Knowledge of Cardiovascular Disease Risk Factors and Determinants among Adolescents at a Tertiary Hospital in Nigeria: A Cross-Sectional Study

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ABSTRACT

Background: Cardiovascular disease is rising in sub-Saharan Africa, yet adolescent awareness remains underexplored. Few Nigerian studies have assessed CVD knowledge determinants using validated tools, creating a gap in evidence for targeted prevention. The objective of the study was to assess the level of knowledge of CVD risk factors and identify sociodemographic and lifestyle determinants among adolescents in Benin City.

Methods: This cross-sectional study enrolled 180 adolescents aged 10-19 years, with a mean age of 15.01 ± 2.76 years, attending the Family Medicine Clinic, UBTH, Benin City, from June to August 2023. Knowledge was measured using the modified Heart Disease Facts Questionnaire (HDFQ), 25 items across 5 domains. Scores 0-100 were graded as poor 0- 50, fair 51-70, and good >70. Binary logistic regression identified independent predictors of good knowledge. $p<0.05$ was significant.

Results: Mean composite knowledge score was 49.4 ± 17.9. Overall, 99 (55.0%) had poor knowledge, 54 (30.0%) fair, and 27 (15.0%) good. The CVD risk factors domain scored the highest, 4.2 ± 1.8; the exercise domain scored the lowest 1.5 ± 1.0. Independent predictors of good knowledge were age 10-12 years AOR=10.7, 95%CI:2.4-458, p=0.002 and 13-16 years AOR=4.7, 95%CI:1.4-16.0, p=0.012 versus 17-19 years; tertiary education versus primary AOR=0.02, 95%CI:0.002-0.12 and secondary AOR=0.09, 95%CI:0.03-0.32, p=0.0001. Physical activity was significantly related to knowledge ($\chi^2 = 8.696$, $p = 0.011$). The model explained 22.5% to 30.1% of the variance.

Conclusion: Knowledge of CVD risk factors among adolescents in Benin City is poor. Younger age, higher education, and physical activity predict better knowledge. School and clinic-based interventions targeting older adolescents with low educational attainment are urgently needed.

Keywords: Cardiovascular Disease, Risk Factors, Determinants, Knowledge, Adolescents, Hospital

INTRODUCTION

Cardiovascular diseases (CVD) are the leading cause of death globally, responsible for 17.9 million deaths in 2019 and projected to exceed 20 million annually by 2030 (Mathers & Loncar, 2006). The burden is escalating in sub-Saharan Africa due to the rising prevalence of hypertension, obesity, and diabetes among younger populations (Teo & Rafiq, 2012).

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Adolescence, defined by the United Nations as ages 10-19 years represents a critical window for primordial prevention (UNICEF, 2022). Health behaviours, risk perceptions, and knowledge formed during this period often track into adulthood and influence future CVD risk (Akintunde et al., 2015). Knowledge of CVD risk factors is a prerequisite for preventive behaviour; evidence from high-income settings shows that higher knowledge scores correlate with increased physical activity, healthier diets, and reduced tobacco use (Akintunde et al., 2015).

In Nigeria, adolescents constitute over 43 million individuals, yet empirical data on CVD knowledge remain sparse (UNFPA, 2013). Existing studies have reported poor to fair knowledge levels among adolescents, but most employed non-validated instruments, assessed single institutions, or failed to examine determinants of knowledge (Odunaiya et al., 2021; Wagner et al., 2025). Studies using the validated Heart Disease Facts Questionnaire (HDFQ) in Nigeria are limited, and few have differentiated knowledge of modifiable lifestyle behaviours from knowledge of clinical diseases such as hypertension and diabetes (Wagner et al. 2005; Opoku-Acheampong et al., 2021). This distinction is important because health education may suffice for behavioural risks, while clinical diseases require medical management.

Furthermore, the influence of sociodemographic factors and lifestyle practices on CVD knowledge among Nigerian adolescents is underexplored. Understanding these determinants is essential for designing targeted school and clinic-based health promotion interventions. This evidence gap limits public health planning for adolescent CVD prevention.

Therefore, this study objectives were to: 1) assess the level of knowledge of CVD risk factors among adolescents attending a tertiary hospital in Benin City, Nigeria, using the modified HDFQ; and 2) identify sociodemographic and lifestyle determinants of good knowledge. Findings will inform adolescent health education strategies in Nigeria.

MATERIAL AND METHODS

Study design and setting

This was a hospital-based cross-sectional study conducted at the Family Medicine Clinic, University of Benin Teaching Hospital (UBTH), Benin City, Nigeria, from June to August 2023.

Study Participants

Participants were adolescents aged 10-19 years.

Inclusion and exclusion criteria

All patients aged 10-19 years who gave informed consent or assent were included. Patients with major cognitive or psychiatric disorders, those too ill to respond, and patients with sickle cell anaemia or other known chronic diseases were excluded.

Sample Size

The minimum sample size was determined using the single proportion formula:

$$n = \frac{Z^2 p(1-p)}{d^2}$$

where $Z = 1.96$for a 95% confidence level, $p = 0.619$based on the 61.9% prevalence of poor cardiovascular disease knowledge reported by Odunaiya *et al.* (2021), and $d = 0.05$. This yielded a sample size of 362. Applying finite population correction for the 300 adolescents attending the clinic in 2019 gave:

$$n_f = \frac{n}{1 + (n/N)} = \frac{362}{1 + (362/300)} = 164$$

After adjusting for a 10% non-response rate, the final sample size was 180 participants.

Sampling Technique

Systematic random sampling was used. With a target of 180 participants over 12 weeks, the sampling interval was 5, based on the average daily attendance of 15 adolescents. The first respondent each day was selected by balloting among the first five presenting patients. Every fifth eligible adolescent thereafter was recruited. Hospital numbers were recorded to prevent reselection.

Data collection tools

Data were collected using an interviewer-administered questionnaire incorporating two validated instruments.

Knowledge of CVD risk factors: Assessed using a modified 25-item Heart Disease Facts Questionnaire (HDFQ) developed by Wagner et al., 2005. The original HDFQ has internal consistency of 0.77 using the Kuder–Richardson formula-20. Approximately half the original items specifically address diabetes-related CVD risk. For this study, items 18, 19, 20, 21, 22, 23, and 24 were modified to cover additional risk factors, including alcohol ingestion, irregular sleep patterns, childhood/adolescent lifestyle, and routine medical checks, to align with study objectives. Responses were "true," "false," or "I don't know." Six statements were reverse-scored. Correct responses scored 1; incorrect or "I don't know" scored 0. Total scores were multiplied by 4 to yield a final score of 0-100, categorized as poor <50, fair 51-70, and good >70. The 25 items were grouped

into 5 domains: 1) age, gender, genetics, family history (items 1,2,3,25); 2) risk factors for CVD (items 4,6,8,12,16,18,20); 3) exercise (items 13,14,15); 4) diet and cholesterol (items 9,10,11,17,22); and 5) therapeutic measures and lifestyle intervention (items 5,7,19,21,23,24). The HDFQ was administered by a trained research assistant before clinical consultation to avoid response bias.

Physical activity: Assessed using the International Physical Activity Questionnaire (IPAQ) short-form Version 8 (Craige et al., 2003). The IPAQ evaluates frequencies and durations of walking, moderate, and vigorous physical activity in the previous week. It has good test-retest reliability and adequate validity for adolescents (Lee et al., 2011). Physical activity levels were categorized as "low," "moderate," and "high" per IPAQ scoring Protocol (Lee et al., 2011).

Variables

The primary outcome was the level of knowledge of CVD risk factors. Independent variables were sociodemographic characteristics and physical activity level as measured by IPAQ.

Statistical analysis

Data were analysed using IBM SPSS version 21. Categorical variables were summarized as frequencies and percentages. Continuous variables were presented as mean ± standard deviation. Chi-square test assessed associations between categorical variables and knowledge level. Variables with $p<0.25$ on bivariate analysis were entered into binary logistic regression to identify independent predictors of good knowledge, defined as score >70 versus ≤70. Adjusted odds ratios (AOR) and 95% confidence intervals (CI) were reported. Model fit was assessed using Nagelkerke R^2. Statistical significance was set at $p<0.05$.

Ethical considerations

Ethical approval was obtained from the University of Benin Teaching Hospital Ethics and Research Committee on the 10th of June 2023, with Protocol number: ADM/E22/A/VOL.VII/148301131. Written informed consent was obtained from participants aged ≥18 years and from parents/guardians of those <18 years, with assent from the adolescents. All participant information was kept confidential. Participants incurred no financial obligations nor faced negative consequences for refusing to participate. They were allowed to withdraw from the study at any time without impact on future care.

RESULTS

A total of 180 adolescents participated. The mean age was 15.0 ± 2.8 years, with 41.1% in mid-adolescence (13-16 years) and 36.1% in late adolescence (17-19 years). Females constituted 62.2% of participants. All were Christians, 94.4% were students, and 63.7% had secondary level education (Table 1).

Table 1: Socio-Demographic Characteristics of the Study Participants

Socio-demographic Characteristics	Frequency (n = 180)	Percent
Age Group (years)		
10-12	41	22.8
13-16	74	41.1
17-19	65	36.1
Mean ± SD Age (years)	15.01 ± 2.76	
Gender		
Male	68	37.8
Female	112	62.2
Religion		
Christianity	180	100.0
Islam	0	0.0
African tradition	0	0.0
Level of education		
Primary	19	10.7
Secondary	115	63.7
Tertiary	46	25.6
Occupation		
Student	170	94.4
Self-employed, Business, Apprentice	10	5.6

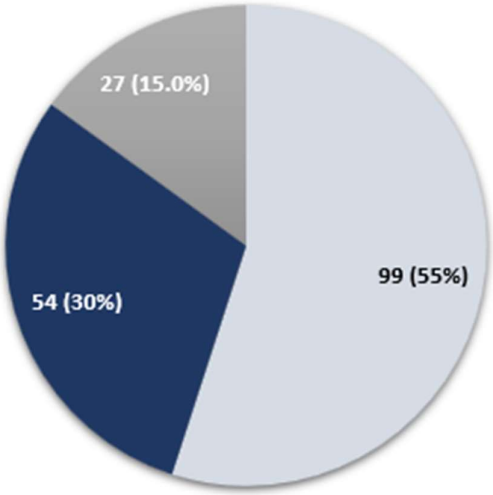

Figure 1: Knowledge of CVD risk factors

The overall mean composite knowledge score was 49.4 ± 17.9. More than half, 55.0% (n=99), had poor knowledge of CVD risk factors, 30.0% (n=54) had fair knowledge, and only 15.0% (n=27) had good knowledge (Figure 1).

Participants scored highest in knowledge of CVD risk factors (4.2 ± 1.8) and lowest in knowledge of the role of exercise (1.5 ± 1.0). Mean scores for therapeutic measures/lifestyle intervention, role of age/gender, and diet/cholesterol were 2.5 ± 1.0, 2.4 ± 1.1, and 1.7 ± 1.4, respectively (Table 2).

Physical activity was significantly related to knowledge (χ^2 = 8.696, p = 0.011). Participants at risk due to low physical activity were more likely to have fair knowledge compared to those not at risk. Other lifestyle behaviours—including smoking, alcohol use, sleep pattern, and high-fat diet—did not show statistically significant associations with knowledge (p > 0.05).

Logistic regression identified age and education as significant predictors of cardiovascular disease knowledge (Table 4). Younger participants (10–12 years: OR = 10.71, 95% CI: 2.46–46.66, p = 0.002; 13–16 years: OR = 4.73, 95% CI: 1.40–15.99, p = 0.012) were more likely to demonstrate good knowledge compared with those aged 17–19 years. Education showed a strong inverse association: primary (OR = 0.017, 95% CI: 0.002–0.123, p < 0.001) and secondary (OR = 0.094, 95% CI: 0.027–0.324, p < 0.001) levels were significantly less likely to predict good knowledge compared with tertiary education. Sex was not significant (male OR = 0.57, 95% CI: 0.26–1.23, p = 0.151). Other variables did not show significant associations. The model explained 22.5% to 30.1% of variance (Nagelkerke R^2=0.225–0.301) (Table 4).

Table 2: Scores for Knowledge Domains of Cardiovascular Disease among Study Participants

Knowledge domain	Mean ± Standard deviation
Domain 1 (Age, Gender)	2.4 ± 1.1
Domain 2 (Risk factor for CVD)	4.2 ± 1.8
Domain 3 (Exercise)	1.5 ± 1.0
Domain 4 (Diet)	1.7 ± 1.4
Domain 5 (Therapeutic measures/Lifestyle Intervention)	2.5 ± 1.0
Composite Knowledge score	49.4 ± 17.9

Table 3: The Relationship between Lifestyle Behaviour Variables and Knowledge of cardiovascular disease among the Study Participants

Variable	Knowledge of CVD			Test statistics	p-value
	Good n (%) (n=27)	Fair n (%) (n=54)	Poor n (%) (n=99)		
Physical Activity					
At Risk	3 (15.8)	11 (57.9)	5 (26.3)	$\chi^2 = 8.696$	0.011
No Risk	24 (14.9)	43 (26.7)	94 (58.4)		
Smoked in the past 30 days					
Yes	0 (0)	3 (60)	2 (40)	Fishers exact test = 1.892	0.433
No	27 (15.4)	51 (29.2)	97 (55.4)		
Alcohol in the past 30 days					
Yes	5 (23.8)	5 (23.8)	11 (52.4)	$\chi^2 = 1.563$	0.451
No	22 (14.0)	49(31.0)	88 (55.0)		
Poor or irregular sleep pattern in the past 30 days					
Yes	7 (18.4)	16(42.1)	15 (39.5)	$\chi^2 = 4.691$	0.405
No	20 (14.1)	38(26.8)	84 (59.1)		
Diets with high fat content					
Yes	9 (15.0)	16 (26.7)	35 (58.3)	$\chi^2 = 0.515$	0.799
No	18 (15.0)	38 (31.7)	64 (53.3)		

n = 180

DISCUSSION

This study assessed knowledge of cardiovascular disease and its predictors among adolescents in Benin City, Nigeria. The overall level of knowledge was poor, with a mean composite score of 49.4 ± 17.9, and more than half (55.0%) of participants demonstrated poor knowledge of CVD risk factors. This finding aligns with previous reports from Ibadan, Nigeria, where Odunaiya et al. (2021) found inadequate CVD knowledge among secondary school adolescents. Akintunde et al., (2015) documented poor heart disease risk factor knowledge among Nigerian university workers The poor knowledge observed is concerning given that CVD remains a leading cause of death globally (WHO, 2015, WHO, 2018) and in Nigeria with projections indicating rising burden in low- and middle-income countries (Mathers et al., 2002; Ike & Onyema, 2020;).

Participants demonstrated better knowledge in the domain of CVD risk factors compared to the role of exercise and diet/cholesterol. This pattern suggests that while adolescents may recognize hypertension and smoking as risk factors, their understanding of primary prevention through physical activity and dietary modification remains limited. Similar domain-specific deficits were reported by Odunaiya et al. (2021) among Nigerian adolescents in Ibadan North and by George et al., 2014, among school children in Delhi. The low score for exercise knowledge is particularly worrying given the rising prevalence of physical inactivity among Nigerian youth and urban adolescents globally (Adeloye et al., 2022; WHO, 2023).

Education level showed a strong and consistent influence (OR = 0.017, p < 0.0001, OR = 0.094, p < 0.0001). Participants with primary and secondary education were markedly less likely to have good knowledge compared to those with tertiary education. This underscores the role of formal education in enhancing health literacy and suggests that higher educational attainment equips individuals with better skills to access, interpret, and apply health information. This dose-response relationship is consistent with studies in Nigeria, where higher educational attainment significantly improved CVD knowledge (Akintunde et al., 2015; Odunaiya et al., 2021).

Age was also significant predictors of knowledge of cardiovascular disease among participants. Younger adolescents (10–12 years and 13–16 years) demonstrated significantly higher odds, (OR = 10.7, p = 0.002, OR = 4.7, p = 0.012) about 10 times and five times respectively, of possessing good knowledge compared to older adolescents (17–19 years). This may suggest that early exposure to health information may be more effective in shaping awareness, possibly due to greater receptivity at younger ages.

Table 4: Predictors of Knowledge of Cardiovascular Disease among the Participants

Variables	B (regression coefficient)	p-value (<0.05)	Odds ratio	95% C.I. for Odds ratio	
				Lower	Upper
Age group (years)					
10-12	2.371	0.002	10.708	2.458	46.658
13-16	1.554	0.012	4.729	1.399	15.987
17-19*			1		
Sex					
Male	-0.564	0.151	0.569	0.264	1.228
Female			1		
Level of Education					
Primary	-4.096	0.0001	0.017	0.002	0.123
Secondary	-2.369	0.0001	0.094	0.027	0.324
Tertiary			1		
Family History of CVD Risk Factor Dx					
Yes			1		
No	-0.306	0.431	0.736	0.343	1.578
Physical Activity					
At Risk			1		
No Risk	-2.529	0.001	0.080	0.019	0.333
Smoked in the past 30 days					
Yes			1		
No	-2.499	0.077	0.082	0.005	1.314
Alcohol in the past 30 days					
Yes			1		
No	-0.602	0.333	0.548	0.162	1.853
Poor/irregular sleep pattern					
Yes			1		
No	-0.446	0.328	0.640	0.262	1.565
Diets with high fat content					
Yes			1		
No	0.552	0.165	1.737	0.797	3.788
Diabetes Mellitus					
Yes			1		
No	-1.706	0.120	0.182	0.021	1.560
Obesity					
Yes			1		
No	0.219	0.600	1.245	0.550	2.817
Hypertension					
Yes			1		
No	0.191	0.746	1.210	0.382	3.835

*Reference category, R^2 (coefficient of determination) = 22.5% to 30.1% .

Contrary to expectations, physical activity was not an independent predictor of good knowledge after adjusting for confounders. Previous Nigerian studies have reported mixed associations between lifestyle behaviours and CVD knowledge, with Emmanuel et al. (2017) finding behavioural and sociodemographic predictors of cardiovascular risk among Nigerian adolescent. The lack of association between smoking, alcohol, sleep, and a high-fat diet with knowledge suggests that risk

behaviours occur independently of factual knowledge, highlighting the knowledge-behaviour gap. The Heart Disease Fact Questionnaire used in this study has been validated for assessing CVD knowledge and is suitable for underserved populations (Wagner et al., 2005; Opoku-Acheampong et al., 2021).

LIMITATIONS

This study's cross-sectional design restricts its ability to establish causality or determine the direction of associations between cardiovascular disease (CVD) knowledge and risk profiles. Because it captures only a single point in time, it cannot account for changes or progression in knowledge and risk factors, which a longitudinal design would better reveal. In addition, the relatively small sample size may limit representativeness, reducing the generalizability of findings to the wider adolescent population.

Furthermore, reliance on self-reported questionnaires introduces potential response and recall bias, as participants may misestimate their knowledge, behaviours, or family health history. The accuracy of results may also be affected by unmeasured confounding factors such as socioeconomic status, access to school health curricula, and cultural influences. These limitations highlight the need for cautious interpretation of findings and suggest that future studies should employ larger, longitudinal designs with more robust measures to strengthen validity.

CONCLUSION

Knowledge of cardiovascular disease risk factors among adolescents in Benin City is poor, with significant deficits in understanding the role of exercise and diet. Higher educational level and older age are independent predictors of good knowledge. Targeted school and church-based health education interventions focusing on lifestyle modification are urgently needed to improve CVD literacy in this population, supporting WHO recommendations for adolescent health interventions. Future research should validate culturally-adapted knowledge assessment tools and evaluate intervention effectiveness.

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Conflict of interest

The authors affirm that they have no conflicts of interest to declare.

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