Sonographic Determination of Carotid Artery Intima-Media Thickness among Apparently Healthy Adults in Kano Metropolis

Original Article

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ABSTRACT

Background: Carotid intima-media thickness (CIMT) is a non-invasive ultrasonographic marker of subclinical atherosclerosis and an established predictor of future cardiovascular events. However, normative CIMT data among apparently healthy adults in Northern Nigeria remain limited, restricting its clinical application for cardiovascular risk assessment.

Aim: This study was aimed at evaluating common carotid intima-media thickness and its relationship with demographic, anthropometric, haemodynamic, biochemical, and metabolic parameters among apparently healthy adults in Kano Metropolis, Nigeria.

Materials and Methods: This was a cross-sectional study included 85 apparently healthy adults (43 males and 42 females) aged 30–60 years recruited from selected hospitals in Kano metropolis between January 2025 and April 2026. Anthropometric indices, blood pressure, fasting plasma glucose, glycated haemoglobin (HbA1c), lipid profile, and serum creatinine were measured using standard procedures. Right (RCIMT), left (LCIMT), and mean carotid intima media thickness (mCIMT) were assessed using high-resolution B-mode ultrasonography with a 7.5-MHz linear transducer. Data were analysed using independent-samples *t*-test, Pearson's correlation, and multiple linear regression. Statistical significance was set at $p< 0.05$.

Results: The participants had a mean age of 44.42 ± 7.22 years. The overall mean right, left, and mean common carotid intima-media thicknesses (RCIMT, LCIMT, and mCIMT) were 0.59 ± 0.02 mm, 0.59 ± 0.02 mm, and 0.59 ± 0.02 mm, respectively. No significant sex differences were observed in RCIMT ($p = 0.538$), LCIMT ($p = 0.622$), or mCIMT ($p = 0.573$). Mean CIMT increased progressively across age groups, from 0.57 ± 0.02 mm among participants aged 30–39 years to 0.61 ± 0.01 mm among those aged 50–60 years. Pearson's correlation analysis demonstrated a strong positive association between age and mCIMT ($r = 0.670$, $p < 0.001$) and a weak positive association between triglyceride levels and mCIMT ($r = 0.261$, $p = 0.016$). No significant correlations were observed between mCIMT and anthropometric, haemodynamic, glycaemic, lipid (except triglycerides), or renal function parameters. Multiple linear regression analysis showed that none of the evaluated clinical variables independently predicted mCIMT after adjustment for potential confounders ($p > 0.05$)

Conclusion: Normative value of common carotid intima-media thickness among apparently healthy adults in Kano Metropolis was established. No significant sex- or side-related differences. There was no significant relationship between mCIMT and demographic, anthropometric, haemodynamic, glycaemic, lipid, or renal variables

Keywords: Carotid intima-media thickness; ultrasonography; common carotid artery; healthy adults; cardiovascular risk; Nigeria.

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Introduction

Cardiovascular disease (CVD) remains the leading cause of morbidity and mortality worldwide, accounting for a substantial proportion of premature deaths and disability. Atherosclerosis is the underlying pathological process in most cardiovascular and cerebrovascular diseases and often develops silently over many years before the onset of clinical symptoms [1]. Consequently, the identification of early vascular changes before the development of overt disease has become an important component of cardiovascular risk assessment and prevention.Carotid intima-media thickness (CIMT) is a non-invasive ultrasonographic measure of the combined thickness of the intimal and medial layers of the carotid arterial wall. It is widely recognized as a surrogate marker of subclinical atherosclerosis and has been shown to correlate with established cardiovascular risk factors and future cardiovascular events [2-4]. Measurement of CIMT using high-resolution B-mode ultrasonography is safe, reproducible, relatively inexpensive, and suitable for population-based studies [2,5].

Numerous studies have demonstrated that increased CIMT is associated with an elevated risk of myocardial infarction, stroke, and cardiovascular mortality [4,6]. Furthermore, CIMT has been used extensively in epidemiological studies and clinical trials to monitor the progression or regression of atherosclerosis and to evaluate the effectiveness of therapeutic interventions [7]. Because CIMT reflects structural arterial wall changes that precede clinical cardiovascular disease, it has become an important tool for cardiovascular risk stratification.

Interpretation of CIMT measurements requires the availability of population-specific reference values. Several studies have shown that CIMT varies according to age, sex, ethnicity, body size, and cardiovascular risk profile [3,8]. Age, in particular, has consistently been identified as one of the strongest determinants of CIMT, with progressive arterial wall thickening occurring as part of the vascular aging process [8]. Consequently, reference intervals established in one population may not be directly applicable to another population with different demographic and ethnic characteristics.

Despite the increasing use of carotid ultrasonography in cardiovascular risk assessment, there remains a paucity of normative CIMT data among healthy adults in many African populations, particularly in Northern Nigeria. The absence of locally derived reference values may limit the clinical interpretation of CIMT measurements and the identification of early vascular abnormalities. Establishing baseline CIMT values among apparently healthy individuals is therefore essential for improving cardiovascular risk assessment and providing reference standards for future clinical and epidemiological studies.This study was conducted to determine reference values and identify determinants of common carotid intima-media thickness among apparently healthy adults in Northwestern Nigeria using B-mode ultrasonography.

Materials and Methods

This was a cross-sectional study conducted among apparently healthy adults in some selected hospitals n Kano Metropolis Nigeria, from January 2025 to April 2026. Ethical approval for the study was obtained from Kano State Ministry of Health Research Ethics Committee, before commencement of the study. Written informed consent was obtained from all participants, and confidentiality and anonymity of collected data were maintained throughout the study. A sample size of 85 healthy adults subjects (50.6% males and 49.4% females) was derived using formula for unknown population sample.

Eligible participants were adults aged 30 years and above with no previous diagnosis of diabetes mellitus, normal fasting plasma glucose (<5.6 mmol/L or <100 mg/dL), and no known history of cardiovascular disease. Individuals with a history of coronary artery disease, myocardial infarction, stroke, peripheral vascular disease, congestive heart failure, chronic kidney disease, inflammatory or autoimmune disorders, malignancy, previous carotid surgery, acute illness or infection within the preceding two months, or inability to undergo carotid ultrasonography were excluded from the study.

Sociodemographic and clinical information was obtained using a structured questionnaire. Height was measured using a portable stadiometer and recorded to the nearest 0.1 cm, while body weight was measured using a calibrated digital weighing scale and recorded to the nearest 0.1 kg. Body mass index (BMI) was calculated as weight divided by the square of height (kg/m^2), whereas body surface area (BSA) was estimated using the Du Bois formula. Blood pressure

was measured after participants had rested in a seated position for at least five minutes using a calibrated digital sphygmomanometer, and systolic and diastolic blood pressures were recorded in millimetres of mercury (mmHg).

Following an overnight fast of 8-12 hours, venous blood samples were collected for the determination of fasting plasma glucose, glycated haemoglobin (HbA1c), lipid profile comprising total cholesterol, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), triglycerides, and serum creatinine. Biochemical analyses were performed using an automated clinical chemistry analyzer (Roche Cobas c501), while HbA1c was determined using high-performance liquid chromatography (Bio-Rad D-10 HbA1c Analyzer). Standard laboratory quality-control procedures were observed throughout the study.

Carotid ultrasonography was performed using a high-resolution B-mode ultrasound scanner (SonoScape A6) equipped with a 7.5-MHz linear-array transducer. Participants were examined in the supine position with slight neck extension and the head rotated approximately 45° away from the side being examined. The right and left common carotid arteries were evaluated in both longitudinal and transverse planes. Carotid intima-media thickness measurements were obtained from the far wall of a plaque-free segment of the common carotid artery approximately 1 cm proximal to the carotid bulb (Plate 1 and 2). Three measurements were obtained on each side and averaged to determine the right carotid intima-media thickness (RCIMT), left carotid intima-media thickness (LCIMT), and mean carotid intima-media thickness (mCIMT). All ultrasound examinations and measurements were performed by the same investigator to minimize inter-observer variability.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 23.0 (IBM Corp., Armonk, NY, USA).Data normality was assessed using the Shapiro-Wilk test. Variables were expressed as mean ± standard deviation. Independent samples t-test was used to compare between male and female participants and between right and left carotid arteries. Pearson's correlation analysis was performed to determine the relationships between mean carotid intima-media thickness and demographic, anthropometric, haemodynamic, glycaemic, lipid, and renal variables. Multiple linear regression analysis was subsequently performed to identify independent predictors of mean carotid intima-media thickness. Statistical significance was set at a p-value of less than 0.05.

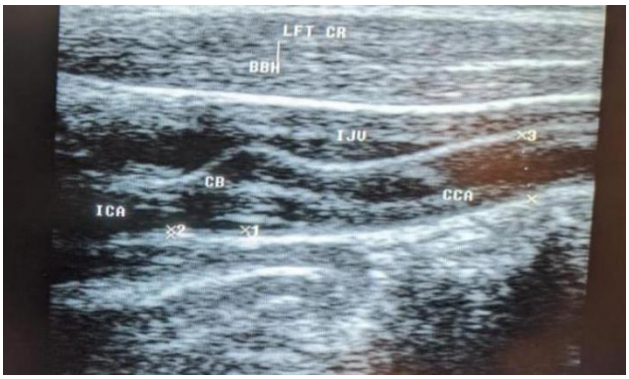
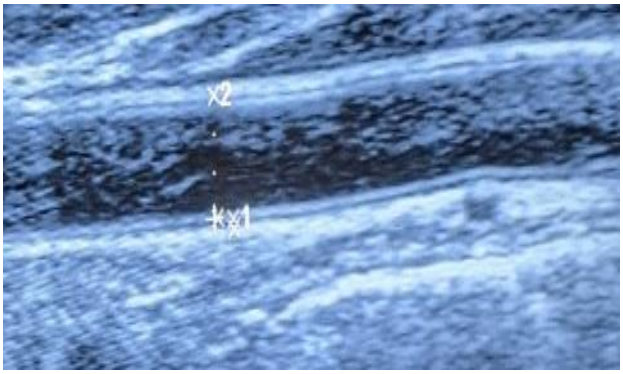


Plate 1. Left carotid artery: Showing the common carotid artery (CCA), Carotid Bulb (CB) and the Internal Carotid Artery (ICA) Image of Carotid Intima-Media thickness

Plate 2. Left carotid artery: Showing the common carotid artery (CCA), Carotid Bulb (CB) and the Internal Carotid Artery (ICA) Image of Carotid Intima-Media thickness



Results

A total of 100 apparently healthy adults comprising 43 (50.6%) males and 42 (49.4%) females participated in the study. The overall mean age of the participants was 44.4 ± 7.2 year as presented in Table 1. The mean height, weight, body mass index (BMI), and body surface area (BSA) of the study population were 1.66 ± 0.07 m, 68.31 ± 9.9 kg, 24.72 ± 2.8 kg/m², and 1.77 ± 0.16 m², respectively presented in Table 1.

The average systolic and diastolic blood pressures were 120.46 ± 8.3 mmHg and 76.59 ± 4.7 mmHg, respectively presented in Table 1. The mean fasting plasma glucose and glycated haemoglobin (HbA1c) were 86.84 ± 8.13 mmol/L and 5.17 ± 0.20%, confirming normal glycaemic status among the participants presented in Table 1. Similarly, the mean serum lipid profile and creatinine concentrations were within normal reference ranges. The overall mean right common carotid intima-media thickness (RCIMT), left common carotid intima-media thickness (LCIMT), and mean common carotid intima-media thickness (mCIMT) were 0.58 ± 0.02 mm, 0.59 ± 0.02 mm, and 0.59 ± 0.02 mm, respectively as presented in Table 1. Comparison of anthropometric, biochemical, haemodynamic, and carotid ultrasonographic parameters between male and female participants is presented in Table 2. The age-related distribution of carotid intima-media thickness is shown in Table 3. Pearson's correlation analysis between mean CIMT and selected demographic, anthropometric, haemodynamic, biochemical, lipid, and renal variables is summarized in Table 4. Multiple linear regression analysis predicting mCIMT is presented in Table 5.

Table 1. Anthropometric, Biochemical and CIMT Characteristics of the participants

Variables	Male (n = 43) Mean ± SD	Female (n = 42) Mean ± SD	Total (n = 85) Mean ± SD	Range
Age (years)	46.05 ± 6.97	42.76 ± 7.18	44.42 ± 7.22	30.00–60.00
Height (m)	1.71 ± 0.05	1.61 ± 0.06	1.66 ± 0.07	1.49–1.81
Weight (kg)	71.94 ± 8.88	64.59 ± 9.60	68.31 ± 9.90	40.70–88.40
BMI (kg/m²)	24.69 ± 2.69	24.75 ± 2.94	24.72 ± 2.80	15.70–29.70
BSA (m²)	1.84 ± 0.13	1.70 ± 0.15	1.77 ± 0.16	1.35–2.09
SBP (mmHg)	120.81 ± 7.91	120.10 ± 8.78	120.46 ± 8.31	99.00–141.00
DBP (mmHg)	76.79 ± 5.07	76.38 ± 4.48	76.59 ± 4.76	67.00–90.00
Fasting Glucose (mmol/L)	87.56 ± 8.46	86.10 ± 7.80	86.84 ± 8.13	72.00–99.00
HbA1c (%)	5.18 ± 0.22	5.15 ± 0.18	5.17 ± 0.20	4.80–5.60
Total Cholesterol (mg/dL)	176.58 ± 13.19	176.76 ± 16.06	176.67 ± 14.59	144.00–212.00
LDL Cholesterol (mg/dL)	99.19 ± 15.54	101.60 ± 15.19	100.38 ± 15.33	67.00–141.00
HDL Cholesterol (mg/dL)	56.07 ± 5.78	54.17 ± 5.04	55.13 ± 5.48	44.00–66.00
Triglycerides (mg/dL)	110.40 ± 19.91	108.86 ± 23.20	109.64 ± 21.48	59.00–163.00
Creatinine (mg/dL)	0.88 ± 0.12	0.88 ± 0.14	0.88 ± 0.13	0.60–1.10
RCIMT (mm)	0.59 ± 0.02	0.59 ± 0.02	0.58 ± 0.02	0.55–0.63
LCIMT (mm)	0.59 ± 0.02	0.59 ± 0.02	0.59 ± 0.02	0.54–0.65
mCIMT (mm)	0.59 ± 0.02	0.59 ± 0.02	0.59 ± 0.02	0.55–0.64

SD: Standard Deviation, BMI: Body Mass Index; BSA: Body Surface Area; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; RCIMT: Right Carotid Intima-Media Thickness; LCIMT: Left Carotid Intima-Media Thickness; mCIMT: Mean Carotid Intima-MediaThickness.

Table 2. Comparison of Anthropometric, Biochemical and Common Carotid Intima-Media Thickness Parameters between Male and Female Participants

Variable	Male (n = 43) Mean ± SD	Female (n = 42) Mean ± SD	p-value
Age (years)	46.05 ± 6.97	42.76 ± 7.18	0.035
Height (m)	1.71 ± 0.05	1.61 ± 0.06	0.001
Weight (kg)	71.94 ± 8.88	64.59 ± 9.60	0.001
BMI (kg/m²)	24.69 ± 2.69	24.75 ± 2.94	0.911
BSA (m²)	1.84 ± 0.13	1.70 ± 0.15	0.001
SBP (mmHg)	120.81 ± 7.91	120.10 ± 8.78	0.693
DBP (mmHg)	76.79 ± 5.07	76.38 ± 4.48	0.694
Fasting Glucose (mmol/L)	87.56 ± 8.46	86.10 ± 7.80	0.410
HbA1c (%)	5.18 ± 0.22	5.15 ± 0.18	0.544
Total Cholesterol (mg/dL)	176.58 ± 13.19	176.76 ± 16.06	0.955
LDL Cholesterol (mg/dL)	99.19 ± 15.54	101.60 ± 15.19	0.472
HDL Cholesterol (mg/dL)	56.07 ± 5.78	54.17 ± 5.04	0.110
Triglycerides (mg/dL)	110.40 ± 19.91	108.86 ± 23.20	0.744
Creatinine (mg/dL)	0.88 ± 0.12	0.88 ± 0.14	0.802
RCIMT (mm)	0.59 ± 0.02	0.59 ± 0.02	0.538
LCIMT (mm)	0.59 ± 0.02	0.59 ± 0.02	0.622
mCIMT (mm)	0.59 ± 0.02	0.59 ± 0.02	0.573

SD: Standard Deviation, **BMI**: Body Mass Index; **BSA**: Body Surface Area; **SBP**: Systolic Blood Pressure; **DBP**: Diastolic Blood Pressure; **RCIMT:** Right Carotid Intima-Media Thickness; **LCIMT**: Left Carotid Intima-Media Thickness; **mCIMT**: Mean Carotid Intima-MediaThickness.

Table 3. Age-Related Distribution of Common Carotid Intima-Media Thickness

Age Range (Years)	n	mCIMT (mm) Mean ± SD	RCIMT (mm) Mean ± SD	LCIMT (mm) Mean ± SD
30–39	22	0.572 ± 0.015	0.569 ± 0.014	0.576 ± 0.017
40–49	41	0.589 ± 0.017	0.586 ± 0.015	0.592 ± 0.019
50–60	22	0.609 ± 0.013	0.607 ± 0.012	0.612 ± 0.016
Total	85	0.590 ± 0.020	0.587 ± 0.020	0.593 ± 0.022

n: Number; **mCIMT**: Mean Carotid Intima Media Thickness, **SD**: Standard Deviation

Table 4: Pearson's Correlation Between mCIMT and Clinical Variables

Variable	R	p-value
Age (years)	0.670	**0.001**
Height (m)	-0.046	0.675
Weight (kg)	0.036	0.740
Body Mass Index (kg/m²)	0.087	0.431
Body Surface Area (m²)	0.020	0.858
Systolic Blood Pressure (mmHg)	0.066	0.547
Diastolic Blood Pressure (mmHg)	-0.100	0.362

Fasting Plasma Glucose (mg/dL)	0.058	0.600
HbA1c (%)	0.151	0.168
Total Cholesterol (mg/dL)	0.112	0.309
LDL Cholesterol (mg/dL)	0.138	0.209
HDL Cholesterol (mg/dL)	-0.106	0.332
Triglycerides (mg/dL)	0.261	0.016

DBP: Diastolic Blood Pressure**; LDL-C:** Low-Density Lipoprotein Cholesterol**; HDL-C:** High-Density Lipoprotein Cholesterol**.**

Table 5: Multiple Linear Regression Analysis Predicting mCIMT

Predictor	B	β	t	p-value	95% CI
AGE	0.000	-0.017	-0.149	0.882	-0.002–0.002
BMI	0.000	-0.053	-0.636	0.527	-0.002–0.001
BSA	0.019	0.130	1.551	0.125	-0.005–0.043
SBP	0.000	0.052	0.905	0.369	0.000–0.000
DBP	0.000	-0.052	-0.894	0.375	-0.001–0.000
FPG	-0.000006	-0.005	-0.086	0.932	0.000–0.000
HbA1c	0.002	0.063	1.069	0.289	-0.002–0.005
TC	0.000035	0.025	0.663	0.663	0.000–0.000
LDL	-0.000091	-0.074	-1.226	0.224	0.000–0.000
HDL	0.000	-0.083	-1.412	0.162	-0.001–0.000
TG	0.000016	0.015	0.257	0.798	0.000–0.000
Creatinine	0.014	0.083	1.455	0.150	-0.005–0.033

CI: Confidence interval, **VIF**: Variance Inflation Factor, Body Mass Index; **BSA** = Body Surface Area; **SBP** = Systolic Blood Pressure; **DBP** = Diastolic Blood Pressure; **FPG** = Fasting Plasma Glucose; **HbA1c** = Glycated Haemoglobin; **TC** = Total Cholesterol; **LDL** = Low-Density Lipoprotein Cholesterol; **HDL** = High-Density Lipoprotein Cholesterol; **TG** = Triglycerides;

Discussion

The present study determined the normative values of common carotid intima-media thickness (CIMT) among apparently healthy adults in Kano Metropolis and evaluated the influence of demographic, anthropometric, haemodynamic, biochemical, and metabolic variables on carotid arterial wall thickness. Establishing population-specific reference values is important because CIMT varies according to age, ethnicity, sex, and cardiovascular risk profile, making locally derived reference standards essential for accurate cardiovascular risk assessment [2, 9, 10].

The participants demonstrated anthropometric characteristics that were generally within normal physiological limits, indicating a predominantly healthy adult population (Table 1). Although males were significantly older and exhibited greater height, weight, and body surface area than females (Table 2), body mass index did not differ significantly between the sexes, suggesting comparable overall adiposity despite differences in body size. These findings are consistent with the well-established phenomenon of sexual dimorphism, whereby males generally possess greater skeletal size and lean muscle mass under the influence of testosterone, while females typically have a greater proportion of body fat because of the effects of oestrogen [11]. Similar sex-related anthropometric differences have been consistently reported in international population-based studies, including analyses by the World Health Organization and the NCD Risk Factor Collaboration demonstrating that males generally have greater body size whereas BMI often remains comparable between the sexes [12, 13].

Haemodynamic measurements further confirmed the favourable cardiovascular status of the participants. Mean systolic and diastolic blood pressures were within normal physiological ranges and did not differ significantly between males and females (Tables 1 and 2). Moreover, neither systolic nor diastolic blood pressure demonstrated significant correlations with mean CIMT (Table 4), nor did either variable independently predict mCIMT after multivariable adjustment (Table 5). These findings likely reflect the normotensive status and relatively homogeneous cardiovascular risk profile of the study population. Blood pressure has been shown to exert a stronger influence on carotid wall thickness mainly in hypertensive individuals or populations with elevated cardiovascular risk, whereas its effect is less pronounced in healthy adults [2, 10]. The absence of significant haemodynamic associations in the present study therefore supports the notion that physiological variations in blood pressure alone are insufficient to produce measurable arterial wall thickening in otherwise healthy individuals.

The biochemical profile also reflected preserved metabolic health. Mean fasting plasma glucose and glycated haemoglobin (HbA1c) values were within recommended reference ranges (Table 1), with no significant differences between males and females (Table 2). Furthermore, neither fasting plasma glucose nor HbA1c correlated significantly with mean CIMT (Table 4), and neither variable independently predicted mCIMT in the regression analysis (Table 5). These findings suggest that normal glucose homeostasis exerts minimal influence on carotid arterial wall thickness in healthy adults. This observation agrees with evidence that endothelial dysfunction and accelerated arterial remodelling occur primarily in the presence of chronic hyperglycaemia and diabetes mellitus rather than under physiological glycaemic conditions [14].

Similarly, lipid concentrations were generally within desirable physiological ranges (Table 1), indicating a favourable cardiovascular risk profile. Although triglyceride concentration demonstrated a weak but statistically significant positive correlation with mean CIMT (Table 4), this relationship disappeared after adjustment for other variables in the multivariable regression model (Table 5). In contrast, total cholesterol, LDL cholesterol, and HDL cholesterol showed no significant associations with carotid wall thickness. The weak association observed with triglycerides may reflect early metabolic influences on endothelial function and vascular remodelling, since elevated triglycerides have been implicated in oxidative stress, inflammation, and lipid accumulation within the arterial wall [15, 16].

However, the absence of independent predictive value suggests that triglycerides alone are insufficient to explain carotid arterial thickening in metabolically healthy adults. Likewise, preserved

renal function was demonstrated by normal serum creatinine concentrations, which neither correlated with nor independently predicted CIMT (Tables 4 and 5).

This finding is consistent with evidence that vascular structural changes related to renal dysfunction become apparent mainly in chronic kidney disease rather than among individuals with preserved renal function [17].

One of the principal findings of this study was the determination of normative CIMT values among apparently healthy adults in Kano Metropolis (Tables 1 and 3). Mean right, left, and overall CIMT values were within internationally accepted reference ranges reported for healthy adult populations, supporting the reliability of the ultrasonographic measurements. Similar normative CIMT values have been reported in studies conducted in Europe, Asia, and Africa, suggesting that carotid arterial wall thickness remains relatively consistent across different populations in the absence of major cardiovascular risk factors [3,8-10,18-21]. The availability of locally derived reference values is particularly important because ethnic, environmental, and lifestyle factors may influence vascular characteristics and cardiovascular risk assessment.

Despite the significant differences observed in anthropometric characteristics between males and females, no statistically significant sex differences were found in right, left, or mean CIMT (Table 2). Likewise, blood pressure, glycaemic indices, lipid profile, and renal function were largely comparable between both sexes. These findings indicate that sex alone has minimal influence on carotid arterial wall thickness in healthy adults once major cardiovascular risk factors are absent. Similar observations have been reported by the ASE Consensus Statement and the Mannheim Carotid Intima-Media Thickness Consensus which concluded that age and cardiovascular risk factors exert greater influence on CIMT than biological sex after appropriate adjustment [2,10].

Age, however, emerged as the most important determinant of carotid arterial wall thickness in the present study. CIMT increased progressively across successive age categories (Table 3), while correlation analysis demonstrated that age showed the strongest positive relationship with mean CIMT (Table 4). These findings are biologically plausible because ageing promotes endothelial dysfunction, elastin fragmentation, collagen accumulation, oxidative stress, vascular smooth muscle proliferation, and chronic low-grade inflammation, all of which contribute to arterial remodelling and vascular stiffening [22, 23].

The study also demonstrated remarkable bilateral symmetry between the right and left common carotid arteries (Tables 1 and 3). Mean CIMT values were highly comparable between both sides, supporting previous reports that carotid wall thickness is generally symmetrical in healthy individuals. Significant side-to-side differences are more commonly associated with focal atherosclerotic plaque formation or localized haemodynamic abnormalities rather than normal physiological ageing [2, 8].

Correlation analysis further demonstrated that, apart from age and triglycerides, none of the measured anthropometric, haemodynamic, glycaemic, lipid, or renal variables showed significant associations with mean CIMT (Table 4). Although several variables demonstrated weak positive or negative relationships, these associations were not statistically significant. Moreover, multiple linear regression analysis revealed that none of the measured clinical or biochemical variables independently predicted mean CIMT after simultaneous adjustment (Table 5). These findings suggest that carotid intima-media thickness is a multifactorial marker of vascular health reflecting the cumulative effects of ageing and multiple interacting cardiovascular processes rather than the isolated influence of any single physiological variable. The relatively narrow range of cardiovascular risk factors among the healthy participants likely reduced the variability necessary to detect independent predictors.

The present study has several important strengths. It established locally derived reference values for common carotid intima-media thickness among apparently healthy adults in Kano Metropolis using standardized B-mode ultrasonography. Equal representation of males and females, together with comprehensive assessment of anthropometric, haemodynamic, biochemical, and metabolic variables, provides a robust baseline for future comparative studies involving individuals with diabetes mellitus, hypertension, or other cardiovascular diseases.

Nevertheless, certain limitations should be acknowledged. The cross-sectional design precludes causal inference regarding the observed associations, while the hospital-based sampling approach may limit the generalisability of the findings to the wider community. In addition, inflammatory biomarkers, insulin resistance indices, endothelial function, arterial stiffness, and lifestyle factors such as physical activity and dietary habits were not evaluated. Future multicentre longitudinal studies involving larger and more diverse populations are therefore recommended to establish national CIMT reference standards for Nigeria and to investigate the longitudinal progression of vascular ageing.

Conclusion

This study determined the normative values for right, left, and mean common carotid intima-media thickness among apparently healthy adults in selected hospital within Kano Metropolis. Mean CIMT was within internationally accepted normal limits and showed no significant differences between males and females or between the right and left carotid arteries. Age demonstrated the strongest association with CIMT, with carotid wall thickness increasing progressively across successive age groups, while triglycerides showed a weak positive correlation that did not remain significant after multivariable adjustment. These findings indicate that carotid intima-media thickness in healthy adults is influenced predominantly by physiological vascular ageing rather than normal variations in cardiovascular risk factors. The normative values generated by this study provide an important baseline for the assessment of subclinical atherosclerosis and future cardiovascular research in Northwestern Nigeria.

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Conflicts of interest: Nil

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