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Sex-and-Gender Differences in Cardiovascular Risk Factors and Their Correlates Among Adults in Freetown, Sierra Leone: A Population-Based Health-Screening Survey

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Abstract

Background: Sex-and-gender differences are crucial modifiers of cardiovascular health, yet most guidelines in sub-Saharan Africa are not sex-and-gender specific. The aim of the study was to examine the relationship between sex-and-gender differences and the prevalence of traditional cardiovascular risk factors and their correlates in a population-based cross-sectional study in Sierra Leone.

Methods: A stratified multistage random sampling technique was employed to recruit 2394 adults aged 20 years and older from October 2021 to October 2023 in Western Area Urban, Sierra Leone. Data collection comprised three components: clinical assessments, self-reported health behaviours, and biochemical measurements, all based on the WHO stepwise approach.

Results: No significant age differences were observed between genders (females 42.06 ± 12 years vs. males 41.76 ± 12.6 years, p = 0.550). Males showed higher prevalence of hypertension (37.4% vs. 33.4%, p = 0.068), diabetes (9.2% vs. 7.4%, p = 0.101), overweight (34.2% vs. 32.3%, p = 0.323), and obesity (10.2% vs. 9.9%, p = 0.818). Conversely, females had significantly higher Body Mass Index (BMI) [25.0 ± 5.0 vs. 24.6 ± 4.4, p = 0.029], waist circumference (WC) [93.6 ± 4.5 vs. 80.0 ± 5.0, p < 0.001], triglyceride levels [1.7 ± 0.35 vs. 1.6 ± 0.32, p =0.013], total cholesterol [5.1 ± 0.77 vs. 4.9 ± 0.66, p < 0.001], and low HDL-C [1.28 ± 0.29 vs. 1.3 ± 0.24, p = 0.016]. Females also had higher odds of dyslipidaemia [OR=1.339; 95% CI: (1.101-1.629), p=0.003] and alcohol consumption [OR=1.229; 95% CI: (1.026 - 1.472), p=0.025]. Women faced 1.8 times greater odds [AOR=1.849; 95% CI: (0.713 - 1.010), p=0.030] of hypertension, 1.4 times higher odds [AOR=1.441; 95% CI: (1.176 - 1.765), p <0.001] of dyslipidaemia, and 1.2 times greater odds [AOR=1.225; 95% CI: (1.0123 - 1.481), p=0.037] of alcohol use compared to men. In women, BMI, WC, and blood sugar levels showed stronger correlations than in men.

Conclusion: This study highlights the higher prevalence of cardiovascular risk factors in women in Sierra Leone, indicating the importance of implementing targeted health policies and interventions to reduce these disparities.

Keywords: Sex-and-gender differences; cardiovascular risk factors; Sierra Leone

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Introduction

Over the past decades, cardiovascular research has mainly focused on men, leading to an underappreciation of sex and gender differences in cardiovascular risk factors. [1,2,3]. Recently, enormous efforts by researchers and Women's Health Initiatives have enhanced our understanding of both sex and gender disparities in cardiovascular disease (CVD) and improved recognition of heart disease in women [4,5,6]. Although it is often assumed that women have a lower incidence of cardiovascular risk compared to men, clinical evidence increasingly indicates that women experience higher mortality rates and worse prognostic outcomes after acute cardiovascular events [3].

The prevention, management and overall health outcomes in cardiovascular medicines are closely linked to the roles played by sex and gender [3,7,8,9]. Despite these, crucial roles, sex and gender are variable factors that significantly impact clinical practice, public health and research in cardiovascular medicine. While several studies from developing countries have reported sex and gender differences in cardiovascular risk factors, there is a notable lack of fata on these differences in Africa, particularly in sub-Saharan Africa (SSA) [9,10,11,12].

Sex is a biological variable dictated by genetics, while gender is a complex social construct shaped by customs, religions, traditions, societal beliefs, and individual behaviour within a historical and social context [13]. The differences in cardiovascular risk factors related to sex and gender arise from the interplay of biological and behavioral factors [11,14]. Biological elements, like variations in sex hormones and chromosomes, may safeguard females from hypertension until menopause, after which gender differences in hypertension tend to diminish [15].

Behavioral factors such as body mass index (BMI), smoking, alcohol intake, unhealthy eating habits, and low physical activity levels also influence these differences. However, the relationship between biological and behavioral risk factors is quite complex [9,16]. Smoking, which is more prevalent among men, has more serious consequences for women due to gender differences in nicotine processing, although these differences have decreased in recent decades [17]. Female smokers face about a 25% higher risk of developing ischemic heart disease or stroke compared to male smokers [18,19]. While women generally follow healthier diets, they are often less physically active than men [20].

Addressing disparities in sex and gender necessitates a clear understanding of their differences. It is important to acknowledge that, while connected, these two concepts are not identical. Despite the rising impact of cardiovascular disease in sub-Saharan Africa (SSA), the links between sex, gender, and CVD are still not well understood.

Research from West Africa, especially Sierra Leone, is scarce. No existing studies from Sierra Leone have explored this topic. This study aimed to examine sex and gender differences in the prevalence of cardiovascular risk factors and their related factors among adults in Freetown, Sierra Leone, based on identifiable risks from the Ecobank (Sierra Leone) study database. Our results will offer crucial insights to inform future research, as well as prevention and treatment strategies for non-communicable diseases (NCDs).

Methods

Ethical approval and registration

Ethical approval was granted by the Sierra Leone Ethics and Scientific Review Committee. The study was registered at https://www.researchregistry.com/browse-the-registry#home/ with the ID researchregistry8201. Case records were assigned serial-coded numbers to ensure anonymity, and all data were managed confidentially. This study adhered to the STROBE guidelines for reporting observational studies in epidemiology.

Study design, setting and cohort group

A cross-sectional, population-based study was carried out from October 2021 to October 2023 among adults in West Area Urban, Freetown, Sierra Leone. Funded by Ecobank Sierra Leone Limited, this programme focused on screening and raising awareness about NCDS. Freetown, the capital of Sierra Leone, has a diverse population of approximately 1.5 million residents [21]. It was chosen as the study site because it is the country's main commercial hub, with a demographic composition that includes all ethnic groups, and where Krio and English are the primary languages spoken.

Sample size, recruitment, and selection

A stratified multistage random sampling approach was used, selecting all official electoral constituencies and dividing them into subzones based on the 2015 census data [21].. Pregnant or lactating women, individuals with mental illness or dementia, and those unwilling to give consent were excluded from the study. The sample size was determined using the Leslie Kish formula, considering the estimated 22% prevalence of hypertension in Sierra Leone, with 5% precision and a 95% confidence interval [22, 23]. To account for potential bias, non-response, and data unavailability, the sample was oversampled by 20%. With a design effect of eight sub-zonal communities, the final estimated sample size was 2531.

Selected participants from sub-zonal communities were invited to National Victoria Park in Freetown for an "Awareness and Screening Campaign for Non-Communicable Diseases." Trained medical students, doctors, and nurses carried out the campaign. Participants who completed the screening questionnaires and measurements

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were subsequently referred to an accredited laboratory for blood sample collection.

Data Collection and Measurements

Demographic and Behavioural Characteristic Data

Data were collected using the WHO stepwise approach, consisting of three categories: clinical assessments (such as blood pressure and anthropometric measurements), self-reported health behaviours (like smoking and alcohol consumption), and biochemical measurements (including lipid profiles and blood glucose). Data confidentiality was preserved by assigning serial coded numbers.

Physical activity was evaluated and classified as "Low," "Moderate," or "Vigorous" using the WHO physical activity questionnaire [24]. Alcohol intake was measured weekly, calculated by multiplying the number of beer bottles consumed each week by 5% (the alcohol content) and 300 mL (the volume of a typical beer bottle), then dividing by 1000 [25]. In Sierra Leone, a standard beer bottle contains 300 mL of liquid with 5% alcohol. Participants were identified as smokers if they had smoked more than 100 cigarettes in their lifetime or were still smoking during the interview [26]. Those who had quit smoking at least 28 days prior to the interview were classified as ex-smokers. During data collection, translators were present to assist participants who did not understand English.

Anthropometric measurements and biochemical analyses

Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured on the right arm of seated participants using an OMRON M3 electronic monitor after a 5-minute rest. Two consecutive measurements were taken, and the average recorded. Hypertension was defined as an average SBP of 140 mm Hg or higher, DBP of 90 mm Hg or greater, or current antihypertensive medication use [27].

Participants' weight, height, and waist circumference were measured while wearing light clothing and barefoot. Weight was recorded to the nearest 0.1 kg, and height to 0.01 m. Body mass index (BMI) was calculated and classified as underweight (BMI < 18.5), normal weight (18.5–24.9), overweight (25.0–29.9), or obese (≥ 30). [28]. Waist circumference (WC) was measured at the midpoint between the last rib and the iliac crest. Abdominal obesity was defined as WC exceeding 88 cm for women and 102 cm for men. [29]

Clinical biochemistry measurements

Blood samples were obtained from participants' median cubital veins between 8:00 and 10:00 AM after an 8 to 10-hour fast. The samples were processed within 4 hours using the Beckman Coulter: AU480 Chemistry System to measure glucose, total cholesterol, triglycerides, HDL-C, and LDL-C.

Diabetes mellitus was characterised by a fasting blood glucose (FBG) of 7.0 mmol/L or higher, HbA1c of at least 6.5%, or the use of insulin or oral hypoglycaemic drugs. Pre-diabetes was indicated by an FPG between 6.1 mmol/L (110 mg/dL) and 6.9 mmol/L (124.9 mg/dL). . Dyslipidaemia was identified when triglycerides (TG) reached 1.70 mmol/L (150 mg/dL) or more, total cholesterol (TC) was 6.22 mmol/L (240 mg/dL) or above, LDL cholesterol was 3.3 mmol/L (130 mg/dL) or higher, HDL cholesterol was below 1.04 mmol/L (40 mg/dL), or if lipid-lowering medications were used..

Participants' blood samples were collected from the median cubital vein between 8:00 and 10:00 AM after an overnight fast of 8 to 10 hours. These samples were processed within 4 hours of collection according to manufacturers' protocols, using the Beckman Coulter AU480 Chemistry System. Measurements included glucose, total cholesterol, triglycerides, HDL-C, and LDL-C. Diabetes mellitus was defined as a fasting blood glucose (FBG) level of 7.0 mmol/L or higher, HbA1c ≥ 6.5%, or the use of insulin or oral hypoglycaemic agents. Pre-diabetes was identified with FPG between 6.1 mmol/l (110 mg/ dL) and 6.9 mmol/l (124.9 mg/dL) [30]. Dyslipidaemia was characterised by triglycerides≥ 1.70 mmol/L (150 mg/dL), total cholesterol≥ 6.22 mmol/L (240 mg/dL), LDL-C≥ 3.3 mmol/l (130 mg/dL), HDL-C <1.04 mmol/L (40 mg/dL), or the use of lipid-lowering medications, indicating abnormal lipid levels [31]..

Statistical Analysis

Data analysis was conducted using IBM SPSS Statistics version 2.6 and STATA version 17. We examined baseline characteristics, cardiometabolic risk factors, and target organ damage by sex and geographic zones. Categorical variables were shown as counts and percentages, with differences evaluated via the Pearson chi-square (χ^2) test. Continuous variables were reported as means ± standard deviations (SD) and compared through one-way analysis of variance (ANOVA). When relevant, median values and interquartile ranges (IQR) were also provided. To explore associations between demographic factors and cardiovascular risk, multivariable logistic regression analysis was performed. A p-value of ≤ 0.05 (two-sided) was deemed statistically significant.

Results

Of the 2,531 eligible individuals, 2,394 participated, yielding a response rate of 94.6%. Fifty-four participants missed the "Ecobank - Cardiovascular Health Screening Campaign" at National Victoria Park, and 76 could not complete the screenings. Distribution was evenly spread among the eight sub-zonal communities, with no significant variation in population distribution (p = 0.950).

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Socio-demographic and behavioural profile of the study sample

The socio-demographic characteristics of the participants are summarized in Table 1. The average age was 41.9 ± 12.3 years (20 -75years), with no significant age difference between genders (females: 42.06 ± 12 years; males: 41.76 ± 12.6 years, p = 0.550).

Table 1: Gender differences in socio-demographic characteristics of participants.

Characteristics	Total n(%)	Female n(%)	Male n(%)	P-value(χ^2)
Basic characteristics				
No.	2394	1250	1144	
Age, by group				
20-29	447(18.7)	255(57.0)	192(43.0)	<0.001(28.9)
30-39	703(29.4)	383(54.5)	320(45.5)	
40-49	684(28.6)	359(52.5)	325(47.5)	
50-59	356(14,9)	141(39.6)	215(60.4)	
>60	204(8.5)	112(54.9)	92(45.1)	
INCOME (Currency = Leone)				
0-500	920(38.4)	504(54.8)	416(45.2)	0.052(7.715)
500-1000	666(27.8)	319(47.9)	347(52.1)	
1100-2000	490(20.5)	256(52.2)	234(46.2)	
>2000	318(13.3)	171(53.8)	147(46.2)	
Education level				
None	618(25.8)	318(51.5)	300(48.5)	0.095(6.361)
Primary	479(20.0)	273(57.0)	206(43.0)	
Secondary	835(34.9)	432(51.7)	403(48.3)	
Tertiary	462(19.3)	227(49.1)	235(50.9)	
Marital status				
single	955(39.9)	504(52.8)	451(47.2)	0.699(1.428)
Married	737(30.8)	372(50.5)	365(49.5)	
Separated/Divorce	586(24.5)	310(52.9)	276(47.1)	
Widow	115(4.8)	63(54.8)	52(45.2)	
Occupation				
Employed	500(20.9)	302(60.4)	198(39.6)	**<0.001(27.6)**
Self-employed	531(22.2)	241(45.4)	290(54.6)	
Unemployed	930(38.8)	466(50.1)	464(49.9)	
Retired	167(7.0)	96(57.5)	71(42.5)	
Student	264(11.0)	145(54.9)	119(45.1)	
BLOOD PRESSURE (mmHg)				
Normal	1061(44.3)	510(48.1)	551(51.9)	**0.002(15.15)**
Pre-hypertension	489(20.4)	278(56.9)	211(43.1)	
Hypertension stage 1	644(26.9)	360(55.9)	284(44.1)	
Hypertension stage 2	200(8.4)	102(51.0)	98(49.0)	
FRUITS/VEGETABLE				
<3 serving	2182(91.1)	1143(52.4)	1039(47.6)	0.592(0.28)
>3 serving	212(8.9)	107(50.5)	105(49.5)	
Alcohol				

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Never	1486(62.1)	783(52.7)	703(47.3)	**0.014(8.14)**
Current	652(27.2)	316(48.5)	336(51.5)	
Previous	256(10.7)	151(59.0)	105(41.0)	
Alcohol intake				
Daily	345(14.4)	151(43.8)	194(56.2)	**0.046(6.14)**
Weekly	285(11.9)	150(52.6)	135(47.4)	
Monthly	134(5.6)	57(42.5)	77(57.5)	
Smoking				
Never	2073(86.6)	1088(52.5)	985(47.5)	0.797(0.45)
Current	198(8.3)	100(50.5)	98(49.5)	
Ex-smoker	123(5.1)	62(50.4)	61(49.6)	
Daily physical activity				
Low	895(37.4)	481(53.7)	414(46.3)	**0.002**(12.38)
Moderate	939(39.2)	515(54.8)	424(45.2)	
Vigorous	511(21.3)	233(45.6)	278(54.4)	
Measures of adiposity				
BMI (kg/m^2)				
Underweight	38(1.6)	21(55.3)	17(44.7)	0.066(7.2)
Normal	1502(62.7)	794(52.9)	708(47.1)	
Overweight	612(25.6)	329(53.8)	283(46.2)	
Obese	240(10.0)	106(44.2)	134(55.8)	
Waist circumference (≥94cm men, ≥80cm women)				
Normal	1882(78.6)	870(46.2)	1012(53.8)	**0.003(8.569)**
Abnormal	512(21.4)	274(53.5)	238(46.5)	
WHtR risk				
Normal (≤0.5)	1050(43.9)	36(3.4)	1014(96.6)	**<0.001(1786.73)**
Increased risk (0.51- 0.59)	1276(53.3)	1146(89.8)	130(10.2)	
High risk (>0.6)	68(2.8)	68(100)	0(0.0)	
WHR (≥0.90 men, ≥0.85 women)				
Low	763(31.9)	753(98.7)	10(1.3)	0.210(3.12)
Moderate	273(11.4)	271(99.3)	2(0.7)	
High	207(8.6)	207(100)	0(0.0)	
Laboratory				
Lipids				
Total Cholesterol (TC) (≥6.2mmol/l)				
Normal	2163(90.4)	1171(54.1)	992(45.9)	**<0.001(32.25)**
High	231(9.6)	79(34.2)	152(65.8)	
LDL-C (≥3.3mmol/l)				
Normal	2077(86.8)	1083(52.1)	994(47.9)	0.858(0.03)
High	317(13.2)	167(52.7)	150(47.3)	
HDL-C (≤1.04mmol/l)				
Normal	2129(88.9)	1142(53.6)	987(46.4)	**<0.00115.68)**
High	317(13.2)	108(40.8)	157(59.2)	
TRIGLYCERIDE (≥1.7mmol/l)				
Normal	1862(77.8)	1011(54.3)	851(45.7)	**<0.001(14.58)**
High	530(22.1)	238(44.9)	292(55.1)	
DIABETES (mmol/l)				
Normal (>6mmol/l)	2084(87.1)	1080(51.8)	1004(48.2)	0.234(2.9)
Pre-diabetes (6.0 – 6.9mmol/l)	103(4.3)	51(49.5)	52(50.5)	
Diabetes (>7.0mmol/l)	199(8.3)	115(57.8)	84(42.2)	

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The results showed that a notable portion of participants (38.4%) had low-income levels, earning between 0 and 500 Leones. No significant difference was observed in this income group between women (54.8%) and men (41.6%) (p = 0.052). While more women completed primary and secondary education, a higher percentage of men graduated from tertiary institutions. However, the differences in educational achievement between genders were not statistically significant (p = 0.095).

Most participants (38.8%) were unemployed. Among them, 45.4% of men and 54.6% of women were self-employed (p < 0.001). Women were more likely to consume alcohol (p = 0.014), whereas men had a higher average daily alcohol intake (p = 0.046).

Women engaged in significantly less daily physical activity than men (p = 0.002). The overall fruit consumption was low at 8.9%, with no difference between genders (p = 0.592). Smoking rates were similar for both genders (p = 0.797).

Gender Differences in Risk Factors for Cardiovascular Diseases

Table 2 presents the prevalence of cardiovascular risk factors, indicating higher rates among males for hypertension (37.4% vs. 33.4%, p = 0.068), diabetes (9.2% vs. 7.4%, p = 0.101), overweight (34.2% vs. 32.3%, p = 0.323), and obesity (10.2% vs. 9.9%, p = 0.818). Conversely, females exhibited significantly higher BMI (25.0 ± 5.0 vs. 24.6 ± 4.4, p = 0.029), waist circumference (93.6 ± 4.5 vs. 80.0 ± 5.0, p < 0.001), triglycerides (1.7 ± 0.35 vs. 1.6 ± 0.32, p = 0.013), total cholesterol (5.1 ± 0.77 vs. 4.9 ± 0.66, p < 0.001), and lower HDL-C (1.28 ± 0.29 vs. 1.3 ± 0.24, p = 0.016).

Table 3 presents the distribution of cardiovascular risk factors by gender. Hypertension was found in 35.3% of participants, while diabetes mellitus affected 8.3%. Additionally, a substantial proportion of individuals were overweight (33.2%), obese (10%), consumed alcohol (37.9%), had abnormal waist circumference (21.4%), and engaged in insufficient physical activity (37.4%). Importantly, women showed significantly higher rates than men in elevated waist circumference, total cholesterol, triglyceride levels, and low physical activity.

Logistic regression analyses (Table 4) indicated that females have higher odds of dyslipidemia [OR = 1.339; 95% CI: (1.101-1.629), p = 0.003] and alcohol consumption [OR = 1.229; 95% CI: (1.026-1.472), p = 0.025]. Adjusted odds ratios (AOR) demonstrated that women are 1.8 times more likely to have hypertension [AOR = 1.849; 95% CI: (0.713-1.010), p = 0.030], 1.4 times more likely to have dyslipidemia [AOR = 1.441; 95% CI: (1.176-1.765), p < 0.001], and 1.2 times more likely to consume alcohol [AOR = 1.225; 95% CI: (1.0123-1.481), p = 0.037] than men. Among women, BMI, waist circumference, and elevated blood sugar levels showed stronger associations.

Discussion

Sex and gender disparities in cardiovascular risk factors are increasingly recognized as significant issues not only in developed countries but also in low- and middle-income countries (LMICs), where the burden of cardiovascular disease (CVD) is growing. Despite greater awareness of cardiovascular health, there is limited scientific research from sub-Saharan Africa (SSA) on this topic, especially in Sierra Leone, where recent health screening campaigns

Table 2: Gender differences in cardiovascular risk factors in mean.

Characteristics	Total (2394)	Female (1144)	Male (1250)	p-value
	N±SD	Mean ± SD	Mean ± SD	
Age	41.9±12.3	42.06±12.0	41.76±12.6	0.55
Weight	74.3±14.9	74.8±15.6	73.8±14.2	0.78
Height	1.7±0.05	1.7±0.05	1.7±0.05	0.302
BMI	24.8±4.7	25.0±5.0	24.6±4.4	**0.029**
WC	87.1±8.3	93.6±4.5	80.0±5.0	**< 0.001**
SBP	127.8±23.3	127.5±23.4	128.1±23.2	0.516
DBP	85.7±11.3	85.4±11.6	86.0±11.0	0.188
Triglyceride	1.65±0,34	1.7±0.35	1.6±0.32	**0.013**
Total Cholesterol	5.0±0.72	5.1±0.77	4.9±0.66	**< 0.001**
Low HDL-C	1.3±0.27	1.28±0.29	1.3±0.24	**0.016**
LDL-C	3.0±0.66	2.98±0.66	3.0±0.65	0.315
FBS	5.1±1.6	5.0±1.61	5.2±1.66	0.08
HBA1C	5.2±1.03	5.2±0.96	5.2±1.09	0.964

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Table 3: Prevalence of cardiovascular risk factors according to sex.

Characteristics	Total n(%)	Female n(%)	Male n(%)	p-value
Overweight	796(33.2)	369(32.3)	427(34.2)	0.323
Obese	240(10.0)	113(9.9)	127(10.2)	0.818
Abnormal waist circumference	512(21.4)	274(24.0)	238(19.0)	**0.003**
Hypertension	844(35.3)	382(33.4)	462(37.4)	0.068
Alcohol intake	908(37.9)	467(37.4)	441(38.5)	0.025
Hx of smoking	195(8.3)	103(9.2)	92(7.5)	0.139
Diabetes	199(8.3)	84(7.4)	115(9.2)	0.101
High Cholesterol	231(9.6)	152(13.3)	79(6.3)	**<0.001**
High LDL-C	317(13.2)	150(13.1)	167(13.4)	0.858
High Triglyceride	530(22.2)	292(25.5)	238(19.1)	**<0.001**
Low daily physical activity	895(37.4)	481(40.1)	414(39.0)	**0.002**

Table 4: Univariate and Multivariate logistic regression of gender and cardiovascular risk factors.

Variables	Univariate OR		Multivariate OR	
	COR 95% CI	p-value	AOR 95%CI	p-value
Overweight				
No	Ref.		Ref.	
Yes	0.918(0.774 - 1.088)	0.323	1.018(0.831 - 1.246)	0.079
Obese				
No	Ref.		Ref.	
Yes	0.968(0.741 - 1.266)	0.818	0.941(0.686 - 1.290)	0.526
Smoking				
Never	Ref.		Ref	
Yes	1.248(0.930 - 1.673)	0.802	1.269(0.940 - 1.712)	0.158
Hypertension				
No	Ref.		Ref	
Yes	0.855(0.723 - 1.012)	0.068	1.849(0.713 - 1.010)	**0.03**
Dyslipidemia				
No	Ref.		Ref.	
Yes	1.339(1.101 - 1.629)	**0.003**	1.441(1.176 - 1.765)	**<0.001**
Diabetes Mellitus				
No	Ref.		Ref.	
Yes	0.782(0.583 - 1.049)	0.101	0.826(0.611 - 1.117)	0.135
ALCOHOL				
No	Ref.		Ref.	
Yes	1.229(1.026 - 1.472)	**0.025**	1.225(1.0123 - 1.481)	**0.037**
Physical activity				
No	Ref.		Ref.	
Yes	1.090(0.927 - 1.289)	0.31	1.090(0.919 - 1.293)	0.323
Fruits/Vegetable intake				
<3 servings	Ref.		Ref.	
>3 servings	1.079(0.814 - 1.431)	0.595	1.063(0.795 - 1.421)	0.682

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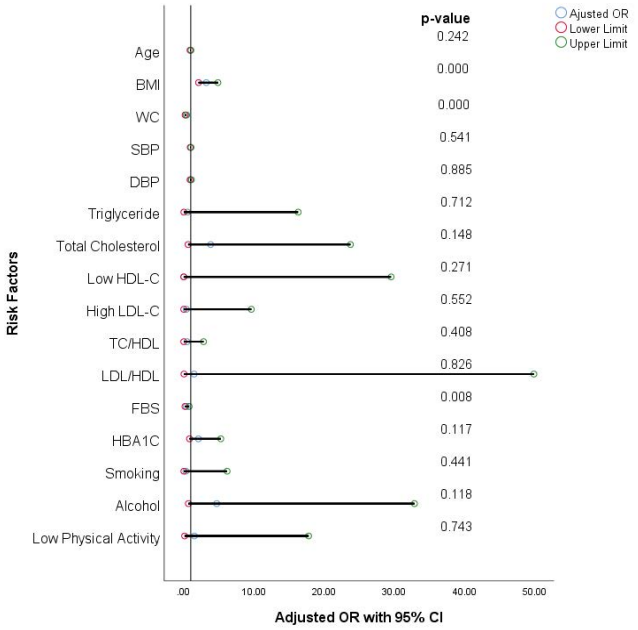

Figure 1: Correlates of cardiovascular risk factors.

have collected substantial data. This study is a pioneering report on sex and gender differences in the prevalence of cardiovascular risk factors among adults in West Africa, offering key insights into the nature of these disparities. The observed differences in CVD risk factors in Sierra Leone highlight complex interactions between biological, socio-cultural, and structural factors.

Our results show a high rate of risk factors for cardiovascular disease in Sierra Leone: hypertension (35.3%), diabetes mellitus (8.3%), overweight (33.2%), obesity (10.0%), abdominal obesity (21.4%), dyslipidaemia (21.4%), low physical activity (37.4%), smoking (8.3%), and alcohol consumption (37.9%). We observed significant gender differences, especially in BMI, abdominal obesity, and lipid profiles. The high prevalence of excess weight among women aligns with findings from Cameroon, Kenya, and Tanzania (12, 32-34). This trend likely reflects socio-cultural factors such as gender-specific work roles, sedentary lifestyles, and cultural attitudes toward weight, where femininity is often linked to a heavier body.

In contrast, studies from Mexico and China have shown higher obesity rates in men compared to women, emphasising cultural differences in gender-specific health outcomes. [37, 38]. The high prevalence of hypertension among men in our study aligns with findings from Njelekela et al. and Sandberg et al. [12, 12,15]. However, differences exist with Dev et al. 's results, likely due to variations in study design, participant demographics, and lifestyle factors. Since two-thirds of our cohort were under 50, the protective role of estrogen against hypertension in women before menopause may explain why hypertension is less common, despite higher obesity rates. [39]..

Despite notable increases in BMI, waist circumference, and WHtR among women, our study observed a lower incidence of hypertension in this group, aligning with results from Tanzanian research. [12]. This raises questions about the link between obesity and hypertension, implying that women might need a higher level of adiposity to experience significant blood pressure increases. This is worrisome because rising obesity rates in younger women are linked to greater cardiovascular risk. [42].

Further notable gender-related differences were seen in lipid profiles, with women showing higher total cholesterol and triglycerides but lower HDL levels. [43, 44]. These differences could be due to greater adiposity in women, which is known to affect lipid metabolism.

The prevalence of type 2 diabetes mellitus in Sierra Leone has been increasing, with rates of 2.4% in 1997, 3.5% in 2009, 6.2% in 2017, and 5.5% in 2020. Our study reports the highest prevalence to date at 8.3%, with a notably higher prevalence in females (9.2%) than in males (7.5%). This is the first study in Sierra Leone to include HbA1c measurements in diabetes screening. Combining HbA1c with fasting blood sugar (FBS) may have contributed to the higher prevalence observed among urban adults. Researchers express concern that relying solely on fasting blood sugar, commonly used in population surveys, might miss many undiagnosed cases, especially in early stages. The higher prevalence among females aligns with a meta-analysis of sub-Saharan Africa, which found women in Southern African countries are more affected than men, whereas in Eastern, Central, and Western Africa, women have lower prevalence than men. Additionally, increased overweight and obesity rates among females contribute to this higher prevalence.

In Africa, smoking rates are rising [43]. Although the overall smoking prevalence in this study is low, a notably higher percentage of women smokers (9.2%) compared to men (7.5%) was observed, with a women-to-men ratio of approximately 0.8 [43,49]. Our findings align with data from Nauru, Denmark, and Sweden [50]. Despite variations in smoking prevalence across Africa, the gender difference observed in our study is a significant risk factor for cardiovascular diseases, highlighting the need for more comprehensive national policies on prevention and cessation programs in Sierra Leone.

Our study revealed a high rate of physical inactivity among participants, especially among females who are significantly more inactive than males. This finding supports existing research indicating that women in Africa often face socio-cultural barriers that restrict their outdoor activities, contributing to greater inactivity. Such sedentary behaviour increases the risk of cardiovascular issues and other negative health effects. [31, 51]

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Logistic regression indicated that women have higher odds of dyslipidemia and alcohol use than men. The multivariate analysis further showed increased adjusted odds for hypertension, dyslipidemia, and alcohol consumption among women. Moreover, a strong link was found between body mass index (BMI), waist circumference (WC), and elevated blood sugar levels in women. These gender-related findings align with other research, despite differences in socio-cultural settings.

This study highlights the burden of cardiovascular risk factors (CVRF) among adults in Sierra Leone, with a particular focus on the increased vulnerability of women. It counters the misconception that women are less susceptible to cardiovascular diseases and has important policy implications for health promotion and lifestyle interventions targeting female-specific risk factors.

The study has multiple strengths, such as a large sample size representative of the general population, rigorous laboratory measures like HbA1c, and data collection by trained clinicians using a validated WHO Stepwise tool. Additionally, it adhered to the 'STROBE' reporting guidelines.

However, there are limitations, such as the inability to establish causality because of its cross-sectional design and limited generalizability since it only examined urban adults. Despite these limitations, the study provides valuable insights into gender-specific cardiovascular risk factors in urban Africa.

In conclusion, the differences in cardiovascular disease by sex and gender are especially significant in Africa. The study shows increasing cardiovascular risks in Sierra Leone, notably among women, possibly due to genetic and environmental influences. Adopting gender-responsive health approaches can enhance prevention and decrease the disease burden. Future research should incorporate gender-specific factors into risk assessments. Long-term studies could reveal how these factors change over time and the effects of interventions.

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Conflict of Interest

The authors declare no conflict of interest.

Informed Consent

The informed consent, which was cleared by the IRB was given to every recruited participant.

Author's Contributions

JBW Russell conceptualized and designed the overall study, and contributed to formal analysis and the original draft writing. Abdul Jalloh also conceptualised and designed the study. TR Koroma handled data curation, formal analysis, and contributed to the writing of the original draft. SK Samura was responsible for data curation and conducted formal statistical analysis. J.M. Coker and D.R. Lisk reviewed and edited the manuscript. M Smith managed the project administration and participant recruitment. All authors critically reviewed the manuscript, contributed important intellectual content, and approved the final draft.

Data Availability

Any inquiries regarding the supporting data availability of this study should be directed to the corresponding author.

No writing assistance was utilized in the production of this manuscript.

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