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Cardiovascular risk factors in semi-urban communities in southwest Nigeria: Patterns and prevalence

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Abstract *Introduction:* Over 80% of cardiovascular deaths take place in low- and middle-income countries; most of these deaths are due to modifiable risk factors. The study aimed at estimating the prevalence and pattern of major cardiovascular risk factors in both men and women older than 18 years.

Methods: This is a cross-sectional study of cardiovascular risk factors among semi-urban dwellers in Ekiti State, south-western, Nigeria. 750 participants were drawn from 10 communities. The instrument used was the standard WHO STEPS (II) questionnaire, while blood samples were obtained for analysis.

Results: There were 750 participants with 529 (70.53%) females. The mean age of participants was 61.7 ± 18.50 years and participants' ≥ 65 years comprised 38.3%. There were 0.8%, 24.9% and 12.4%, who at the time of this study smoked cigarettes, consumed alcohol, and ate a high salt diet, respectively. The prevalence of hypertension, diabetes, generalized and abdominal obesity was 47.2%, 6.8%, 8.5% and 32.0%, respectively, with only 48.9% receiving hypertension treatment. Elevated total cholesterol, LDL-cholesterol, and low HDL was seen in 4.4%, 16.7% and 56.3% respectively.

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Conclusion: High prevalence of cardiovascular risk factors call for an urgent need for more public health attention and reinforcement of primary preventive strategies to curb its menace.

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1. Introduction

Cardiovascular diseases (CVDs) are the number one cause of death globally; more people die annually from CVDs than from any other non-communicable disease [1]. An estimated 17.3 million people died from CVDs in 2008, representing 30% of all global deaths. Of these deaths, an estimated 7.3 million were due to coronary heart disease and 6.2 million were due to stroke [2]. Over 80% of CVD deaths take place in low- and middle-income countries and occur almost equally in men and women [1]. Ischemic heart disease and stroke together accounted for 12.9 million deaths in 2010 or one in four deaths worldwide. Of the leading causes of deaths, diabetes mellitus (DM) is the fastest growing globally, responsible for 1.3 million deaths in 2010, which is twice as many as in 1990. Approximately 9.4 million (16.5% of all) deaths can be attributed to hypertension. These include 51% of deaths due to stroke and 45% of deaths due to coronary artery disease. The number of people who die from CVDs – mainly from heart disease and stroke – has been predicted to rise to 23.3 million if no preventive measures are put in place by 2030 [1,3]. CVDs are projected to remain the single leading cause of death [3].

The high burden of CVDs in the developing countries is attributed to the increasing prevalence of atherosclerotic diseases, and perhaps driven by urbanization and increasing risk factor levels which may be modifiable. These risk factors include smoking, lack of physical activity, low fruit and vegetable intake, high fat and salt intake, hypertension, abdominal obesity, dyslipidemia, and excess alcohol intake [3]. The upward trend of CVDs in sub-Saharan Africa is likely a result of the increasing prevalence of some of these modifiable risk factors [4]. Most CVDs can be prevented by early detection and proper management of these risk factors.

Most of the semi-urban (i.e., population density between 1000–3000 persons per square kilometer) communities are inhabited by children, illiterate and semi-illiterate men and women, retirees (who relocated from cities after retirement from active service), all of whom usually belong more to the low- and middle-socioeconomic strata [5]. Cardio-

vascular risk factors among semi-urban dwellers have been thought to be intermediate in occurrence between the rural and urban communities due to admixture of westernized and traditional lifestyles the inhabitants are thought to adopt [6–8]. In suggesting an evidence-based context for government and other health policy planners on health education programs in low-resource settings like Nigeria (with an estimated 60.9% of the citizens living in absolute poverty and majorly living in rural areas) [9], it is important to quantify the proportion of the population at high overall risk of CVDs in order to match this with available resources.

Hence, this study was carried out to estimate the pattern and prevalence of major cardiovascular risk factors in both men and women 18 years and older living in a semi-urban area of Nigeria.

2. Methodology

2.1. Study area

Nigeria is the most populous country in Africa with an estimated population of at least 174.5 million people [9]. The country is made up of 6 geo-political zones with a total of 36 States and the Federal Capital Territory in Abuja. The south-west zone is comprised of 6 States (Lagos, Ogun, Oyo, Osun, Ondo, and Ekiti). The majority speak Yoruba, and the zone is located between latitude 2.8°E and 6.8°E of the Equator with a longitude of 6.0°N and 8.2°N. The study was carried out in Ekiti State. The State is divided into 3 senatorial districts (Ekiti South, North and West). The study area was Ekiti North senatorial district which is made up of 5 local government areas (Ido/Osi, Ikole, Ilejemeje, Moba, Oye LGAs). A total of 10 communities (all semi-urban) were randomly selected within the senatorial districts (2 communities per LGA).

2.2. Study population

The majority of the inhabitants in these communities are of low socio-economic status. They are mainly farmers, traders, and artisans. The community also consists of teachers and retirees who usually depend on their meager pension monies,

goodwill from people and are dependent on their children in the cities. The only tertiary health institution located within this senatorial district is the Federal Medical Centre (FMC), Ido-Ekiti. Most individuals in these communities rarely attend hospitals (which is usually far, if it even exists). Hence, most depend on alternative medicine and spiritual healing homes. They also patronize native doctors/healers, patent medicine dealers and quacks for their medical needs.

A convenient sample of 835 participants aged 18 years and above were recruited for this study from the selected communities. The information sheet and consent form written in English was interpreted for the participants in the local language and informed consent was obtained. The research protocol was approved by the Ethics Committee of the Federal Medical Centre, Ido-Ekiti.

2.3. Clinical evaluation and sample collection

The clinical evaluation and sample collection were carried out at screening centers in these communities. These included: churches, mosques, town halls, health centers, and other convenient centers. Prior notices and permissions were obtained from traditional rulers, opinion leaders, church leaders and mosque leaders.

2.4. The questionnaire used was the WHO STEPS (II) questionnaires [10]

Questionnaires were administered by the physicians, and the clinical evaluation was obtained.

The participants' anthropometric data were obtained: weight (kg), height (m), waist circumference (cm) and hip circumference (cm). The heights were measured to the nearest 0.1 cm by stadiometer; and the weight was measured to the nearest 0.1 kg using a standardized bathroom scale [11,12]. The waist circumference was taken at mid-way between the sub-costal margin and the iliac crest, while the hip circumference was taken as the widest diameter over the greater trochanters [13].

2.5. Blood tests

3ml of fasting blood was collected in plain bottles (participants were already informed of being in a fasting state and this was further ascertained at the point of sample collection) for blood chemistry analysis—total cholesterol (TC), low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C), and triglycerides (TG).

Blood sugar was tested with Accu-check glucometer, the measuring ranges of the device for glucose is 50–600 mg/dl. All samples were analyzed at the chemical pathology department, Federal Medical Centre, Ido-Ekiti.

2.6. Definition of risk factors

Hypertension was defined as systolic blood pressure > 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg and/or concomitant use of antihypertensive medications [14]. Classification of hypertension was based on JNC 7, i.e., Stage I SBP = 140–159 and/or DBP = 90–99 mmHg, and Stage II SBP ≥ 160 and /or DBP ≥ 100 mmHg [15].

Diabetes mellitus (DM) was diagnosed if fasting plasma glucose level (FPG) ≥ 7.0 mmol/L, a reported history of diabetes or use of glucose-lowering drugs [16,17].

Impaired fasting glycemia (IFG) was defined by FPG ranging from 6.1 to 6.99 mmol/L. Subjects found to have DM or IFG were reported to have abnormal glucose tolerance (dysglycemia) [18].

Overweight and generalized obesity were defined as body mass index (BMI) ≥ 25 and 30 kg/m² respectively. Abdominal obesity was defined as waist circumference of ≥ 94 cm in men and ≥ 80 cm in women according to IDF criteria [19].

Lipid abnormality was defined as raised TG level ≥ 1.7 mmol/L or specific treatment for this lipid abnormality, reduced HDL-Cholesterol < 1.03 mmol/L in males and < 1.30 mmol/L in females or specific treatment for this lipid abnormality and TC level ≥ 5.2 mmol/L (200 mg/dL) or specific treatment for this lipid abnormality [20].

Age as a risk factor was defined as > 55 years in males and > 60 years in females.

Waist:hip ratio (WHR) as a risk factor was defined as > 0.90 for men and 0.85 for women [21].

Salt as a risk factor was defined as the addition of extra salt to the meal at the table.

The use of tobacco was examined using; ever smoked, current smoker, and never smoked.

Alcohol consumption was assessed by number of drinks of beer per day; < 2 drinks or > 2 drinks.

2.7. Framingham risk score

The Framingham risk score was used to classify the risk of developing cardiovascular events in the next 10 years into mild, moderate, and severe risks.

2.8. Statistical analysis

The Statistical Package for Social Sciences software (SPSS Inc, Chicago, IL v17) was used for data

analysis. Continuous variables were expressed as means \pm standard deviation (SD), while categorical variables presented as frequencies and percentages. Comparison for statistical significance was by Student's *t*-test for continuous variables or Chi square analysis for categorical variables. All tests were two-tailed with $p < 0.05$ taken as statistical significance.

3. Results

A total of 750 were analyzed out of the 835 participants who were screened; this represents a response rate of 89.8%, which was higher in females than in males (91% vs. 88.6%); the others could not be analyzed because of incomplete data. The age of these participants ranged from 18 years to 82 years. The mean age of the studied population was 61.7 ± 18.2 years (male respondents, 60.0 ± 20.0 ; female respondents, 62.4 ± 17.3 years, $p = 0.092$). Other demographic profiles of the study population are shown in [Table 1](#) and [Table 2](#).

The prevalence of the different cardiovascular risk factors among the 750 participants were as follows: hypertension 354 (47.2%), generalized obesity (BMI ≥ 30) 64 (8.5%), abdominal obesity 230 (32%), diabetes 51 (6.8%), hypercholesterolemia 44 (5.9%) subjects ([Table 3](#)).

While 22 (2.9%) and 195 (26.0%) participants had been diagnosed with diabetes and hypertension respectively, only 10 (45.5%) and 30 (15.4%) participants were receiving treatment for hypertension and diabetes respectively. The level of physical activity showed that most of the population were physically active and almost half of them (46.7%) eat fruits and vegetables at least 2–3 times per week.

This study showed that 354 (47.2%) participants had hypertension, 51 (6.8%) had diabetes and 45 (6.0%) had pre-diabetes. Among those with hypertension, 49.9% had stage I, while 50.1% had stage II. Blood glucose of all participants varied between 4.0 and 18.4 mmol/L (mean, 5.6 ± 1.5 mmol/L). The proportion of diabetic patients achieving FPG of ≤ 7.2 mmol/L was 7 (31.8%), while those who met the target blood pressure control of $\leq 140/90$ mmHg was 43 (22%). Furthermore, the prevalence of hypertension increased with age, while indices of obesity also increased significantly with age but later decreased among the elderly, after the age of 60 years ([Table 4](#)).

The level of lipid abnormalities is shown in [Table 3](#). The mean value of total cholesterol is 3.16 ± 1.2 mmol/L; it was significantly higher in females than in males ($p = 0.020$).

[Table 5](#) shows that the majority of the participants (77.1%) had a low 10 year absolute risk of developing cardiovascular events, and males are at a significantly higher risk than females.

4. Discussion

In developing countries, the increase in CVD burden is largely the result of an increase in the prevalence of risk factors. These cardiovascular risks whose onset and presence are usually insidious and asymptomatic are not diagnosed early and not managed optimally. There is relatively a lack of access to various interventions used to achieve successes in developed countries [[22](#)].

The gender bias in this study in favor of females is similar to other studies [[22,23](#)]. It may be explained by the migration of young/middle-aged people, particularly males, to towns and cities in search of white collar jobs and also due to longer life expectancy in women [[9](#)]. Also, older people generally tend to retire to the rural and semi-rural areas after active service in towns and cities. The patterns in this study showed that major modifiable CVD risk factors were very common in the studied adults' population in these semi-urban communities, statistically increasing with age and having similar patterns between sexes, except measures of obesity, HDL-C and total cholesterol that are significantly higher in women than men. Hypertension, smoking, DM, and excessive alcohol intake are considered as some of the most important risk factors for CVD [[24](#)]. Estimates from this study shows that 47.2% of adults suffered from hypertension, more than half of them previously unaware. This prevalence was much higher than 29.7% reported by Adedoyin et al. [[8](#)], but similar to 46.4% reported by Ejim et al. [[23](#)]. This higher prevalence may be related to older participants in this study compared with studies quoted above. The prevalence of generalized obesity and abdominal obesity in this study was 8.5% and 32% respectively. This prevalence of obesity is lower than 11.1% reported in Abia State, and 10.3% reported in Mauritius [[25,26](#)]. Compared with men, women had a significantly higher prevalence of obesity indices (generalized and abdominal) than men. This agrees with findings of other studies in Nigeria [[22–24](#)] and elsewhere in Africa [[27](#)]. The high proportion of obese subjects in women is likely due to the sedentary types of occupations, like petty trading (which encourages weight gain), compared with men who are mainly involved in occupations that require mobility (farming, artisan, etc.). It may also be due to the fact that obesity is still "fash-

Table 1 Basic socio-demographic profile of the study population.

Parameter	Male n (%)	Female n (%)	Total n (%)	P value
Sex	221 (29.4)	529 (70.6)	750 (100.0)	<0.001
<i>Marital status</i>				<0.001
Single	31 (4.1)	14 (1.9)	45 (6.0)	
Married	177 (23.6)	257 (34.3)	434 (57.9)	
Widowed	11 (1.5)	257 (34.2)	268 (35.7)	
Divorced	2 (0.3)	1 (0.1)	3 (0.4)	
<i>Education</i>				<0.001
None	89 (11.9)	324 (43.2)	413 (55.1)	
Primary	54 (7.2)	115 (15.3)	169 (22.5)	
Secondary	52 (6.9)	55 (7.4)	107 (14.3)	
Tertiary	26 (3.5)	35 (4.6)	61 (8.1)	
<i>Employment status</i>				<0.001
Unemployed	14 (1.9)	71 (9.4)	85 (11.3)	
Trading	9 (1.2)	300 (40.0)	309 (41.2)	
Farming	111 (14.8)	100 (13.3)	211 (28.1)	
Unskilled labor	35 (4.6)	17 (2.3)	52 (6.9)	
Professional	16 (2.1)	24 (3.3)	41 (5.4)	
Others	36 (4.7)	17 (2.2)	53 (6.9)	
<i>Cigarette Smoking</i>				<0.001
Yes	5 (0.7)	1 (0.1)	6 (0.8)	
No	216 (28.8)	528 (70.4)	744 (99.2)	
<i>Alcohol consumption</i>				<0.001
Yes	123 (16.4)	64 (8.5)	187 (24.9)	
No	98 (13.1)	465 (62.0)	563 (75.1)	
<i>Excessive Salt intake</i>				<0.001
Yes	55 (7.3)	38 (5.1)	93 (12.4)	
No	166 (22.1)	491 (65.5)	657 (87.6)	
<i>Intake of fruits and vegetables</i>				<0.001
Don't take	5 (0.7)	12 (1.6)	17 (2.3)	
<3 days/week	141 (18.8)	311 (41.5)	452 (60.3)	
≥3 days/week	75 (10.0)	206 (27.5)	281 (37.5)	
<i>Family History of hypertension</i>				<0.001
Yes	8 (1.1)	16 (2.1)	24 (3.2)	
No	213 (28.4)	513 (68.4)	726 (96.8)	
<i>Family History of diabetes</i>				<0.001
Yes	5 (0.7)	6 (0.8)	11 (1.5)	
No	216 (28.8)	523 (69.7)	739 (98.5)	
<i>Intentional physical inactivity</i>				<0.001
Yes	38 (5.1)	15 (2.0)	53 (7.1)	
No	183 (24.4)	514 (68.5)	697 (92.9)	

Most participants (82.8%) were low-income earners and 87.4% were unemployed, farmers, petty traders or artisans.

ionable'' in Nigeria among women as it is thought to depict affluence.

The prevalence of type 2 diabetes mellitus in this study was 6.8%, which is higher than 2.2%–2.8% by other workers in the country [28,29], and also higher than 5.0% estimates for Nigeria by the International Diabetes Federation (IDF) [30]. It is

possible that the high prevalence of DM in this study is a reflection of the high prevalence of hypertension, which is one of the risk factors for T2DM [13], and the older nature of the study population. However, although BMI and WC (which are both risk factors for T2DM) are significantly higher in these female subjects, the reason for the lower

Table 2 Clinical and biochemical profile of the study population (\pm Standard Deviation).

Variable	Men	Women	Total	P-value
Age(years)	59.96(20.01)	64.42(17.28)	61.7(18.50)	0.090
Weight(kg)	60.96(12.97)	57.77(13.54)	58.71(13.44)	0.003
Height(m)	1.64(0.12)	1.56(0.09)	1.58(0.11)	<0.001
BMI(kg/m ²)	22.61(5.52)	23.68(5.50)	23.36(5.53)	0.013
Waist Circumference(cm)	83.31(9.61)	86.69(12.66)	85.69(11.94)	<0.001
Hip Circumference(cm)	89.42(7.51)	94.63(10.99)	93.09(10.35)	<0.001
Waist-Hip ratio	0.93(0.06)	0.93(0.43)	0.93(0.26)	0.104
Systolic blood pressure(mmHg)	142.32(28.71)	142.39(28.54)	142.37(28.57)	0.976
Diastolic blood pressure(mmHg)	81.07(14.97)	81.77(13.82)	81.57(14.16)	0.530
Total Cholesterol(mmol/L)	3.01(0.97)	3.21(1.13)	3.16(1.20)	0.020
HDL-C(mmol/L)	1.12(0.54)	1.02(0.46)	1.05(0.49)	0.014
TG-C(mmol/L)	0.74(0.34)	0.82(0.53)	0.79(0.48)	0.035
LDL-C(mmol/L)	1.69(1.08)	1.82(0.95)	1.78(0.95)	0.040
TC/HDL	3.44(2.60)	3.80(2.50)	3.69(2.55)	0.070

Body mass index (BMI), Total cholesterol (TC), low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C), triglycerides (TG-C).

Table 3 Distribution of CVD risk factors of the study population by gender.

Variable	Male n = 221(%)	Female n = 529(%)	P-value
Age	142(64.3)	355(67.1)	<0.001
Smoking	5(2.3)	1(0.2)	<0.001
HTN	104(48.9)	250(47.3)	0.583
Low HDL-C	110(49.8)	312(59.0)	<0.001
Elevated TC	4(1.8)	29(5.5)	0.030
Elevated LDL-C	35(15.8)	90(17.0)	0.748
Overweight	44(19.9)	117(22.1)	<0.001
Generalized obesity	5(2.3)	59(11.2)	<0.001
Abdominal obesity	10(4.2)	230(43.5)	<0.001
IFG	16(7.2)	29(5.5)	0.034
Diabetes Mellitus	19(8.6)	32(6.0)	0.168

Hypertension (HTN), impaired fasting glucose (IFG), high density lipoprotein cholesterol (HDL-C), Total cholesterol (TC), low density lipoprotein cholesterol (LDL-C).

Table 4 Prevalence of Cardiovascular risk factors by age group.

Age (years)	N	HTN	Overweight	Generalized obesity	Abdominal obesity	IFG	Diabetes mellitus	P value
<30	61	13(21.3)	5(8.2)	4(6.6)	6(0.9)	1(1.6)	3(4.9)	<0.001
31–40	56	11(19.6)	13(23.2)	7(12.5)	12(21.4)	1(1.8)	6(10.7)	<0.001
41–50	100	46(46.0)	28(28.0)	14(14.0)	31(31.0)	5(5.0)	11(11.0)	<0.001
51–60	112	56(50.0)	32(28.6)	18(16.1)	41(36.6)	4(3.6)	7(6.2)	<0.001
61–70	187	110(58.8)	45(24.1)	12(6.4)	57(30.5)	17(9.1)	16(8.6)	<0.001
>70	234	141(60.3)	38(16.2)	9(3.8)	51(21.8)	17(7.3)	23(9.8)	<0.001

Hypertension (HTN), impaired fasting glucose (IFG).

prevalence of DM in females compared with males is not apparent.

Moderate and high risk of developing major cardiovascular events over 10 years in this study pop-

ulation is substantial (22.9%), meaning that about 1 in 4 has between 10% and 20% chance of developing a major cardiovascular event over the next 10 years. Hence, preventive measures to modify

Table 5 Category of 10 year absolute cardiovascular risk by sex (using Framingham risk score).

Variable	Male = 221	Female = 529	DF	χ^2 value	P value
Low risk	157(71.0)	421(79.6)	2	6.802	0.033
Intermediate risk	51(23.1)	82(15.5)			
High risk	13(5.9)	26(4.9)			

these risk factors will be appropriate. The high prevalence of cardiovascular risk factors calls for the urgent need for more public health attention and reinforcement of primary preventive strategies to curb its menace. Those detected to have cardiovascular risks were referred to healthcare facilities for management, and those with high risk of developing cardiovascular events were encouraged to adopt a healthy lifestyle.

The strength of this study lies in its relatively moderate sample size and its being population based. It, however, has some limitations. The use of self report and its accuracy regarding alcohol consumption, vegetable servings, salt intake and use of tobacco may be questioned given that the participants are mostly illiterate and semi-literate.

Authors' contribution

OR and OAM designed the study, data collection, statistical analysis, and were involved in the final draft of the manuscript. OO and BAO were involved in the data collection, statistical analysis and final draft of the manuscript. ISO was involved in the statistical analysis and final draft of the manuscript.

Conflicts of interest

The authors disclose that they have no competing interests.

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