	128(46.0) 166(28.6)	368(54.0) 415(71.4)	34.904	<0.005*
Obesity (Waist circumference) Present Absent	263(45.3) 131(26.4)	318(54.7) 365(73.6)	41.005	<0.005*
Diabetes mellitus Present Absent	63(75.0) 331(33.3)	21(25.0) 662(66.7)	57.957	<0.005*

Key. BMI= body mass index; *=statistically significant

Binary logistic regression was carried (table 4) out to assess the effects of patients' demographic and clinical characteristics on the presence of hypertension, and after adjusting for other variables, the presence of diabetes mellitus was a significant predictor for hypertension as persons with diabetes mellitus were 6.4 times more likely to be hypertensive (95% CI =3.713-11.133, p<0.005). Other predictors of hypertension in this study population included increasing age as the elderly age group were 6.2 times more likely to be hypertensive (95% CI=3.904-10.037, p<0.005), male sex (aOR=1.88, p=0.002), patients with a family history of hypertension in a first degree relative (aOR=2.46, p<0.005), and obesity defined using BMI (aOR=1.80, p=0.002) or central obesity with the WC (aOR=1.93, p=0.002).

Table 4. Logistic regression model for the predictors of hypertension in the study population

Variable	Adjusted odds ratio	95% CI	p value
Age group Young Middle aged Elderly	 Reference 2.13 6.26	 1.516-2.983 3.904-10.037	 <0.005* <0.005*
Sex Male Female	 1.88 Reference	 1.255-2.804	 0.002*
Family history of hypertension Yes No	 2.46 Reference	 1.658-3.646	 <0.005*
Obesity (BMI) Present Absent	 1.80 Reference	 1.246-2.599	 0.002*
Obesity (Waist circumference) Present Absent	 1.93 Reference	 1.284-2.890	 0.002*
Diabetes mellitus Present Absent	 6.43 Reference	 3.713-11.133	 <0.005*

Key. BMI= body mass index; *=statistically significant

Prevalence and predictors of diabetes mellitus

The prevalence of diabetes mellitus in the study population was 7.8% (84 persons) as shown in figure 3. Diabetes mellitus was observed to occur more frequently in females (8.3%) than males (6.3%), but this was not statistically significant. Diabetes was however significantly more prevalent in elderly persons, persons with a family history of diabetes in a first degree relative, hypertensives and subjects with central obesity as seen in table 5.

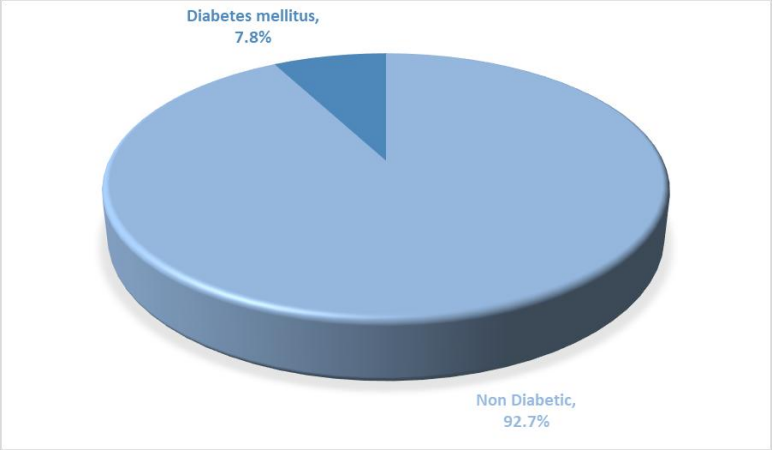

Figure 3. Frequency of diabetes mellitus in the study population

Table 5. Demographic and clinical characteristics of subjects with diabetes mellitus

Variable	Diabetes mellitus		χ^2	p value
	Present Frequency (%)	Absent Frequency (%)		
Age group				
Young	19(3.1)	590(96.9)	44.451	<0.005*
Middle aged	46(13.0)	309(87.0)		
Elderly	19(16.8)	94(83.2)		
Sex				
Male	16(6.3)	238(93.7)	1.040	0.308
Female	68(8.3)	755(91.7)		
Family history of diabetes				
Yes	21(20.8)	80(79.2)	26.16	<0.005*
No	63(6.5)	913(93.5)		
Significant alcohol use				
Yes	12(4.7)	243(95.3)	1.446	0.068
No	72(8.8)	750(91.2)		
Obesity (BMI)				
Present	43(8.7)	453(91.3)	0.968	0.325
Absent	41(7.1)	540(92.9)		
Obesity (Waist circumference)				
Present	61(10.5)	520(89.5)	12.786	<0.005*
Absent	23(4.6)	473(95.4)		
Hypertension				
Present	63(16.0)	331(84.0)	57.957	<0.005*
Absent	21(3.1)	662(96.9)		

Key. BMI= body mass index; *=statistically significant

Significant predictors of diabetes mellitus in this population included family history of DM (aOR=2.94, p<0.005), central obesity (aOR=1.93, p=0.014), hypertension (aOR=3.64, p<0.005) as well as being elderly (aOR=3.59, p<0.005) as demonstrated in table 6.

Table 6. Logistic regression model for the predictors of diabetes mellitus in the study population

Variable	Adjusted odds ratio	95% CI	p value
Age group			
Young	Reference		
Middle aged	3.19	1.789-5.722	<0.005*
Elderly	3.59	1.750-7.370	<0.005*
Family history of diabetes			
Yes	2.94	1.603-5.395	<0.005*
No	Reference		
Obesity (Waist circumference)			
Present	1.93	1.144-3.255	0.014*
Absent	Reference		
Hypertension			
Present	3.64	2.103-6.296	<0.005*
Absent	Reference		

Key. *=statistically significant

IV. Discussion

Sub-Saharan African countries are currently witnessing an epidemic transition from communicable diseases to non-communicable diseases and Nigeria is not exempted. This descriptive cross-sectional study in a community in southern Nigeria has highlighted this high burden of hypertension, diabetes and obesity. The prevalence of the selected NCDs (obesity -46%[BMI], 53.9% [WC], 51.8% [WHR], hypertension -36.6%, and diabetes mellitus- 7.8%) mirrors reports obtained from other African and Western studies. [4,5,7,14-17]

In this health survey program, male participation was poor, collaborating findings from other authors who have reported better health seeking behaviours in women when compared to men. [18-20] This may imply a large male pool of residents in this community who are hypertensive or living with diabetes that are not aware of the disease, are undiagnosed and therefore untreated, further contributing to the ill health of this region. Furthermore, of the 80 persons living with diabetes, 63(78.8%) of them were aware, however, of the 394 hypertensive patients, only 199(50.5%) were aware of their hypertensive status and this may be due to the asymptomatic nature of hypertension, often referred to as the silent killer. [3] A Nigerian national review of literature found a much lower awareness of hypertension at 29%, [21] but the proximity of the study site to the urban town of Port Harcourt and tertiary health care as well as the large cohort of participants with secondary and tertiary education may account for a higher awareness rate in our study population.

In this study, increasing age was an independent predictor of hypertension and diabetes and this finding has been confirmed by various other authors where elderly people are more likely to have these chronic diseases. [5,6,21,22] Over half of the recruited patients were less than 45years of age, and although the prevalence of hypertension was higher in elderly patients, the absolute number of young and middle-aged people with hypertension cannot be overemphasized as this may result in a surge in the incidence of cardiovascular complications of hypertension in this economically viable age group. The development and progression of complications of hypertension in young/middle-aged are influenced by a complex interplay of genetic, environmental and behavioural factors, contributing to disability and premature deaths and substantial healthcare costs. [3,23] Understanding associated risk factors as well as the cardiovascular risk it poses to specific populations is crucial for developing targeted and effective preventive and therapeutic interventions.

Obesity was common in this cohort of the population, and the frequency of obesity was higher when categorized by waist circumference or waist-hip ratio in contrast to BMI (53.9%/51.8% vs 46%). Studies consistently show a high prevalence of overweight and obesity in Nigeria with regional variations from the lowest prevalence in the Northwest to the highest in the Southwest. [7,24] The high prevalence in this study when compared to previous large population studies further buttresses the rising trajectory of overweight and obesity in Nigeria. [24,25] Additionally in this study, obesity when defined by BMI or waist circumference was an independent predictor for the development of hypertension, but only abdominal obesity was an independent predictor of diabetes mellitus. Increased waist circumference specifically tracks abdominal fat (central adiposity), which is a stronger predictor of metabolic risk, diabetes mellitus and cardiovascular disease because it reflects metabolically active visceral fat. BMI and WC provide different complementary information and a high WC within the normal BMI range still indicates increased risk for chronic diseases, thus combining the BMI with the WC offers the best overall assessment of obesity related health risks. [24,26,27] Consequently, there is a need to implement personalized, cost-effective population-based measures to curb obesity, thereby lowering the growing challenge of NCDs in this community.

This high prevalence of obesity, hypertension, and diabetes observed in this semi-urban population underscores an urgent requirement for multi-faceted community-based interventions tailored to the local context. Population growth and increasing urbanization of Nigerian rural areas is associated with the attendant shift towards the sedentary lifestyle and consumption of high salt processed food that encourage non-communicable diseases. [28] The community interventions should involve scalable primordial and primary prevention strategies. Targeted community-wide programs with health education should be focused towards the at-risk groups to salvage their already compromised health status. Lifestyle modification remains the foundation and should be prioritized with a healthy diet and regular physical activity to maintain a healthy weight, tobacco cessation, and moderate alcohol intake. [23,29] Frequent screening can play an active role for early identification of individuals at risk and timely provision of treatment where necessary. Furthermore, faith-based and market-based outreach programs serve as critical entry points for reaching undiagnosed individuals, particularly given the near absence of formal screening programs in many Nigerian communities. [30] Evidence indicates that task-shifting and task-sharing with trained Community Health Workers can effectively bridge the gap in NCD care by conducting routine screenings, providing health education on lifestyle modifications, and ensuring medication adherence. [28]

V. Conclusion

This study revealed a high prevalence of hypertension, diabetes, and obesity which could place immense strains on community health and household economies, echoing the broader epidemiological transition observed across Nigeria. There is need for interventions that are culturally sensitive and integrated into the existing community structure, tailored to address the unique context of this riverine population, including challenges related to access, infrastructure, and local beliefs about health. Successful community-based interventions will require multi-level engagement, from empowering local health workers to involving traditional leaders and leveraging existing social networks. An effective public health strategy will need to combine health education, affordable screening, and access to basic treatment.

Limitations

In this large-scale community survey, the diagnosis of hypertension was based on the blood pressure measurement at one seating, without confirmation on subsequent days. Also, the diagnosis of diabetes mellitus was also based on a single capillary blood glucose measurement. Repeated measurements of these variables would better represent participants' true values.

Statement of Ethical Considerations

This study was approved by health research ethics committee of the Rivers State University Teaching Hospital (RSUTH/REC/2024/712) Informed consent was obtained from all participants before data collection.

Disclosure of Conflict of Interest

The authors declare no conflict of interest

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