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ORIGINAL ARTICLE

Gender Disparities in Cardiometabolic Risk Factors Among Young Nigerian Adults

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ABSTRACT

Cardiometabolic diseases are increasingly emerging in young adults in low- and middle-income countries, including Nigeria. Evidence suggests that cardiometabolic risk factors may manifest differently by gender, yet data among young Nigerian adults remain limited. This study assessed gender disparities in cardiometabolic risk factors among young adults in Abia State, Nigeria. A population-based cross-sectional study was conducted among 219 young adults aged 17–40 years recruited from selected urban and rural communities in Abia State. Sociodemographic data were collected using structured questionnaires. Anthropometric measurements, blood pressure, fasting blood glucose, and lipid profiles were assessed using standard procedures. Cardiovascular risk was estimated using Framingham, QRISK2, and ASCVD risk scores. Gender differences were evaluated using independent t-tests, chi-square tests, and correlation analyses, with statistical significance set at $p < 0.05$. Females constituted 63.5% of participants. Females had significantly higher mean body mass index and a higher prevalence of overweight (23.0% vs. 11.3%), obesity (7.2% vs. 1.3%), and central obesity (19.4% vs. 2.5%) compared with males ($p < 0.05$). Females also exhibited significantly higher mean HDL-cholesterol levels. Males had significantly higher mean systolic blood pressure and Framingham risk scores than females ($p < 0.05$). Dyslipidemia prevalence was generally low but occurred more frequently among females. Cardiovascular risk scores showed weak correlations with anthropometric measures, except for a significant positive association between QRISK score and waist-to-hip ratio. The findings suggest that gender-tailored interventions focusing on weight management in females and blood pressure control in males may improve early cardiometabolic disease prevention in this population.

Keywords: Cardiometabolic risk; Gender disparities; Young adults; Obesity; Cardiovascular risk; Nigeria.

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1.0 INTRODUCTION

Cardiometabolic diseases (CMDs), including ischemic heart disease, stroke, type 2 diabetes mellitus (T2DM), and related conditions driven by metabolic dysfunction such as hypertension and dyslipidemia, remain the leading causes of global mortality and morbidity (Roth et al., 2020). The World Health Organization (WHO) estimates that non-communicable diseases (NCDs), largely driven by CMDs, account for approximately 75% of all global deaths, with low- and middle-income countries (LMICs) experiencing a disproportionately high and rapidly growing burden (WHO, 2024). The Global Burden of Disease (GBD) study consistently demonstrates the profound impact of CMDs on years of life lost (YLLs), years lived with disability (YLDs), and disability-adjusted life years (DALYs), highlighting their detrimental effects on healthcare systems and socioeconomic development, particularly within LMICs (Abbafati et al., 2020; Leong et al., 2017). Nigeria, Africa's most populous country, is undergoing a marked epidemiological transition characterized by a steady rise in NCDs alongside persistent infectious disease challenges (Abdel, 2005). Cardiometabolic conditions now constitute a major public health concern, driven by rapid urbanization, economic transitions, and lifestyle changes such as increased consumption of energy-dense and processed foods, reduced physical activity, rising obesity rates, and increased tobacco and alcohol use (Chukwuonye et al., 2013; Okwuonu et al., 2015). This transition has placed significant strain on a healthcare system historically oriented toward acute infectious diseases and maternal–child health, with limited capacity for chronic disease prevention and long-term management (Maiyaki & Garbati, 2014). National and regional studies in Nigeria continue to report increasing prevalence of key cardiometabolic risk factors, including hypertension, obesity, dyslipidemia, and impaired glucose metabolism across adult populations (Adegoke et al., 2010; Akinkugbe, 1997; Karaye et al., 2007; Oguoma et al., 2015). A particularly concerning aspect of this trend is the growing burden of cardiometabolic risk among young adults. Once regarded as conditions of older age, CMDs and their antecedent risk factors are now increasingly detected earlier in life (Demaio et al., 2013; Yusuf et al., 2020). Young adulthood (18–40 years) represents a critical developmental period marked by significant physiological, behavioral, and social transitions (Arnett, 2000). During this stage, unhealthy lifestyle practices may promote the early onset of insulin resistance, dyslipidemia, hypertension, and subclinical atherosclerosis, thereby increasing the likelihood of premature cardiovascular disease and diabetes in later life (Berenson et al., 1998; McGill et al., 2008). Early identification of cardiometabolic risk in young adults is therefore essential for the implementation of effective, low-cost preventive strategies (Lloyd-Jones et al., 2010). Despite this, cardiometabolic research and intervention efforts in Nigeria have largely focused on older adults, leaving a notable gap in understanding risk patterns among younger populations (Abshire, 2014). Within this context, gender differences in cardiometabolic risk factors warrant particular attention. Biological differences in body composition, hormonal profiles, and fat distribution, alongside sociocultural and behavioral influences, may result in distinct cardiometabolic risk patterns among young men and women. Emerging evidence from Nigerian populations suggests that females may exhibit higher levels of general and central obesity, while differences in lipid profiles and other metabolic markers may vary by sex. However, gender-disaggregated data on cardiometabolic risk factors among young Nigerian adults remain limited, especially at the community and state levels. Moreover, Nigeria's cultural and socioeconomic heterogeneity contributes to regional variation in disease patterns and risk exposures (Akpa et al., 2020). Abia State, located in the South-Eastern geopolitical zone, exemplifies a region undergoing rapid socioeconomic and lifestyle transitions (Kalu & Ugbor, 2022). The coexistence of urban centers such as Aba and Umuahia with surrounding rural communities has been accompanied by changing dietary practices, reduced physical activity, and increasing psychosocial stress (Okafor et al., 2014). Despite these shifts, there is a paucity of contemporary, state-specific data examining cardiometabolic risk among young adults in Abia State, particularly with respect to gender-based differences (Risk et al., 2015).

This study therefore aims to address this critical gap by assessing gender disparities in cardiometabolic risk factors among young adults aged 18–40 years in Abia State, Nigeria. By evaluating anthropometric indices, blood pressure, fasting blood glucose, lipid profiles, and established cardiovascular risk scores, the study seeks to generate gender-specific evidence on the distribution and clustering of cardiometabolic risk factors in this population. Such insights are essential for informing targeted, gender-responsive prevention strategies and strengthening early screening and intervention efforts aimed at reducing the future burden of cardiometabolic diseases among young Nigerians.

2.0 MATERIALS AND METHODS

2. 1 Study design and setting

This study employed a population-based cross-sectional design to assess gender disparities in cardiometabolic risk factors among young Nigerian adults. The study was conducted in selected urban and rural communities in Abia State, located in the South-Eastern geopolitical zone of Nigeria. Abia State comprises a mix of rapidly urbanizing centers and semi-rural settlements, providing a suitable context for examining cardiometabolic risk patterns among young adults exposed to varying lifestyle and socioeconomic conditions (Kalu & Ugbor, 2022).

2.2 Study population and sampling

The study population consisted of young Nigerian adults aged 17–40 years residing in Abia State. A total of 219 participants (80 males and 139 females) were recruited from eight locations across the state, including five urban and three rural communities: Christ the King Church World Bank, Winners Chapel Agbama, Federal Medical Centre, Medical Students' Hostel, Okpuala Ngwa, Ntigha, Urata, and Umuosu. Participants were selected using a purposive sampling approach, consistent with previous community-based cardiometabolic risk assessments in similar Nigerian populations (Risk et al., 2015).

2.3 Inclusion and exclusion criteria

Eligible participants were male or female young adults aged 17–40 years who had resided in the selected communities for at least one year prior to the study and who provided informed consent. Pregnant women were excluded due to pregnancy-related physiological alterations known to influence anthropometric and biochemical cardiometabolic parameters. Individuals receiving medications known to affect lipid metabolism, including statins, corticosteroids, or hormonal therapies, were also excluded from the study.

2.4 Ethical considerations

Ethical approval for the study was obtained from the Research Ethics Committee of the Federal Medical Centre, Umuahia (FMC/QEH/G 596/Vol.10/570). Written informed consent was obtained from all participants prior to data collection, and confidentiality was ensured through anonymization of all collected data.

2.5 Data collection procedures

2.5.1 Sociodemographic and lifestyle data

Sociodemographic and lifestyle information was collected using a structured questionnaire administered to all participants. Data obtained included age, sex, smoking status, dietary patterns, physical activity levels, and family history of diabetes. Gender was recorded as male or female and served as the primary grouping variable for gender-based comparative analyses.

2.5.2 Anthropometric measurements

Body weight was measured to the nearest 0.1 kg using a calibrated weighing scale, with participants wearing light clothing and no footwear. Height was measured to the nearest 1 cm using a wall-mounted stadiometer. Body mass index (BMI) was calculated as weight divided by height squared (kg/m²) and classified according to World Health Organization (WHO) criteria (WHO, 2000).

Waist circumference (WC) was measured using a non-elastic measuring tape at the midpoint between the lower margin of the last rib and the iliac crest, following standard procedures. Abdominal obesity was defined as waist circumference >102 cm for males and >88 cm for females (AlMajed et al., 2011). Waist-to-hip ratio (WHR) was calculated using standard anthropometric methods.

2.5.3 Blood pressure measurement

Blood pressure was measured using a standardized sphygmomanometer after participants had rested in a seated position for at least five minutes. Three consecutive readings were obtained, and the average value was recorded. Hypertension was defined as systolic blood pressure ≥140 mmHg, diastolic blood pressure ≥90 mmHg, or current use of antihypertensive medication, in line with established clinical criteria (De Backer et al., 2005).

2.6 Biochemical analysis

Fasting blood glucose levels were determined using finger-prick capillary blood samples and measured with a standard glucometer (Accu-Chek Active, Roche), following an overnight fast. Serum lipid profiles, including total cholesterol, triglycerides, and high-density lipoprotein cholesterol (HDL-C), were analyzed using standard enzymatic methods as previously described (Gordon et al., 1977; Richmond, 1973). Low-density lipoprotein cholesterol (LDL-C) and very low-density lipoprotein cholesterol (VLDL-C) were calculated using the Friedewald equation (William et al., 1972). Lipid abnormalities were classified according to World Health Organization and National Institutes of Health guidelines, including hypercholesterolemia, low HDL-C, elevated LDL-C, and hypertriglyceridemia (AlMajed et al., 2011).

2.7 Cardiovascular risk assessment

Ten-year cardiometabolic risk was estimated using established cardiovascular risk prediction models, including the Framingham Risk Score, QRISK2, and the Atherosclerotic Cardiovascular Disease (ASCVD) risk estimator. Risk scores were calculated based on the component variables specified in each model, and participants were categorized into risk strata according to standard thresholds. Gender-specific distributions of calculated risk scores were examined, recognizing the documented limitations of these tools in younger populations (D'agostino et al., 2000; Mahmood et al., 2014).

2.8 Statistical analysis

Data were entered and analyzed using SPSS version 25 (IBM Corp., USA). Descriptive statistics were used to summarize participant characteristics and cardiometabolic risk factors. Continuous variables were expressed as means with standard deviations, while categorical variables were presented as frequencies and percentages. Gender differences were assessed using independent t-tests for continuous variables and chi-square tests for categorical variables. Statistical significance was set at $p < 0.05$.

3.0 RESULTS

3. 1 Sociodemographic characteristics of study participants

A total of 219 young adults aged 17–40 years participated in the study. This comprised 139 females (63.5%) and 80 males (36.5%). The largest proportion of participants fell within the 21–30-year age group (44.3%), followed by those aged 31–40 years (29.7%) and 17–20 years (26.0%). The prevalence of existing cardiometabolic conditions was low across the study population, with hypertension reported in 2.7%, diabetes in 4.6%, and smoking in 5.9% of participants. However, 18.3% reported a family history of diabetes, indicating potential inherited cardiometabolic risk (Table 1).

Table **1**. Demographic characteristics of study participants

Variable	Number (n=219)	Percentage (%)
Gender		
Female	139	63.5
Male	80	36.5
Age group		
17-20	57	26.0
21-30	97	44.3
31-40	65	29.7

High blood pressure		
No	213	97.3
Yes	6	2.7
Smoking		
No	206	94.1
Yes	13	5.9
Diabetes		
No	209	95.4
Yes	10	4.6
Family history of diabetes		
No	179	81.7
Yes	40	18.3

3.2 Gender differences in anthropometric characteristics

The mean anthropometric characteristics of participants by gender are presented in Table 2. There was no significant difference in mean age between females and males (26.42 ± 7.41 vs. 26.76 ± 7.45 years; *p = 0.75*). Males were significantly taller than females (173.96 ± 6.83 cm vs. 162.94 ± 7.51 cm; *p < 0.001*). In contrast, females had a significantly higher mean body mass index (BMI) compared to males (22.94 ± 4.97 kg/m² vs. 19.90 ± 4.01 kg/m²; *p < 0.001*). Mean waist circumference (WC) was higher among females than males, although this difference was not statistically significant (77.76 ± 11.05 cm vs. 76.61 ± 9.08 cm; *p = 0.41*). Males exhibited a higher mean waist-to-hip ratio (WHR) than females, but this difference was also not statistically significant (0.85 ± 0.14 vs. 0.83 ± 0.11; *p = 0.16*) (Table 2).

Table 2. Mean distribution of participants' anthropometrics

Participants	Age	Height (m)	Weight (kg)	BMI (kg/m²)	WC (cm)	WHR
Female	26.42 ± 7.41	162.94 ± 7.51*	60.65 ± 12.38	22.94 ± 4.97*	77.76 ± 11.05	0.83 ± 0.11
Male	26.76 ± 7.45	173.96 ± 6.83	60.17 ± 12.61	19.9 ± 4.01	76.61 ± 9.08	0.85 ± 0.14
P-value	0.75	0.00	0.78	0.00	0.41	0.16

*BMI- Body Mass Index; WC- Waist Circumference; WHR- Waist-to-hip Ratio. Values are expressed as Mean ± SD. Values with * show statistical significance at P<0.05.*

3.3 Gender-based distribution of body mass index

Gender-specific BMI classification revealed significant differences in nutritional status between males and females (χ^2 = 13.0, *p = 0.005*). Approximately half of both females (50.4%) and males (51.3%) had normal BMI, overweight and obesity were more prevalent among females. Specifically, 23.0% of females were overweight compared to 11.3% of males, and obesity was observed in 7.2% of females versus 1.3% of males. Conversely, underweight status was more common among males (36.3%) than females (19.4%) (Table 3).

3.4 Gender differences in central obesity based on waist circumference

Assessment of abdominal obesity using waist circumference demonstrated a marked gender disparity. Central obesity was significantly more prevalent among females (19.4%) compared to males (2.5%) (*Fisher's exact test = 0.001*). The majority of males (97.5%) had normal waist circumference, whereas 80.6% of females fell within the normal range (Table 4).

Table **3**. Gender-based body mass index (BMI) distribution

BMI	Female N (%)	Male N (%)	Total N (%)	
Normal	70 (50.4)	41 (51.3)	111 (50.7)	
Obese	10 (7.2)	1 (1.3)	11 (5.0)	*P = 0.005*
Overweight	32 (23.0)	9 (11.3)	41 (18.7)	*X^2= 13.0*
Underweight	27 (19.4)	29 (36.3)	56 (25.6)	
Total (N=219)	139 (63.5)	80 (36.5)	219 (100)	

Table **4**. Gender-based waist circumference (WC) distribution

WC	Female N (%)	Male N (%)	Total N (%)	
Normal	112 (80.6)	78 (97.5)	190 (86.8)	Fisher's
Obese	27 (19.4)	2 (2.5)	29 (13.2)	= 0.001
Total (N=219)	139 (63.5)	80 (36.5)	219 (100)	

The prevalence of Waist Circumference (WC) among the study population showed a significant high obesity in females than males with a frequency of 27 and 2 respectively.

3.5 Gender differences in blood pressure and biochemical profiles

Mean systolic blood pressure (SBP) was significantly higher in males than females (126.61 ± 18.44 mmHg vs. 119.87 ± 17.34 mmHg; *p = 0.007*), while no significant gender difference was observed in diastolic blood pressure (DBP) (*p = 0.263*). Although, triglyceride levels were lower in the females than male, females exhibited higher mean levels of total cholesterol and low-density lipoprotein cholesterol (LDL-C) compared to males. However, these differences were not statistically significant. Notably, females had a significantly higher mean high-density lipoprotein cholesterol (HDL-C) level than males (1.62 ± 0.76 mmol/L vs. 1.42 ± 0.68 mmol/L; *p = 0.048*) (Table 5).

3.6 Gender-based prevalence of dyslipidemia

The prevalence of hypercholesterolemia was low across the study population. Only two cases (0.9%) were identified, both among females, while no male participant exhibited hypercholesterolemia (Table 6).

3.7 Gender differences in cardiovascular risk scores

Mean values of traditional and electronic cardiovascular risk markers are presented in Table 7. Males demonstrated a significantly higher mean Framingham risk score compared to females (0.36 ± 0.21 vs. 0.23 ± 0.24; *p = 0.001*). No statistically significant gender differences were observed for other traditional lipid-derived risk indices, including Atherogenic Index of Plasma (AIP), Castelli's Risk Index I and II, Atherogenic Coefficient, Non-HDL cholesterol, QRISK, and ASCVD scores (Table 7).

Author contributions

I.I.I. contributed to the study conception and design. O.C.A., I.I.I., N.E.I., Material preparation and data collection. O.C.A. statistical analysis. O.C.A. and I.I.I, writing of original draft and review and editing. All authors read and approved the final manuscript.

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Table 5: Mean value of Participants' Biochemical Profiles

Participants	SBP (mmHg)	DBP (mmHg)	TC (mmol/L)	HDL (mmol/L)	LDL (mmol/L)	TAG (mmol/L)
Female	119.87 ± 17.34*	80.37 ± 11.99	4.54 ± 2.24	1.62 ± 0.76*	1.39 ± 1.44	3.28 ± 2.01
Male	126.61 ± 18.44	78.53 ± 11.2	4.33 ± 1.92	1.42 ± 0.68	1.27 ± 1.34	3.39 ± 1.84
P-value	0.007	0.263	0.483	0.048	0.556	0.688

*SBP- Systolic Blood Pressure; DBP- Diastolic Blood Pressure; TC- Total Cholesterol; HDL- High Density Lipoprotein; LDL- Low Density Lipoprotein; TAG- Triacylglycerol. Values are expressed as Mean ± SD. Values with * show statistical significance at p < 0.05.*

Table **6**. Gender-based body distribution of dyslipidemia (Hypercholesterolemia)

Hypercholesterolemia	Female N (%)	Male N (%)	Total N (%)	
No	137 (98.6)	80 (100)	217 (99.1)	Fisher's = 0.53
Yes	2 (1.4)	0 (0.0)	2 (0.9)	
Total (N=219)	139 (63.5)	80 (36.5)	219 (100)	

Table **7**. Mean value of participants' traditional and electronic risk markers

Participants	AIP	CR-I	CR-II	AC	NHC	Framingham	Qrisk	ASCVD
Female	0.37 ± 0.54	4.19 ± 5.72	1.43 ± 2.96	3.19 ± 5.72	2.92 ± 2.43	0.23 ± 0.24*	0.1 ± 0.03	0.25 ± 0.27
Male	0.39 ± 0.44	4.05 ± 3.31	1.25 ± 1.46	3.05 ± 3.31	2.92 ± 2.01	0.36 ± 0.21	0.1 ± 0.02	0.31 ± 0.24
P-value	0.745	0.849	0.621	0.849	0.987	0.001	0.052	0.112

*AIP- Atherogenic Index of Plasma; CR-I- Castell's Risk Index I; CR-II- Castell's Risk Index II; AC- Atherogenic Coefficient; NHC- Non-HDLc. Values are expressed as Mean ± SD. Values with * show statistical significance at p < 0.05.*

3.8 Association between cardiovascular risk scores and anthropometric measures

Correlation analysis showed weak positive associations between Framingham risk scores and anthropometric variables including BMI, WC, WHR, height, and weight; however, none of these associations reached statistical significance (*p > 0.05*) Using the QRISK model, a significant positive correlation was observed between QRISK scores and WHR (r = 0.218; *p = 0.001*). Other anthropometric variables showed weak and non-significant positive associations with QRISK scores, while height demonstrated a weak negative association. Similarly, ASCVD risk scores showed weak positive correlations with BMI, WC, WHR, height, and weight, none of which were statistically significant (Table 8).

Table **8**. Correlation of Framingham scores, QRISK scores and ASCVD scores with anthropometric measures

	Variable	**r**	**P-value**
Correlation with Framingham scores	WC	0.086	0.205
	BMI	0.023	0.730
	Height	0.062	0.362
	Weight	0.077	0.259
	WHR	0.126	0.062
Correlation with QRISK scores	WC	0.129	0.056
	BMI	0.094	0.167
	Height	-0.071	0.298
	Weight	0.062	0.358
	WHR	0.218	0.001
Correlation with ASCVD scores of participants	WC	0.031	0.647
	BMI	0.032	0.639
	Height	0.052	0.444
	Weight	0.091	0.179
	WHR	0.076	0.264

4.0 DISCUSSION

This study investigated gender disparities in cardiometabolic risk factors among young adults (17–40 years) residing in Abia State, Nigeria, revealing differences in anthropometric measures, lipid profiles, and cardiovascular risk scores. A striking observation from our research is the significantly higher prevalence of overweight (23.0% vs. 11.3%), obesity (7.2% vs. 1.3%), and central obesity (19.4% vs. 2.5%) among females when compared to their male counterparts. Furthermore, females exhibited a significantly higher mean Body Mass Index (BMI) and notably higher mean High-Density Lipoprotein Cholesterol (HDL-C) levels. While not reaching statistical significance, there was also a trend toward a higher prevalence of hypercholesterolemia and hypertriglyceridemia among females. These findings resonate with emerging evidence from Nigerian populations and the broader WHO African region, which suggest that females often present with higher levels of both general and central obesity (Adeloye et al., 2021; Chukwuonye et al., 2022). A comprehensive analysis of 54 STEPS surveys across the WHO African region (198,901 adults) confirms that women have significantly higher obesity prevalence than men (13.3% vs. 4.6%), with females being nearly five times more likely to be obese (Adjusted Odds *Ratio 4.92, 95% CI: 4.13–5.89)* (Agboyibor et al., 2026). This large-scale evidence supports our observation of the "female predilection" for obesity in our Abia State cohort and underscores that our findings are not isolated but reflect a concerning regional trend. The clustering of cardiovascular risk factors is also significantly higher in women than men, as demonstrated among Nigerian university students where women were twice as likely to be overweight or obese (AOR = 2.2; 95% CI = 1.41–3.43) (Olufayo et al., 2023). Several interconnected factors likely contribute to these observed gender differences in obesity and dyslipidemia. Biologically, females are predisposed to a higher percentage of body fat, primarily due to hormonal influences, particularly estrogen, which promotes fat storage through multiple mechanisms (Karastergiou et al., 2012; Osborne, 2025). Estrogen encourages fat accumulation by influencing alpha-adrenergic receptors in adipocytes and promoting lipoprotein lipase activity in subcutaneous adipose tissue, with women demonstrating higher enzymatic activity in subcutaneous depots compared to men (Davis et al., 2013). Evolutionarily, this sex-specific fat distribution pattern supports reproductive functions, providing energy reserves for pregnancy and lactation (Lassek & Gaulin, 2009). While this fat distribution is often gluteofemoral (peripheral), the higher central obesity observed in our study suggests a concerning shift toward metabolically detrimental abdominal fat accumulation, potentially influenced by reproductive transitions, hormonal changes, or lifestyle factors within this critical age group (Davis et al., 2013). Beyond biology, sociocultural and behavioral factors play a pivotal role. In many African societies, including Nigeria, cultural norms can differentially influence dietary practices and physical activity levels between men and women. The ongoing rapid urbanization in Nigeria has led to increased consumption of energy-dense and processed foods (Osborne, 2025). These dietary shifts, coupled with increasingly sedentary lifestyles, may disproportionately affect women, who might face limited access to recreational physical activity or societal expectations that restrict their outdoor movement. Recent research across sub-Saharan Africa confirms that girls consistently engage in less vigorous physical activity than boys, with barriers including cultural norms, family responsibilities, and environmental constraints (Wachira et al., 2022). Studies specifically examining barriers to physical activity among African women identify culture and family responsibilities as primary obstacles, with gender roles and familial expectations limiting women's autonomy to engage in physical activity (Batalha et al., 2025). Moreover, cultural perceptions that favor a larger female body size may reduce concern about weight gain, thereby contributing to higher obesity prevalence (Puoane et al., 2005). Qualitative research among South African women demonstrates that overweight and obesity are often viewed positively within cultural contexts, with participants reporting that being "fat" reveals the female figure, makes them more attractive to men, and aligns with cultural expectations (Draper et al., 2016). While some studies suggest that modern African immigrants increasingly reject obesity as desirable (Hurston et al., 2024), traditional cultural norms within Nigeria may still perpetuate tolerance for larger body sizes among women, potentially reducing motivation for weight management. Interestingly, despite higher adiposity, females in our study demonstrated significantly higher mean HDL-C levels, which are known to confer cardioprotective effects. This favorable lipid profile may partially offset the adverse effects of increased adiposity in young women, although the long-term implications of this balance remain uncertain. This observation aligns with the biological understanding that premenopausal women typically exhibit higher HDL-C levels due to estrogen's favorable influence on lipid

metabolism (Davis et al., 2013). However, the shift toward central obesity observed in our female cohort (19.4% vs. 2.5% in males) signals potential future metabolic risk, as postmenopausal transitions are associated with increased visceral adiposity and declining HDL-C levels (Davis et al., 2013).
Conversely, despite females presenting with higher rates of obesity and certain dyslipidemias, males in this study exhibited a significantly higher mean Framingham Risk Score. This seemingly paradoxical finding underscores the multifactorial nature of cardiovascular risk estimation and the weighting of individual risk components within prediction models. A major contributor to this disparity was the significantly higher mean systolic blood pressure (SBP) observed in males. Elevated SBP is a key determinant of cardiovascular risk and a major component of the Framingham Risk Score (D'Agostino et al., 2008). Although smoking prevalence was low in this study, smoking is heavily weighted in Framingham-based risk estimation, and smoking rates are generally higher among males in many populations, including Nigeria (WHO, 2023). Although, total cholesterol level was high in females, males exhibited slightly higher mean triglyceride levels and lower HDL-C levels, which contribute to an overall higher calculated cardiovascular risk. Biological differences in the progression and expression of cardiometabolic risk factors may also predispose males to earlier or more aggressive risk accumulation, with androgens promoting visceral adipose tissue deposition and associated metabolic disturbances (Davis et al., 2013).
This study utilized established cardiovascular risk prediction tools, including the Framingham Risk Score, QRISK2, and the Atherosclerotic Cardiovascular Disease (ASCVD) risk estimator. However, the limitations of these tools when applied to young populations are well documented (D'Agostino et al., 2008; Rapsomaniki et al., 2014). These models were primarily developed in older, predominantly Western populations and are designed to estimate short-term (10-year) cardiovascular risk. Consequently, they may underestimate lifetime risk in young adults with early-onset cardiometabolic abnormalities, potentially delaying preventive interventions. Furthermore, these tools may not adequately account for population-specific genetic, environmental, and lifestyle factors relevant to young Nigerian adults. The weak correlations observed between anthropometric measures and both Framingham and ASCVD scores in this study reinforce these limitations. Notably, the significant association between QRISK score and waist-to-hip ratio suggests that central obesity may be more sensitively captured by this model, highlighting the relevance of body fat distribution in early cardiometabolic risk assessment.
This study contributes valuable gender-disaggregated evidence on cardiometabolic risk factors among young Nigerian adults, addressing an important gap identified in existing literature. The findings align with the broader epidemiological transition occurring across Nigeria and other low- and middle-income countries, where non-communicable diseases are rising alongside persistent infectious disease burdens (Adeloye et al., 2015). Abia State, characterized by rapid urbanization and lifestyle transitions, provides a representative context for examining these emerging risks. The observed prevalence of obesity, dyslipidemia, hypertension, diabetes, and a notable family history of diabetes among this young cohort underscores the early onset of cardiometabolic vulnerability. These patterns mirror global trends showing earlier manifestation of cardiometabolic risk factors and diseases (Mozaffarian et al., 2016), with long-term implications for premature cardiovascular morbidity and mortality (Moran et al., 2014; Yusuf et al., 2001).
Recent data from Lagos University Teaching Hospital demonstrates that stroke and heart failure remain major contributors to cardiovascular disease admissions in Nigeria, with hypertension as the primary driver (Ogah et al., 2014). The significantly higher systolic blood pressure observed in our male participants aligns with this pattern—hypertension frequently aggregates other risk factors and drives cardiovascular outcomes in Nigerian populations. Furthermore, a 17-year cohort study in a rural Nigerian community (1991–2008) showed BMI rising from 20.7 to 23.7 kg/m² and hypertension prevalence increasing dramatically from 7.4% to 20.9% (Okeahialam et al., 2012), demonstrating the rapid escalation of cardiometabolic risk in Nigerian populations and making our focus on young adults (17–40 years) particularly timely.

Limitations
This study has limitations worth noting. First, the cardiovascular risk prediction models utilized, including the Framingham Risk Score, QRISK2, and the ASCVD risk estimator, were originally developed and validated in older, predominantly Western populations. These these tools may not adequately capture population-specific genetic, environmental, and lifestyle factors inherent to young Nigerian adults, which can influence cardiometabolic risk patterns. This is evidenced by the weak correlations between anthropometric measures and both Framingham and ASCVD risk scores observed in our study. Also, the cross-sectional design of the study limits the ability to infer causality or temporal trends in cardiometabolic risk factor development. Further longitudinal studies incorporating locally adapted or novel risk assessment tools are needed to improve cardiovascular risk prediction and intervention strategies tailored to young Nigerian populations.

Conclusion
This study demonstrates clear gender disparities in cardiometabolic risk factors among young Nigerian adults in Abia State. Females exhibited a higher burden of general and central obesity and adverse lipid patterns, while males showed higher systolic blood pressure and greater estimated cardiovascular risk based on Framingham scoring. These findings highlight the early emergence of sex-specific cardiometabolic risk profiles in young adulthood, even in the absence of overt disease. The results underscore the need for early, gender-sensitive screening and prevention strategies that address sociocultural, behavioral, and biological determinants of cardiometabolic risk. Targeted interventions aimed at promoting healthy weight, improving physical activity, and controlling blood pressure in young adults may help mitigate the future burden of cardiometabolic diseases in Nigeria and similar low- and middle-income settings.

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Conflict of interest
The authors declare that there are no conflicts of interest regarding the publication of this paper. The authors confirm that there are no financial, personal, or professional relationships that could have influenced the work reported in this manuscript.

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