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Renal Dysfunction and Inflammation as a Cardiovascular Risk Factor among Selected Residents of Ibadan North Local Government, Ibadan, Nigeria

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ABSTRACT

Background: Cardiovascular diseases (CVD) remain a leading cause of morbidity and mortality worldwide. Renal dysfunction and systemic inflammation are recognized risk factors for CVD. This study investigates the prevalence of renal dysfunction and inflammatory markers as cardiovascular risk factors among selected residents of Ibadan North Local Government.

Methods: A total of 265 respondents were enrolled in this cross-sectional study. Sociodemographic data were collected using structured questionnaires. Blood samples were analyzed for creatinine, urea, troponin I, and C-reactive protein (CRP). Statistical analyses included descriptive statistics, multiple regression, and independent t-tests to determine relationships between renal function, inflammatory markers, lifestyle factors, and cardiovascular risk.

Results: The majority of respondents were male (60.4%) and aged 21–30 years (41.5%). Elevated creatinine and troponin I levels were observed in 17.0% and 16.2% of participants, respectively. CRP was elevated in 15.8% of respondents. Regression analyses revealed significant associations between age and BMI with CRP levels, and between creatinine and troponin I levels ($p<0.05$). Alcohol consumption was significantly associated with higher CRP levels ($p<0.05$). Males and older participants had higher creatinine and troponin I levels.

Conclusion: Renal dysfunction and systemic inflammation are prevalent among residents of Ibadan North and constitute significant cardiovascular risk factors. Lifestyle modifications and early monitoring of renal and inflammatory markers are recommended to mitigate CVD risk.

Keywords: Renal Dysfunction; Inflammation; Cardiovascular Risk Troponin I; C-Reactive Protein

Introduction

Cardiovascular diseases (CVDs) are a major public health concern globally, responsible for substantial morbidity and mortality (Benjamin, et al. [1]). Renal dysfunction is an established risk factor for cardiovascular events due to the interrelationship between kidney impairment, endothelial dysfunction, and systemic inflammation (Go AS, et al. [2,3]). Elevated serum creatinine and urea indicate impaired kidney function, which has been linked to increased cardiac biomarkers such as troponin I, reflecting myocardial injury (Apple FS, et al. [4]). Inflammation plays a central role in the pathophysiology of atherosclerosis and cardiovascular events (Ridker, et al. [5]) C-reactive protein (CRP) is a sensitive biomarker of systemic inflammation and an independent predictor of CVD (Pearson, et al. [6]). Lifestyle factors, including alcohol consumption, smoking, and physical inactivity, exacerbate inflammation and contribute to cardiovascular risk (O'Keefe, et al. [7]). This study aims to determine the prevalence of renal dysfunction and elevated inflammatory markers and evaluate their association with cardiovascular risk factors among residents of Ibadan North Local Government.

Materials and Methods

Study Design and Population This cross-sectional study involved 265 residents of Ibadan North Local Government, selected through stratified random sampling. All participants provided informed consent prior to enrollment. Data Collection Sociodemographic information, including age, sex, BMI, education, marital status, occupation, and lifestyle factors (exercise, alcohol intake, smoking), was collected via structured questionnaires. Biochemical Analysis Blood samples were collected and analyzed for creatinine, urea, troponin I, and CRP using standard laboratory methods. Creatinine and urea were measured by enzymatic colorimetric methods. Troponin I and CRP were quantified using immunoassays. Statistical Analysis Descriptive statistics summarized sociodemographic data and biochemical markers. Multiple regression analyses assessed the relationship between predictors and CRP, troponin I, and creatinine levels. Independent samples t-tests evaluated the influence of lifestyle choices on CRP. Statistical significance was set at $p<0.05$.

Results

Socio-demographic Characteristics Table 1 shows that 60.4% of participants were male. The majority were aged 21–30 years (41.5%), with 38.5% having normal BMI and 28.7% classified as obese. Education levels varied, with 51.3% attaining secondary education. Nearly half of the respondents were single (47.9%) or married (47.2%). Occupation distribution indicated 47.9% artisans and 29.8% students. The largest proportion of respondents resided in Oritamefa (27.9%). Prevalence of Renal Dysfunction and Inflammatory Markers Table 2 shows 17.0% of participants had elevated creatinine levels, 16.2% had elevated troponin I, and 15.8% had elevated CRP. Specific Risk Factors Contributing to Cardiovascular Diseases Regression analysis indicated age and BMI were significant predictors of CRP levels ($p<0.05$), while gender, marital status, and occupation were not significant (Table 3). Influence of Lifestyle Choices on Cardiovascular Health Independent t-tests revealed that alcohol intake was significantly associated with higher CRP levels ($p<0.05$; Cohen's $d = 0.911$). Exercise and smoking did not significantly affect CRP (Table 4). Role of Renal Dysfunction on Cardiac Marker Regression analysis demonstrated a strong positive association between serum creatinine and troponin I ($p<0.05$), while urea was not significant (Table 5). Disparities in Cardiovascular Risk Age and gender significantly influenced CRP, troponin I, and creatinine levels, while education, marital status, and occupation were not significant (Table 6). Renal Function Tests, CRP, and Troponin I Table 7 presents the descriptive statistics for renal and inflammatory markers. Creatinine ranged from 0.3 to 5.1 mg/dL (mean = 1.37±1.04), urea ranged from 10–73 mg/dL (mean = 33.73±12.66), CRP ranged from 0.001–1.4 mg/dL (mean = 0.23±0.26), and troponin I ranged from 0.0001–54.3 ng/mL (mean = 8.52±19.26).

Table 1: Socio-demographic characteristics of the respondents.

Variable	Frequency n (%)
Age (in years)	
10-20	58 (21.9)
21-30	110 (41.5)
31-40	54 (20.4)
41-50	29 (10.9)
51+	14 (5.3)
Gender	
Male	160 (60.4)
Female	105 (39.6)
BMI	
<18.5	27 (10.2)
18.5-24.9	102 (38.5)
25.0-29.9	60 (22.6)
>30	76 (28.7)
Education	
Nil	26 (9.8)
Primary	31 (11.7)
Secondary	136 (51.3)
Tertiary	72 (27.2)
Marital status	
Single	127 (47.9)
Married	125 (47.2)
Divorced	7 (2.6)
Widowed	6 (2.3)
Occupation	

Artisan	127 (47.9)
Civil servant	51 (19.2)
Driver	8 (3.0)
Student	79 (29.8)
Location	
Oritamefa	74 (27.9)
Bodija	61 (23.0)
Agbowo	36 (13.6)
Agodi	54 (20.4)
Samanda	40 (15.1)

Table 2: Prevalence of renal dysfunction and inflammatory markers.

Variable	Frequency n (%)
Creatinine	
Normal Creatinine	220 (83.0)
High Creatinine	45 (17.0)
Troponin I	
Normal TRP	222 (83.8)
High TRP	43 (16.2)
C-reactive protein	
Normal CRP	223 (84.2)
Minor CRP elevation	29 (10.9)
Moderate CRP elevation	13 (4.9)

Table 3: Cardiovascular risk factors among the respondents.

Predictors	CRP
Constant	1.070 (7.473)
Age	0.097 (2.536)*
Gender	-0.003 (-0.053)
Marital status	0.067 (1.270)
BMI	-0.077 (-2.258)*
Occupation	-0.017 (-0.452)
R^2	0.071
N	265

Note: T statistics in parentheses; CRP – C-reactive protein; *significant at p<0.05

Table 4: T-test results comparing the impact of lifestyle choices on cardiovascular health.

Life-style choices	N	Mean	SD	T	P	Cohen's d
Exercise						
Yes	11	1.1818	0.40452			
No	254	1.2087	0.51821	-0.169	0.866	-0.052
Alcohol intake						
Yes	26	1.6154	0.80384			
No	239	1.1632	0.45205	4.412	0.001*	0.911
Smoking						
Yes	26	1.2692	0.60383			
No	239	1.2008	0.5036	0.644	0.52	0.133

Note: *Significant at p<0.05.

Table 5: Impact of renal dysfunction on cardiac marker.

Predictors	cTnI
Constant	0.018 -2.879
Urea	-0.049 -0.171
Creatinine	1.018 (0.001) *
R^2	0.947
N	265

Note: T statistics in parentheses; cTnI – Troponin I; *significant at p<0.05.

Table 6: Effect of sociodemographic characteristics on inflammatory marker, troponin and creatinine level.

Sociodemographic characteristics	CRP	cTnI	Cr
Constant	0.094	-26.836	-0.368
	-1.297	(-6.040)	(-1.490)
Age	0.046	8.804	0.457
	(2.396)*	(7.498)*	(6.989)*
Gender	-0.029	8.951	0.345
	(-0.860)	(4.365)*	(3.026)*
Education	-0.005	0.241	0.009
	(-0.220)	-0.181	-0.115
Marital status	0.002	2.052	0.088
	-0.065	-1.217	-0.935
Occupation	-0.002	0.521	-0.003
	(-0.089)	-0.43	(-0.047)
R^2	0.042	0.333	0.289
N	265	265	265

Note: T statistics in parentheses; *significant at p<0.05.

Table 7: Levels of renal function tests, C-reactive protein, and Troponin I.

n = 265				
	Minimum	**Maximum**	**Mean**	**SD**
C-reactive protein (mg/dL)	0.001	1.4	0.23	0.26
Troponin I (ng/mL)	0.0001	54.3	8.52	19.26
Urea (mg/dL)	10	73	33.73	12.66
Creatinine (mg/dL)	0.3	5.1	1.37	1.04

Note: SD – Standard deviation.

Discussion

This study highlights the prevalence of renal dysfunction and systemic inflammation among residents of Ibadan North and their contribution to cardiovascular risk. Elevated creatinine was closely linked to troponin I, indicating an interplay between renal impairment and cardiac injury, consistent with previous studies (Go AS, et al. [2,4]). Age and male gender were significant predictors of elevated creatinine and troponin I, aligning with established epidemiological patterns (Benjamin, et al. [1]). CRP was significantly elevated in alcohol consumers, suggesting lifestyle factors exacerbate inflammation. The weak explanatory power of sociodemographic variables for CRP indicates other unmeasured factors, such as diet and chronic comorbidities, may contribute (Ridker, et al. [5,6]). Public health interventions promoting regular screening for renal and inflammatory markers and lifestyle modifications could mitigate cardiovascular risk in this population.

Conclusion

Renal dysfunction and systemic inflammation are prevalent and constitute important cardiovascular risk factors among residents of Ibadan North. Early detection and lifestyle interventions are crucial to reduce morbidity and mortality associated with cardiovascular diseases.

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