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Prevalence and risk factors of cardiovascular health and diabetes among adults living in Lagos Island, Lagos State, Nigeria

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Abstract

Cardiovascular diseases and diabetes mellitus represent significant public health challenges in Nigeria. This cross-sectional study investigated the prevalence and risk factors of cardiovascular health and diabetes among adults in Lagos Island, Lagos State, Nigeria. The study included 297 participants aged 18 years and above, with data collected through structured questionnaires, physical measurements, and biochemical analyses. The findings revealed hypertension as the most prevalent cardiovascular condition (34.7%), followed by obesity (29.3%) and diabetes mellitus (26.6%). Medication adherence was notably low, with only 21.9% taking hypertension medication and 15.2% taking diabetes medication. Physical activity levels were generally insufficient, with 29.3% reporting no regular exercise. Sleep patterns showed that most participants got inadequate sleep, with 41.8% getting only 5-7 hours per night and 22.6% getting less than 5 hours. Biochemical measurements indicated borderline elevated means for various parameters, including fasting blood glucose (108.6 mg/dL) and total cholesterol (202.3 mg/dL). Knowledge levels regarding cardiovascular health and diabetes were predominantly fair to poor, although 81.8% of participants believed lifestyle changes could prevent or manage these conditions. Logistic regression analysis identified age (OR = 1.11, 95% CI: 1.05-1.17), BMI (OR = 1.15, 95% CI: 1.07-1.25), and family history (OR = 2.10, 95% CI: 1.42-3.09) as significant predictors of diabetes, while physical activity showed a protective effect (OR = 0.66, 95% CI: 0.49-0.89). The study concludes that there is a high prevalence of cardiovascular risk factors among adults in Lagos Island, coupled with poor medication adherence and limited health knowledge. These findings underscore the urgent need for comprehensive interventions focusing on health education, lifestyle modification, and improved healthcare access, particularly targeting high-risk groups such as older adults and those with family history of cardiovascular diseases or diabetes.

Keywords: Cardiovascular Disease; Diabetes Mellitus; Lagos Island; Hypertension; Medication Adherence; Risk Factors

1. Introduction

Cardiovascular diseases (CVDs) and diabetes mellitus (DM) are two of the most prevalent chronic conditions worldwide, contributing significantly to morbidity, mortality, and healthcare expenditure. CVDs, which include coronary heart disease, cerebrovascular disease, and peripheral arterial disease, are the leading cause of death globally, accounting for an estimated 17.9 million deaths annually (World Health Organization, 2021). Similarly, the global prevalence of diabetes has been steadily increasing, with an estimated 463 million adults living with the condition in 2019, and projections suggest that this number will rise to 700 million by 2045 (International Diabetes Federation, 2019). The growing burden of these chronic diseases has prompted extensive research into their risk factors, management

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strategies, and the complex interplay between cardiovascular health and diabetes among adults (Einarson *et al*., 2018; Kosiborod *et al*., 2018).

The relationship between cardiovascular health and diabetes is bidirectional and multifaceted. Diabetes is a well-established risk factor for the development of CVDs, with adults with diabetes having a two- to four-fold increased risk of cardiovascular events compared to those without diabetes (Low Wang *et al*., 2016). This increased risk is attributed to various pathophysiological mechanisms, including hyperglycemia-induced endothelial dysfunction, oxidative stress, inflammation, and the formation of advanced glycation end products (AGEs) (Strain and Paldánius, 2018). Moreover, the presence of comorbid conditions, such as hypertension, dyslipidemia, and obesity, which are common among individuals with diabetes, further exacerbates the risk of cardiovascular complications (American Diabetes Association, 2021). Conversely, poor cardiovascular health can also contribute to the development of diabetes. For instance, obesity, particularly central adiposity, is a major risk factor for both CVDs and type 2 diabetes (Riobó Serván, 2014). Additionally, insulin resistance, a hallmark feature of type 2 diabetes, is often present in individuals with cardiovascular risk factors, such as metabolic syndrome, further highlighting the intricate link between these conditions (Ormazabal *et al*., 2018).

In Nigeria, the prevalence of cardiovascular disease (CVD) and its associated risk factors has been a growing concern. Odukoya *et al*. (2024) found that among diabetic patients in Lagos State, the most prevalent modifiable risk factors were inadequate sleep (91.6%), abdominal obesity (82.6%), and high blood pressure (72%), with 40.3% of participants having three or more co-existing CVD risk factors. Oluyombo *et al*. (2015) reported a high prevalence of hypertension (47.2%), abdominal obesity (32.0%), and low HDL cholesterol (56.3%) in semi-urban communities in southwest Nigeria. Oguoma *et al*. (2017) characterized CVD risk factors in subjects with impaired fasting glucose (IFG) and diabetes, revealing that elevated blood levels of total cholesterol were the most predictive co-morbid risk factor. Amadi *et al*. (2023) investigated the prevalence of ideal cardiovascular health (ICH) metrics in Nigerians, finding that only 7.8% of participants had 5-7 ideal metrics, with ideal diet being the least prevalent behavioral factor (6.5%). Mbakwem *et al*. (2023) observed a cumulative increase in both CVD admissions and deaths over a 16-year period in Lagos, reflecting the epidemiological transition in Nigeria.

While these studies have provided valuable insights into the prevalence and risk factors of CVD and diabetes in various regions of Nigeria, there is a lack of comprehensive data specific to the adult population living in Lagos Island, Lagos State. The present study aims to fill this gap by investigating the prevalence and risk factors of cardiovascular health and diabetes among adults living in Lagos Island, Lagos State, Nigeria

2. Methods

2.1. Study Area

This study was conducted in Lagos Island Local Government Area (LGA), one of the 20 LGAs in Lagos State, Nigeria. Lagos Island is a densely populated urban area located in the southern part of Lagos State, with a population of approximately 209,665 people within an area of just 8.7 km^2 according to the 2006 National Population Census. The LGA is known for its vibrant commercial activities, with a mix of residential and business districts. It is home to a diverse population with varying socioeconomic backgrounds, making it an ideal location to study the prevalence and risk factors of cardiovascular health and diabetes in an urban Nigerian setting. The study included adult participants aged 18 years and above who were residents of Lagos Island LGA.

2.2. Research Design

This study employed a cross-sectional descriptive research design to investigate the prevalence and risk factors of cardiovascular health and diabetes among adults living in Lagos Island, Lagos State, Nigeria. A cross-sectional design was chosen as it allows for the assessment of the prevalence of a condition and the association between risk factors and the outcome of interest at a single point in time. This design is particularly useful for estimating the prevalence of disease in a population and understanding the current health status of the community.

2.3. Study Population Sample and Sampling Technique

The study population consisted of adults aged 18 years and above residing in Lagos Island LGA, which had a total population of 209,437 according to the 2006 National Population Census. The study included adults aged 18 years and above who had resided in Lagos Island LGA for at least one year and provided written informed consent, while excluding pregnant women, individuals with cognitive impairment that could affect their ability to provide accurate information, those with known terminal illnesses, non-residents, and those who had lived in the area for less than one year prior to data collection.

To determine the sample size for this study, the Taro Yamane formula was utilized, resulting in a sample size of 400 participants following a 95% CL and 0.05 margin of error. A multistage sampling technique was employed to ensure a representative sample of the study population. In the first stage, Lagos Island LGA was purposively selected due to its diverse population and urban characteristics. In the second stage, four wards were randomly selected from the LGA. In the third stage, households within the selected wards were randomly chosen using a systematic sampling approach. Finally, eligible adults from the selected households were invited to participate in the study until the desired sample size was achieved.

2.4. Instrument for Data Collection

The study utilized a structured questionnaire to gather information on participants' socio-demographic characteristics, medical history, and lifestyle factors. Additionally, physical measurements such as blood pressure, body mass index, and waist circumference were obtained, and biochemical tests, including fasting blood glucose and lipid profile, were performed to assess the participants' cardiovascular and diabetic status. The questionnaire underwent content validation through expert panel review by three healthcare professionals, followed by pilot testing among 40 adults (10% of the sample size) in a neighboring LGA to assess face validity and test-retest reliability (kappa coefficients ranging from 0.76 to 0.88 for key variables), with subsequent modifications made based on feedback.

2.5. Method of Data Collection and Analysis

Data were collected using an in-person method, where trained research assistants administered a structured questionnaire to the participants. The questionnaire gathered information on socio-demographic characteristics, medical history, lifestyle factors, and knowledge and perception of cardiovascular health and diabetes. Physical measurements, including blood pressure, body mass index, and waist circumference, were obtained using standardized techniques. Biochemical tests, such as fasting blood glucose and lipid profile, were performed by trained medical personnel.

Blood pressure was measured using calibrated automated devices (Omron HEM-907XL) after 5 minutes of rest in a seated position with three consecutive readings taken 2 minutes apart on the right arm at heart level, while anthropometric measurements were obtained using standardized techniques (height measured to nearest 0.1cm using a stadiometer, weight to nearest 0.1kg using calibrated digital scales, and waist circumference measured at the midpoint between the lowest rib and iliac crest using a non-stretchable tape), and blood samples were collected after 8-12 hours of overnight fasting between 7:00-10:00 AM, processed within 2 hours, and analyzed using automated analyzers (Roche Cobas c311) with daily quality controls.

The collected data were then entered into a computer and analyzed using IBM SPSS Statistics version 27.0. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the socio-demographic characteristics, prevalence of cardiovascular disease and diabetes, and the distribution of risk factors. Inferential statistics, such as logistic regression analysis, was employed to examine the associations between risk factors and the outcomes of interest. A p-value of less than 0.05 was considered statistically significant.

2.6. Ethical Considerations

All participants provided written informed consent prior to study enrollment, with the consent form available in both English and Yoruba languages, detailing the study purpose, procedures, potential risks and benefits, voluntary nature of participation, right to withdraw, and measures to ensure data confidentiality.

2.7. Quality Control Measures

A comprehensive quality control system was implemented, including three-day standardized training for research assistants, daily equipment calibration, duplicate measurements for critical parameters, internal and external quality control for laboratory analyses, double data entry with validation checks, and regular supervision by field coordinators who conducted random spot checks of data collection procedures and completed questionnaires for accuracy and completeness.

3. Results and discussion

This section presents comprehensive findings from a cross-sectional study conducted in Lagos Island, examining socio-demographic characteristics, medical history, lifestyle factors, physical measurements, and health knowledge among adult residents, with a response rate of 74.3% and physical measurements conducted on a 10% subsample.

Table 1 Socio-demographic Characteristics of Participants (N = 297)

Variable	Frequency (n)	Percentage (%)
Age		
18-29 years	68	22.9
30-39 years	79	26.6
40-49 years	56	18.9
50-59 years	47	15.8
60 years and above	47	15.8
Gender		
Male	134	45.1
Female	163	54.9
Marital Status		
Single	102	34.3
Married	147	49.5
Divorced	26	8.8
Widowed	22	7.4
Education Level		
No formal education	37	12.5
Primary	85	28.6
Secondary	116	39.1
Tertiary	59	19.9

The demographic analysis (Table 1) revealed that adults aged 30-39 years constituted the largest age group (n = 79, 26.6%), followed by those aged 18-29 years (n = 68, 22.9%). The gender distribution showed a slight female predominance (n = 163, 54.9%) compared to males (n = 134, 45.1%). Regarding marital status, nearly half of the participants were married (n = 147, 49.5%), while a significant proportion were single (n = 102, 34.3%). Educational attainment data indicated that the majority had formal education, with secondary education being the most prevalent (n = 116, 39.1%), followed by primary education (n = 85, 28.6%), while a minority had no formal education (n = 37, 12.5%).

The medical history data (Table 2) demonstrated that hypertension was the most prevalent condition (n = 103, 34.7%), followed by obesity (n = 87, 29.3%) and diabetes mellitus (n = 79, 26.6%). High cholesterol was present in a significant minority (n = 69, 23.2%). A substantial proportion of participants (n = 128, 43.1%) reported no diagnosed conditions. Medication adherence was notably low, with only 21.9% (n = 65) taking hypertension medication and 15.2% (n = 45) taking diabetes medication. Family history of cardiovascular disease or diabetes was reported by more than one-third of participants (n = 112, 37.7%).

Analysis of lifestyle factors (Table 3) revealed that the majority of participants were non-smokers (n = 216, 72.7%), with only 17.2% (n = 51) being current smokers. Regarding alcohol consumption, occasional drinking was most common (n = 154, 51.9%), while regular consumption was reported by a minority (n = 40, 13.5%). Sleep patterns showed that most participants got 5-7 hours of sleep (n = 124, 41.8%), while a concerning proportion got less than 5 hours (n = 67, 22.6%). Physical activity levels were generally low, with the largest group exercising only 1-2 days per week (n = 92, 31.0%), and a significant proportion reporting no physical activity (n = 87, 29.3%).

Table 2 Medical History of Participants (N = 297)

Variable	Frequency (n)	Percentage (%)
Hypertension	103	34.7
Diabetes Mellitus (DM)	79	26.6
High Cholesterol	69	23.2
Obesity	87	29.3
None of the above	128	43.1
Medication for Hypertension	65	21.9
Medication for DM	45	15.2
Family History of CVD or DM	112	37.7

Table 3 Lifestyle Factors of Participants (N = 297)

Variable	Frequency (n)	Percentage (%)
Smoking Status		
Yes	51	17.2
No	216	72.7
Quit	30	10.1
Alcohol Consumption		
Never	103	34.7
Occasionally	154	51.9
Regularly	40	13.5
Average Sleep (hours)		
Less than 5 hours	67	22.6
5-7 hours	124	41.8
7-9 hours	88	29.6
More than 9 hours	18	6.1
Physical Activity		
Never	87	29.3
1-2 days per week	92	31.0
3-4 days per week	61	20.5
5 or more days per week	57	19.2

The physical and biochemical measurements (Table 4) revealed concerning health indicators. The mean systolic blood pressure was elevated at 134.6 mmHg (SD = 14.5), ranging from 110 to 170 mmHg, while the mean diastolic pressure was 86.2 mmHg (SD = 9.7). The average BMI indicated overweight status at 29.3 kg/m^2 (SD = 4.1). Mean waist circumference was 92.8 cm (SD = 7.3). Biochemical parameters showed borderline elevated means for fasting blood glucose (108.6 mg/dL, SD = 12.4), total cholesterol (202.3 mg/dL, SD = 24.8), and LDL cholesterol (122.7 mg/dL, SD = 20.6). HDL cholesterol levels were suboptimal at 48.9 mg/dL (SD = 7.1).

Table 4 Physical and Biochemical Measurements of Participants (N = 30)

Variable	Mean	SD	Min	Max
Systolic BP (mmHg)	134.6	14.5	110	170
Diastolic BP (mmHg)	86.2	9.7	70	110
BMI (kg/m^2)	29.3	4.1	18.2	36.8
Waist Circumference (cm)	92.8	7.3	78.0	109.0
Fasting Blood Glucose (mg/dL)	108.6	12.4	85	130
Total Cholesterol (mg/dL)	202.3	24.8	160	250
HDL Cholesterol (mg/dL)	48.9	7.1	35	65
LDL Cholesterol (mg/dL)	122.7	20.6	90	160
Triglycerides (mg/dL)	145.3	21.4	100	180

Table 5 Knowledge and Perception of Cardiovascular Health and Diabetes (N = 297)

Variable	Frequency (n)	Percentage (%)
Ever Received Education on Cardiovascular Health?		
Yes	163	54.9
No	134	45.1
Ever Received Education on Diabetes?		
Yes	150	50.5
No	147	49.5
Knowledge of Cardiovascular Health		
Poor	76	25.6
Fair	103	34.7
Good	79	26.6
Excellent	39	13.1
Knowledge of Diabetes		
Poor	58	19.5
Fair	109	36.7
Good	92	31.0
Excellent	38	12.8
Belief that Lifestyle Changes Can Prevent/Manage CVD and Diabetes		
Yes	243	81.8
No	21	7.1
Unsure	33	11.1

The analysis of health knowledge and perceptions (Table 5) showed that slightly more than half of participants had received education on cardiovascular health (n = 163, 54.9%) and diabetes (n = 150, 50.5%). Knowledge levels for both

conditions were predominantly fair to poor, with 34.7% (n = 103) reporting fair cardiovascular health knowledge and 36.7% (n = 109) reporting fair diabetes knowledge. Only a small minority claimed excellent knowledge in either area (13.1% and 12.8% respectively). Notably, an overwhelming majority (n = 243, 81.8%) believed that lifestyle changes could prevent or manage these conditions.

Table 6 Logistic Regression Analysis of Risk Factors for Diabetes (N = 297)

Variable	B	SE	Wald	p-value	Odds Ratio (OR)	95% CI for OR
Age (years)	0.10	0.03	12.36	<0.001	1.11	1.05 – 1.17
BMI (kg/m^2)	0.14	0.04	14.89	<0.001	1.15	1.07 – 1.25
Physical Activity	-0.42	0.16	6.59	0.010	0.66	0.49 – 0.89
Family History of DM	0.74	0.21	12.34	<0.001	2.10	1.42 – 3.09
Smoking Status	0.38	0.24	2.56	0.109	1.46	0.92 – 2.29

The logistic regression analysis (Table 6) identified several significant predictors of diabetes. Age showed a significant positive association (OR = 1.11, 95% CI: 1.05-1.17, $p < 0.001$), as did BMI (OR = 1.15, 95% CI: 1.07-1.25, $p < 0.001$). Family history of diabetes emerged as the strongest predictor (OR = 2.10, 95% CI: 1.42-3.09, $p < 0.001$). Physical activity demonstrated a significant protective effect (OR = 0.66, 95% CI: 0.49-0.89, $p = 0.010$). Smoking status showed a non-significant positive association (OR = 1.46, 95% CI: 0.92-2.29, $p = 0.109$).

4. Discussion

The findings revealed that hypertension was the most prevalent cardiovascular condition among the study population, followed by obesity and diabetes mellitus. This high prevalence could be attributed to urbanization, sedentary lifestyle, and dietary changes in Lagos Island. These findings align with Odukoya *et al*. (2024), who reported high blood pressure as a major risk factor among diabetic patients in Lagos State. Similarly, Oluyombo *et al*. (2015) found a significant prevalence of hypertension in semi-urban communities in southwest Nigeria. Mbakwem *et al*. (2023) also observed an increasing trend in CVD-related admissions and deaths over a 16-year period in Lagos.

The study found low medication adherence rates among participants with diagnosed conditions. This could be due to various factors including cost of medications, poor access to healthcare facilities, and inadequate health education. This finding is concerning as it increases the risk of complications. Oguoma *et al*. (2015) highlighted how socioeconomic status affects accessibility to CVD risk screening, which may influence medication adherence. Odukoya *et al*. (2024) also emphasized the need for primary and secondary preventive measures to address CVD risks among patients.

Physical activity levels were generally low among participants, with a significant proportion reporting no regular exercise. This could be attributed to the urban environment of Lagos Island, which may not be conducive to physical activity, coupled with long working hours and traffic congestion. This finding corresponds with Amadi *et al*. (2023), who found that ideal physical activity was among the least prevalent cardiovascular health metrics in Nigerians. Odukoya *et al*. (2024) also reported inadequate physical activity as a significant risk factor among their study population.

Sleep patterns showed that most participants got insufficient sleep, which could be related to work demands, stress, and urban lifestyle factors. This finding is particularly significant given that Odukoya *et al*. (2024) identified inadequate sleep as the most prevalent modifiable risk factor for CVD among diabetic patients in Lagos State. The relationship between poor sleep and cardiovascular health requires further investigation in the Nigerian context.

The biochemical measurements revealed borderline elevated means for various parameters, including fasting blood glucose and cholesterol levels. This could be attributed to poor dietary habits, physical inactivity, and genetic factors. These findings are consistent with Oguoma *et al*. (2017), who found that elevated blood levels of total cholesterol were the most predictive co-morbid risk factor among subjects with impaired fasting glucose and diabetes. Oluyombo *et al*. (2015) also reported significant prevalence of abnormal lipid profiles in their study population.

Knowledge levels regarding cardiovascular health and diabetes were predominantly fair to poor, despite the high prevalence of these conditions. This could be due to inadequate health education programs and limited access to health

information. However, the majority of participants believed that lifestyle changes could prevent or manage these conditions, indicating a positive attitude toward health behavior modification. This finding relates to Onyemelukwe *et al*. (2020), who emphasized the importance of intensifying health education among healthcare workers. Amadi *et al*. (2023) also highlighted the need for improving healthy living among Nigerians given the low prevalence of ideal cardiovascular health metrics.

The logistic regression analysis identified age, BMI, and family history as significant predictors of diabetes, while physical activity showed a protective effect. These associations could be explained by the cumulative effect of lifestyle factors over time and genetic predisposition. Similar findings were reported by Oguoma *et al*. (2017), who found that age was an important factor in the co-occurrence of CVD risk factors. Addie and John Taiwo (2024) also identified demographic factors as significant predictors of diagnosed cardiovascular diseases in Lagos State

5. Conclusion

Based on the findings of high prevalence of cardiovascular risk factors, poor medication adherence, insufficient physical activity, inadequate sleep, borderline elevated biochemical parameters, and limited health knowledge among adults in Lagos Island, there is an urgent need for comprehensive interventions focusing on health education, lifestyle modification, and improved healthcare access, with particular attention to high-risk groups such as older adults and those with family history of cardiovascular diseases or diabetes.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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