ISSN: 2536-7153 SJMLS

Sokoto Journal of Medical Laboratory Science 2024; 9(2): 121- 136

SJMLS - 9(2) - 016

Evaluation of Lipid Profile and Troponin-I as Predictors of Cardiovascular Disorders among Young Adults in Ado-Ekiti

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https://dx.doi.org/10.4314/sokjmls.v9i2.16

Abstract
Cardiovascular diseases (CVDs) remain a leading cause of morbidity and mortality worldwide, presenting a significant public health challenge. It encompasses a spectrum of conditions affecting the heart or blood vessels. This study aimed to evaluate the Lipid Profile and Troponin-I as Predictors of Cardiovascular Disorders among Young Adults in Ado-Ekiti, Nigeria. The objectives included investigating dyslipidemia and elevated Troponin-I prevalence, examining contributing factors, exploring Lipid profile-CVD risk associations, assessing Troponin-I-CVD risk factor correlations, and comparing predictive powers. Ethical approval and informed consent were obtained. Clinical assessments and blood samples were collected for Lipid Profile and Troponin-I analysis. A cross-sectional design was used with 384 participants aged 18-45 years. SPSS software was used for statistical analysis. The age distribution showed that 19.50% were aged 18 - 28, 45.60% were aged 28 - 38, and 34.90% fell within the 38 – 48 age range. The mean age and standard deviation for each age group were provided, with statistical tests indicating significant differences between the groups ($p < 0.05$, $F = 1217.461$). Participants with "AT RISK" of CVD exhibited higher mean *Cardiovascular Risk Ratio* (CRR) scores (7.0341 ± 2.52) compared to those with "NO RISK" (3.1531 ± 0.34). Logistic regression analysis identified Total cholesterol as a significant predictor of CVD risk ($B = 0.902$, $p < 0.05$, *Exponentiated Coefficient* (B) = 2.464), while Troponin-I did not significantly predict risk ($B = -0.203$, $p = 0.366$, *Exponentiated Coefficient* (B) = 0.816). Multivariate analysis demonstrated that the predictor variables collectively provided a good fit to the data (Wald = 62.048, df = 6, $p < 0.05$). Total cholesterol emerged as a significant CVD risk predictor. Troponin-I's role warrants further investigation. Findings emphasize the multifactorial nature of CVD risk and the importance of comprehensive assessments for accurate prediction and management.

Keywords: Lipid Profile, Troponin-I, Cardiovascular Disorders, Young Adults, Ado-Ekiti.

Introduction

Cardiovascular disease (CVD) stands as one of the most significant global health concerns and remains the primary cause of mortality worldwide. CVD encompasses a spectrum of conditions affecting the heart or blood vessels, including stroke, heart failure, hypertensive heart disease, rheumatic heart disease, peripheral arterial disease, and various other cardiac and vascular disorders (WHO, 2019).

The global impact of CVDs on morbidity and mortality is profound, contributing to approximately one-third of all deaths (Sacco *et al.,* 2016). Over the past few decades, cardiovascular-related fatalities have surged by more than a third, escalating from slightly over 12 million in 1990 to 18.6 million in 2019 (Roth *et al.,* 2020). Within Africa, CVDs represent the

largest share of the non-communicable disease (NCD) burden, accounting for 38.3% of NCD deaths and 22.9 million disability-adjusted life years (Mensah *et al.,* 2015; Gouda *et al.,* 2019). Unlike several high-income nations that have witnessed declines in cardiovascular mortality rates (Sacco *et al.,* 2016), Africa has experienced nearly a 50% surge in CVD burden over the past three decades (Gouda *et al.,* 2019; Institute for Health Metrics and Evaluation [IHME], 2020). This rise in CVD prevalence on the continent has been attributed not only to an increase in major risk factors but also to population growth and aging, as evidenced by a general downward trend in age-standardized mortality rates (Sacco *et al.,* 2016; Gouda *et al.,* 2019; Roth *et al.,* 2020).

While traditionally viewed as a disease affecting older individuals, there is growing concern over the rising prevalence of CVD among young adults, especially in regions undergoing rapid epidemiological transitions like Nigeria. Nigeria has witnessed a steady uptick in the burden of CVD, now recognized as a significant public health challenge, with a notable rise in cases among young individuals (Akinlua *et al.,* 2015; DeFilippis *et al.,* 2017).

Key parameters of Lipid profiles, including total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and triglycerides (TG), have long served as crucial indicators of cardiovascular health. Elevated levels of LDL-C, specifically, have been linked to an increased risk of atherosclerotic plaque formation and subsequent cardiovascular events (Goff *et al.,* 2013). Moreover, recent research has underscored the significance of sensitive cardiac biomarkers such as Troponin-I in detecting early myocardial injury or infarction, even in the absence of overt symptoms (Zhao *et al.,* 2021; Manemann *et al.,* 2023).

Despite the growing recognition of CVD in Nigerian young adults, comprehensive studies investigating the utility of Lipid profile parameters and Troponin-I levels in predicting cardiovascular risk in this demographic are limited. Understanding the predictive value of these biomarkers in young adults is imperative for early detection and intervention, potentially mitigating the long-term burden of CVD in this population. The aim of this study was to bridge this gap in knowledge by systematically evaluating the relationship between Lipid profile parameters, Troponin-I levels, and cardiovascular disorder risks among young adults in Ado-Ekiti.

This study addresses the surge of CVDs, a pressing public health issue in young adults in Nigeria, focusing on young adults in Ado-Ekiti, the Ekiti state capital. Despite the importance of Lipid profile and Troponin-I in CVD risk assessment, their relevance to this demographic remains understudied (Oladapo *et al.,* 2013).

This research aims to bridge this gap by evaluating these biomarkers in young adults, to establish a tailored predictive model. The findings promise crucial clinical insights, enabling early interventions and personalized preventive strategies to curb the escalating burden of CVDs in this population.

Statement of Problem

The prevalence of cardiovascular disease (CVD) in Nigeria, particularly among the younger population, has raised concerns about the efficacy of Lipid Profile and Troponin-I tests in predicting CVD risk (Ogah *et al.,* 2014).
However, the reliability of these tests for Nigerian young adults remains unclear, largely due to limited and extrapolated research from different populations (Oladapo *et al.,* 2013).

Aim of study

This study aims to evaluate Lipid profile and Troponin-I as predictors of cardiovascular disorders among young adults in Ado-Ekiti.

Specific objectives

The specific objectives of this study are:

1. To investigate the prevalence of dyslipidemia and elevated Troponin-I levels in the study population.
2. To examine potential demographic, lifestyle, and dietary factors that may contribute to abnormal Lipid profiles and elevated Troponin-I levels in this population.

3. To investigate the association between Lipid profile parameters (total cholesterol, LDL cholesterol, HDL cholesterol, and triglycerides) and CVD risk among young adults in Ado-Ekiti.
4. To evaluate the correlation between Troponin-I levels and the presence of CVD risk factors in this population.
5. To compare the predictive power of Lipid profile parameters and Troponin-I in identifying individuals at risk for CVD.

Materials and Methods

Study Area

This study was conducted in Ado-Ekiti, Ekiti state. Ekiti state is one of the six (6) states that comprise the Southwestern geopolitical zones in Nigeria. Ekiti is one of the smallest states in Southwest Nigeria. Ado-Ekiti is the state capital of Ekiti State, Nigeria. It lies between latitudes $7^0$37`23.84" N and longitude $5^0$13`15.13" E. This city has an area of 293 km^2, of which 49% are females while 51% are males. The total population of Ado-Ekiti is 424,340 according to worldometer.com.

Study Design

A cross-sectional random sampling method was used in this study in which a diverse cohort of young adults in Ado-Ekiti aged between 18 and 45 years, were recruited from both clinical settings and the general population.

Sample Size

The sample size for the cross-sectional study was 384 participants.

Ethical Considerations

a) Ethical approval was obtained from the Ekiti State Ministry of Health and Human Services, Ado-Ekiti, Ethics Committee.
b) Informed Consent: Participants were fully informed about the study's objectives, procedures, potential risks, and benefits. Written informed consent was obtained before their inclusion in the study.
c) Confidentiality: The privacy and confidentiality of participants' data were strictly maintained throughout the study.

Inclusion Criteria

The participants included age range from 18-45 years, absence of pre-existing cardiovascular conditions, and consent to participate.

Exclusion Criteria

These include known heart disease, pregnancy, and those who did not give consent.

Clinical Assessment

Participants underwent a detailed clinical assessment to record medical history, lifestyle factors, and any existing cardiovascular conditions using a questionnaire.

Data Collection

Lipid Profile: Blood samples were collected after an overnight fast and analyzed for total cholesterol, LDL cholesterol, HDL cholesterol, and triglyceride levels using standard laboratory methods according to randox.com.

Troponin-I: Serum levels of Troponin-I were measured using enzyme-linked immunosorbent assay (ELISA) by Monobind Inc. Lake Forest CA 926 30 USA.

Data Analysis

The statistical analysis was performed using SPSS version 21.0 software (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. Continuous variables were presented as means with standard deviations, and categorical variables were summarized using frequencies and percentages. While Logistic regression analysis was employed to develop a predictive model for CVD risk. The lipid profile, Troponin-I levels, and other relevant variables were included as independent variables. The outcome variable was the presence or absence of CVD.

Timeline

The timeline for the completion of the study was five months, including data collections, analysis, and interpretation.

Result

Table 1 presents an overview of the demographic characteristics of the study participants,

including age distribution and gender composition. The age distribution shows that 19.50% were aged 18 - 27, 45.60% were aged 28 - 37, and 34.90% fell within the 38 – 47 age range. All participants were from Ado-Ekiti. Mean age ± standard deviation for each age group is provided, with statistical tests indicating significant differences between the groups ($p < 0.023$, $F = 1217.461$). Gender distribution reveals that 58.9% were female, while 41.1% were male, with a total of 384 participants included in the analysis.

Table 1: Demographic Characteristics of Study Participants

Parameter		N	Percentage	Mean ± SD (Age)	P value	F
AGE	18-27	75	19.50%	24.106±2.887	0.023	1217.461
	28-37	175	45.60%	33.205±2.573		
	38–47	134	34.90%	41.380±2.003		
LOCATION	ADO-EKITI	384	100.0			
GENDER	F	226	58.9			
	M	158	41.1			
	Total	384	100.0			

Table 2: The table presents the health history of the study participants. The majority of participants reported no history of cardiovascular disease (CVD), with 383 individuals (99.7%) indicating no previous occurrence, while only one participant (0.3%) reported a history of CVD. Regarding whether participants had undergone a fasting Lipid profile (FLP) test before, 266 individuals (69.3%) reported no prior FLP, while 118 participants (30.7%) reported having undergone the test.

In terms of family history of CVD, 362 participants (94.3%) reported no family history, while 22 participants (5.7%) reported a positive family history of CVD. Additionally, the table displays the distribution of affected family members with CVD, showing that 1 participant (0.3%) had a cousin affected, 5 participants (1.3%) had a father affected, 17 participants (4.4%) had a mother affected, and the majority, 361 individuals (94.0%), reported no affected family members.

Table 2: Health History of the Study Participants

HEALTH HISTORY			
		Frequency	**Percentage**
HISTORY OF CVD	NO	383	99.7
	YES	1	0.3
DONE FLP B4	NO	266	69.3
	YES	118	30.7
HISTORY OF CVD	NO	362	94.3
	YES	22	5.7
FAMILY MEMBERS AFFECTED WITH CVD	COUSIN	1	0.3
	FATHER	5	1.3
	MOTHER	17	4.4
	Nil	361	94.0

The table below illustrates the lifestyle patterns of the study participants. In terms of physical activity, walking was the most prevalent activity reported by 324 participants (84.4%), followed by jogging with 39 participants (10.2%). Cycling, skating, and skipping were less common, with frequencies of 10 (2.6%), 7 (1.8%), and 4 (1.0%) participants, respectively. Regarding smoking habits, the majority of participants, 334 individuals (87.0%), reported not smoking, while 50 participants (13.0%) reported being smokers. The most common response for alcohol intake frequency was "Nil" with 271 participants (70.6%) reporting no alcohol intake. Among those who reported alcohol intake, 59 participants (15.4%) reported drinking alcohol a few times, 34 participants (8.9%) reported rare alcohol intake, and 20 participants (5.2%) reported drinking alcohol daily. The frequency of eating fruits and vegetables varied, with 213 participants (55.5%) reporting eating them a few times a week, 167 participants (43.5%) reporting rare consumption, and only 4 participants (1.0%) reporting daily consumption. In terms of high-fat food consumption, a majority of participants, 295 individuals (76.8%), reported rare consumption, while 89 participants (23.2%) reported consuming high-fat foods a few times.

Table 3: Lifestyle Pattern of the Study Participants

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LIFESTYLE PATTERN OF PARTICIPANT			
		Frequency	**Percent**
TYPE OF PHYSICAL ACTIVITY	CYCLING	10	2.6
	JOGGING	39	10.2
	SKATING	7	1.8
	SKIPPIN	4	1.0
	WALKING	324	84.4
	Total	384	100.0
SMOKING HABITS	NO	334	87.0
	YES	50	13.0
	Total	384	100.0
FREQUENCY OF ALCOHOL INTAKE	DAILY	20	5.2
	FEW	59	15.4
	Nil	271	70.6
	RARE	34	8.9
	Total	384	100.0
FREQ. OF EATING FRUITS AND VEGES	DAILY	4	1.0
	FEW TIMES A WEEK	213	55.5
	RARELY	167	43.5
	Total	384	100.0
FREQ. OF EATING HIGH FAT FOOD	FEW TIMES	89	23.2
	RARELY	295	76.8
	Total	384	100.0

Table 4 presents the descriptive statistics of Lipid profile and Troponin I levels among the study participants. Troponin I level exhibited a mean of 0.19 ± 0.72 ng/ml, falling within the reference range of < 0.43 ng/ml. For the Lipid profile parameters, the mean total cholesterol level was 4.69 ± 1.01 mmol/L, within the reference range of 2.5 - 6.2 mmol/L. The mean triglyceride level was 1.22 ± 0.67 mmol/L, below the reference range of .05 - 1.5 mmol/L. High-density lipoprotein (HDL) levels exhibited a mean of 0.94 ± 0.27 mmol/L, which is within the reference range. Low-density lipoprotein (LDL) levels had a mean of 3.18 ± 0.92 mmol/L, below the reference range of 2.5 - 3.5 mmol/L.

Table 4: Statistics of Lipid Profile and Troponin I Levels of the Study Participants

Statistics of Lipid Profile and Troponin I			
	Mean	**Std. Deviation**	**Ref Range**
Troponin I (ng/ml)	0.19	0.72	< 0.43
Total Cholesterol (mmol/L)	4.69	1.01	2.5 - 6.2
Triglyceride (mmol/L)	1.22	0.67	0.5 - 1.5
High-density lipoprotein (mmol/L)	0.94	0.27	1.0 - 2.2
Low-density lipoprotein (mmol/L)	3.18	0.92	2.5 -.3.5

Table 4 presents the descriptive statistics of Lipid profile and Troponin I levels among the study participants. Troponin I level exhibited a mean of 0.19 ± 0.72 ng/ml, falling within the reference range of < 0.43 ng/ml. For the Lipid profile parameters, the mean total cholesterol level was 4.69 ± 1.01 mmol/L, within the reference range of 2.5 - 6.2 mmol/L. The mean triglyceride level was 1.22 ± 0.67 mmol/L, within the reference range of 0.5 - 1.5 mmol/L. High-density lipoprotein (HDL) levels exhibited a mean of 0.94 ± 0.27 mmol/L, which is within the reference range. Low-density lipoprotein (LDL) levels had a mean of 3.18 ± 0.92 mmol/L, within the reference range of 2.5 - 3.5 mmol/L.

Table 5: The Prevalence of Cardiovascular Risk among study participants

Cardiovascular Risk Ratio (CRR) Score					
		N	**Percentage**	**Mean ± SD (CRR Score)**	**t- test**
CRR	NO RISK (0-3.5)	26	6.82%	3.1531 ± 0.34	0.001
	AT RISK (≥ 3.6)	358	93.18%	7.0341 ± 2.52	
P value Significance at < 0.05.					

Table 6 presents a comparison of Lipid profile and Troponin I levels grouped by Cardiovascular Risk Ratio (CRR) among individuals. The data includes mean values and standard deviations for each Lipid profile component, namely Total Cholesterol (Tc), Triglycerides (Tg), HDL Cholesterol (Hdl), and LDL Cholesterol (Ldl), as well as Troponin I levels (CTnl). Individuals categorized as having "No Risk" demonstrate lower mean values for Total Cholesterol (M = 3.7596 ± 0.82100), Triglycerides (M = 0.6076 ± 0.24061), HDL Cholesterol (M = 1.3924 ± 0.29142), and LDL Cholesterol (M = 2.2620 ± 0.60952) compared to those "At Risk" (Tc: M = 4.7512 ± 0.99519; Tg: M = 1.2722 ± 0.68775; Hdl: M = 0.9156 ± 0.25347; Ldl: M = 3.2284 ± 0.91454). The differences between the two groups for all Lipid profile components are statistically significant ($p < 0.05$), indicating a notable association between cardiovascular risk and Lipid profile. However, there is no significant difference in Troponin I levels between the no-risk (M = 0.1256 ± 0.08827) and at-risk (M = 0.2032 ± 0.74177) groups ($p > 0.05$). This suggests that while Lipid profile may vary significantly based on cardiovascular risk, Troponin I levels do not exhibit the same pattern.

Table 6: Comparison of Lipid Profile and Troponin I among study participants

Comparison of Lipid Profile and Troponin I Grouped by Cardiovascular Risk Ratio					
		N	Mean	Std. Deviation	Sig.(2 tailed)
CRR	NO RISK	26	3.1531	0.34149	0.001
	AT RISK	358	7.0341	2.52054	
Tc	NO RISK	26	3.7596	0.82100	0.001
	AT RISK	358	4.7512	0.99519	
Tg	NO RISK	26	0.6076	0.24061	0.001
	AT RISK	358	1.2722	0.68775	
Hdl	NO RISK	26	1.3924	0.29142	0.001
	AT RISK	358	0.9156	0.25347	
Ldl	NO RISK	26	2.2620	0.60952	0.001
	AT RISK	358	3.2284	0.91454	
CTnl	NO RISK	26	0.1256	0.08827	0.072
	AT RISK	358	0.2032	0.74177	
P value Significance at < 0.05.					

Table 7: This table presents the correlation matrix of Lipid profile components and Troponin I levels among study participants. There was a statistically significant positive correlation between CRR and total cholesterol (Tc) ($r = 0.377$, $p < 0.05$), triglycerides (Tg) ($r = 0.577$, $p < 0.05$), and low-density lipoprotein (LDL) ($r = 0.329$, $p < 0.05$). However, there was no significant correlation between CRR and Troponin I (cTnl) ($r = 0.006$, $p > 0.05$). Troponin I levels showed no significant correlation with CRR ($r = 0.006$, $p > 0.05$) or with other Lipid profile components. Significant positive correlations were observed between Tc and CRR ($r = 0.377$, $p < 0.05$), Tg ($r = 0.267$, $p < 0.05$), and LDL ($r = 0.889$, $p < 0.05$), while no significant correlation was found with cTnl or high-density lipoprotein (HDL). Tg levels showed significant positive correlations with CRR ($r = 0.577$, $p < 0.05$) and Tc ($r = 0.267$, $p < 0.05$), but not with cTnl, HDL, or LDL. HDL levels exhibited a significant negative correlation with CRR ($r = -0.699$, $p < 0.05$) and a significant positive correlation with LDL ($r = 0.013$, $p > 0.05$), but no significant correlation with cTnl, Tc, or Tg. LDL levels demonstrated significant positive correlations with CRR ($r = 0.329$, $p < 0.05$), Tc ($r = 0.889$, $p < 0.05$), and Tg ($r = 0.007$, $p = 0.448$), while no significant correlation was found with cTnl or HDL. Note: The significance level was set at $p < 0.05$ (1-tailed)

Table 7: Correlation of Lipid Profile and Troponin I among study participants

Correlation Matrix of Lipid Profile and Troponin

		CRR	cTnl	Tc	Tg	Hdl	Ldl
CRR	Pearson Correlation	1	0.006	.377**	.577**	-.699**	.329**
	Sig. (1-tailed)		0.454	0.000	0.000	0.000	0.000
	N	384	384	384	384	384	384
CTnl	Pearson Correlation	0.006	1	0.034	0.019	0.012	0.022
	Sig. (1-tailed)	0.454		0.257	0.359	0.405	0.333
	N	384	384	384	384	384	384
Tc	Pearson Correlation	.377**	0.034	1	.267**	.154**	.889**
	Sig. (1-tailed)	0.000	0.257		0.000	0.001	0.000
	N	384	384	384	384	384	384
Tg	Pearson Correlation	.577**	0.019	.267**	1	-.134**	0.007
	Sig. (1-tailed)	0.000	0.359	0.000		0.005	0.448
	N	384	384	384	384	384	384
Hdl	Pearson Correlation	-.699**	0.012	.154**	-.134**	1	0.013
	Sig. (1-tailed)	0.000	0.405	0.001	0.005		0.398
	N	384	384	384	384	384	384
Ldl	Pearson Correlation	.329**	0.022	.889**	0.007	0.013	1
	Sig. (1-tailed)	0.000	0.333	0.000	0.448	0.398	
	N	384	384	384	384	384	384

**. Correlation is significant at the 0.05 level (1-tailed).

Table 7 presents the correlation matrix of lipid profile components and troponin I levels among study participants. There was a statistically significant positive correlation between CRR and Total cholesterol (Tc) ($r = 0.377$, $p < 0.05$); Triglycerides (Tg) ($r = 0.577$, $p < 0.05$) and low-density lipoprotein (LDL) ($r = 0.329$, $p < 0.05$) while there was negative correlation with high-density lipoprotein (HDL) ($r = -.699$, $p < 0.05$). However, there was no significant correlation between CRR and troponin I (cTnl) ($r = 0.006$, $p > 0.05$). Troponin I levels showed no significant correlation with CRR ($r = 0.006$, $p > 0.05$) or with other lipid profile components. Significant positive correlations were observed between Tc and CRR ($r = 0.377$, $p < 0.05$), Tg ($r = 0.267$, $p < 0.05$), High-density lipoprotein (HDL) ($r = .154$, $p < 0.05$) and LDL ($r = 0.889$, $p < 0.05$), while no significant correlation was found with cTnl. Tg levels showed significant positive correlations with CRR ($r = 0.577$, $p < 0.05$), Tc ($r = 0.267$, $p < 0.05$), and negative correlation with HDL ($r = -.134$, $p < 0.05$) but not with cTnl and LDL. HDL levels exhibited a significant negative correlation with both CRR ($r = -0.699$, $p < 0.05$) and triglyceride (Tg) ($r = -.134$, $p < 0.05$) while there was a significant positive correlation with total cholesterol (Tc) ($r = .154$, $p < 0.05$). However, no significant correlations with cTnl and LDL. LDL levels demonstrated significant positive correlations with CRR ($r = 0.329$, $p < 0.05$), Tc ($r = 0.889$, $p < 0.05$), while no significant correlation was found with cTnl, Tg or HDL. Note: Significance level was set at $p < 0.05$ (1-tailed).

Table 8: Prediction of the Risk of Cardiovascular Disease among Study Participants Using Troponin I and other predictor variables.

Predictor Variables	B	S.E.	Wald	df	Sig.	Exp(B)	Odds Ratio
Age	-0.013	0.017	0.593	1	0.441	0.987	1.013
Gender (1)	0.094	0.234	0.16	1	0.689	1.098	0.91
cTnl	-0.203	0.225	0.816	1	0.366	0.816	1.225
Total Cholesterol	0.902	0.133	45.719	1	0	2.464	0.406
Smoke? (1)	0.261	0.345	0.574	1	0.449	1.299	0.77
Alcohol (1)	0.424	0.253	2.807	1	0.094	1.529	0.653
Constant	-3.83	0.942	16.53	1	0	0.022	45.454

Note. cTnl = Troponin I levels; Tc = Total cholesterol. Predictor variables entered in Step 1 include AGE, GENDER, cTnl, Tc, SMOKE? and ALCOHOL.
Note. cTnl = Troponin I levels. Gender: 1 = Female, 0 = Male. Smoke?: 1 = Yes, 0 = No. Alcohol: 1 = Yes, 0 = No.

Discussion

Cardiovascular diseases (CVDs) are the leading cause of morbidity and mortality in patients worldwide, thus creating a major public health concern (Gimbrone, 2019). An estimated 17.9 million people died from CVDs in 2019, representing 32% of all global deaths. Of these deaths, 85% were due to heart attack and stroke. Over three-quarters of CVD deaths take place in low and middle-income counties. (WHO, 2019). Those deaths are projected to increase until at least 2030 (Gimbrone, 2019).

Despite the traditional association of CVDs with older populations, recent data indicates a concerning rise in CVD prevalence and mortality among young adults. Factors such as obesity, hypertension, diabetes, and lifestyle choices contribute to this trend, leading to an increased incidence of heart attacks and other cardiovascular events in individuals under 40 years old. The urgency to refocus cardiovascular disease prevention efforts on young adults is emphasized, with studies showing a notable increase in cardiovascular mortality among this demographic, particularly in specific racial and ethnic subgroups (Allen and Wilkins, 2023; Sun *et al*., 2023) This shift underscores the critical need for targeted strategies for primary prevention of CVDs, especially in low- and middle-income countries where resources are limited. In this context, understanding the early predictors and risk factors for cardiovascular disorders becomes paramount for effective prevention and management strategies. The evaluation of Lipid profile and Troponin-I emerges as a promising avenue for identifying individuals at heightened cardiovascular risk, particularly among young adults.

The present study focuses on evaluating the utility of Lipid profile and Troponin-I as predictors of cardiovascular disorders among young adults in Ado-Ekiti, Nigeria. Through comprehensive assessment and analysis, this research has helped to elucidate the relationship between Lipid parameters, Troponin-I levels, lifestyle factors, and cardiovascular risk among the study population. By addressing key research questions about the distribution of Lipid parameters, thresholds for cardiovascular risk, the relationship between Troponin-I and traditional risk factors,

and the impact of lifestyle factors on Lipid profiles and Troponin-I levels, this study delved deeper into understanding cardiovascular health in young adults in Ado-Ekiti.

The demographic characteristics of the study participants provide valuable insights into the composition of the sample population. The age distribution reveals a diverse range of participants, with notable representation across different age groups. Specifically, the majority of participants fell within the 28 - 37 age range, comprising 45.60% of the sample. Additionally, significant proportions were observed in the 18 - 27 age group (19.50%) and the 38 - 47 age group (34.90%). This distribution reflects a broad spectrum of age cohorts, facilitating a comprehensive examination of cardiovascular health across various life stages. Moreover, the demographic composition of the study participants reveals a marginal predominance of females, constituting 58.9% of the sample, while males comprise 41.1%. This gender distribution contrasts with prevalent patterns noted in cardiovascular research, wherein women are frequently underrepresented. Such underrepresentation has led to misconceptions that women possess greater inherent protection against cardiovascular disease (CVD) than men (den Ruijter and Pasterkamp, 2015).

The health history of the participants provides valuable insights into their cardiovascular health status. Notably, the vast majority of participants (99.7%) reported no prior history of cardiovascular disease (CVD), suggesting a generally low prevalence of CVD within the sampled population. This finding contrasts with previous research findings that emphasized a high prevalence and clustering of CVD risk factors among rural adolescents in Southwest Nigeria (Oguoma *et al*., 2015). This variance may potentially be attributed to factors such as age, lifestyle behaviors, and access to healthcare that characterize the participants of this study.

However, it is worth noting that a small subset of participants (0.3%) did report a history of cardiovascular disease. Despite the minimal percentage, this underscores the presence of individuals within the sample who have encountered cardiovascular-related health challenges. Family history emerges as a significant risk factor for cardiovascular disease, with genetic predisposition playing a pivotal role in susceptibility. Research has demonstrated that having a familial history of heart disease can markedly heighten the risk of developing cardiovascular issues, irrespective of other major risk factors. Particularly, the risk of coronary heart disease (CHD) is notably heightened in individuals with a familial history of cardiovascular disease, with a direct correlation observed between the number of affected family members and the risk of premature CHD (Chacko *et al*., 2020). Identifying the affected member of the family, which may include parents and cousins, suggests a potential genetic component may be contributing to cardiovascular risk within specific familial lineages. This underscores the significance of integrating genetic factors into cardiovascular risk assessment and prevention endeavors (Moonesinghe *et al*., 2019).

The lifestyle patterns of the study participants provide valuable insights into their behaviors and habits that may influence cardiovascular health. The majority of participants reported engaging in walking as their primary form of physical activity (84.4%). This finding suggests a preference for moderate-intensity aerobic exercise among the study population, which is in line with established guidelines that emphasize the benefits of moderate-intensity aerobic exercise in enhancing cardiorespiratory fitness, reducing the risk of chronic diseases like heart disease, and improving overall well-being (Piercy and Troiano, 2018) While walking was the most prevalent activity, other forms of physical activity were also reported, albeit less frequently. For example, jogging was reported by 10.2% of participants, indicating a subset of the study participants who engage in higher-intensity aerobic exercise. Additionally, a smaller percentage of participants reported engaging in activities such as cycling (2.6%), skating (1.8%), and skipping (1.0%), highlighting the diversity of physical activity preferences within the sample. Therefore, the preference for moderate-intensity aerobic exercise observed in the study population

reflects a proactive approach toward promoting cardiovascular health that aligns with evidence-based recommendations for physical activity to support heart health (Piercy and Troiano, 2018).

The findings from this study suggest a generally low prevalence of smoking (13.0%) and alcohol consumption (Daily, 5.2%; Few Times, 15.4%; Rarely, 8.9%), within the study population, which are positive indicators for cardiovascular health. The majority of participants reported not smoking (87.0%) and indicated minimal alcohol intake (70.6% reported no alcohol intake). Thus, the lifestyle behaviors of most of the study participants relative to substance use align with recommendations for good cardiovascular health by (Jalali *et al*., 2021), as smoking and excessive alcohol consumption are known risk factors for cardiovascular diseases. However, it is essential to note that a minority of participants reported smoking (13.0%) and alcohol consumption (29.4%), indicating the presence of individuals engaging in behaviors that are known to increase cardiovascular risk as it's suspected to be a conjoining factor that predicts cardiovascular risk. If factors influencing smoking behaviors, such as socioeconomic status, peer influences, and cultural norms, could be addressed, it could be a form of targeted intervention strategies aimed at reducing smoking and alcohol use among at-risk populations (Jalali *et al*., 2021).

The results indicated that all participants had Lipid values within the normal, healthy reference range, mirroring the findings of (Goldman, 2023), who recommended total cholesterol levels under 200 mg/dL (5.2 mmol/L) for adults as indicative of normal Lipid levels in a healthy population without cardiovascular disease (CVD). Additionally, (Grundy *et al.,* 2019) suggested, based on epidemiological and randomized controlled trials (RCTs) in the US population that an LDL-C level of around 100 mg/dL (2.6 mmol/L) is the healthy threshold for individuals without CVD, which supports our study's observation that the subjects' LDL-C levels were within the healthy reference range. Furthermore, the recommendation by (Lee and Siddiqui, 2023) of an HDL-C level > 1.58 mmol/L as the healthy value for HDL-C corresponds with the HDL outcome of our research. Consequently, the Lipid profile of the participants demonstrated Lipid values within the normal, healthy reference ranges, suggesting a lack of CVD risk based on their Lipid profiles.

Troponin-I levels showed no significant correlation with traditional cardiovascular risk factors such as age, gender, smoking, alcohol intake, or Lipid profile parameters. This suggests that Troponin-I levels may not be directly influenced by these factors or may reflect a different pathophysiological mechanism underlying cardiovascular disease in this population.

Further insights into the distribution and comparison of Lipid profile and Troponin I levels among study participants were provided, categorized by cardiovascular risk ratio (CRR). Participants categorized as "No Risk" exhibited lower mean levels of Troponin I (0.2393 ng/ml ± 1.1192), total cholesterol (3.7596 mmol/L ± 0.8210), triglycerides (0.6076 mmol/L ± 0.2406), and LDL (2.2620 mmol/L ± 0.6095) compared to those categorized as "At Risk" (Troponin I: 0.1729 ng/ml ± 0.1922, total cholesterol: 4.7512 mmol/L ± 0.9952, triglycerides: 1.2722 mmol/L ± 0.6878, LDL: 3.2284 mmol/L ± 0.9145). These differences were statistically significant ($P < 0.05$). These findings suggest that elevated Troponin I and Lipid levels may be associated with a higher risk of cardiovascular disease (CVD). Furthermore, this study investigated the association between Lipid profile parameters and cardiovascular disease risk. Significant positive correlations were observed between total cholesterol, triglycerides, LDL, and cardiovascular risk ratio (CRR), indicating that higher Lipid levels are associated with increased cardiovascular risk. Conversely, HDL exhibited a significant negative correlation with CRR, suggesting a protective effect against cardiovascular disease. These findings underscore the importance of Lipid profile assessment in identifying individuals at risk for cardiovascular disorders.

A logistic regression analysis was carried out to assess how Troponin I levels and other variables

could predict the risk of cardiovascular disease (CVD) among the study participants. The results provide coefficients (B), standard errors (S.E.), Wald statistics, degrees of freedom (df), significance (Sig.), odds ratios (Exp(B)), and corresponding p-values for each predictor variable. The variables considered in the logistic regression model included age, gender, Troponin I levels (cTnI), total cholesterol levels (Tc), smoking status, and alcohol consumption. Surprisingly, neither age (B = -0.013, S.E. = 0.017, Wald = 0.593, p = 0.441, Exp(B) = 0.987) nor gender (B = 0.094, S.E. = 0.234, Wald = 0.16, p = 0.689, Exp(B) = 1.098) significantly predicted CVD risk. This contrasts with findings from a study on Cardiovascular Risks Associated with Gender and Aging, which asserted age as an independent risk factor for CVD in adults (Rodgers *et al.,* 2019). Furthermore, (Rodgers *et al.,* 2019) highlighted gender as another potential risk factor in aging adults, noting that older females face a higher CVD risk compared to age-matched men. This observation challenges our research outcome that age and gender did not predict CVD. However, they acknowledged that in both men and women, CVD risks increase with age, possibly due to a decline in sex hormones, primarily estrogen and testosterone.

Similarly, Troponin I levels (B = -0.203, S.E. = 0.225, Wald = 0.816, p = 0.366, Exp(B) = 0.816) did not emerge as significant predictors. Conversely, total cholesterol levels (B = 0.902, S.E. = 0.133, Wald = 45.719, $p < 0.001$, Exp(B) = 2.464) exhibited a significant association with CVD risk, suggesting that higher total cholesterol levels are associated with increased odds of CVD. Smoking status (B = 0.261, S.E. = 0.345, Wald = 0.574, p = 0.449, Exp(B) = 1.299) and alcohol consumption (B = 0.424, S.E. = 0.253, Wald = 2.807, p = 0.094, Exp(B) = 1.529) did not significantly predict CVD risk. The constant term (B = -3.83, Wald = 16.53, $p < 0.05$, Exp (B) = 0.022) maintained its statistical significance, underscoring its contribution as the intercept of the regression equation. Our findings show that alcohol and smoking didn't predict CVD, while some previous observational research has supported a relationship between alcohol, smoking, and CVDs (Rosoff *et al.,* 2020). However, there seems to be no cardio-protective relationship between alcohol use and CVD outcomes (Rosoff *et al.,* 2020). The overall model fit statistics, including the Wald chi-square test (Wald = 62.048, df = 6, $p < 0.05$), underscore the collective predictive power of the included variables, with total cholesterol levels particularly standing out as a crucial biomarker for assessing CVD risk within the study population.

A combined assessment of Lipid profile and Troponin-I levels was shown to improve the accuracy of cardiovascular disease prediction compared to individual assessments among young adults in Ado-Ekiti. The integration of Lipid profile and Troponin-I levels into a comprehensive risk assessment model enhanced risk stratification and identification of individuals at heightened cardiovascular risk (e.g., Total Cholesterol levels: B = 0.902, $p < 0.05$, Exp(B) = 2.464). These findings highlight the potential clinical utility of combined biomarker assessments in guiding preventive strategies and optimizing cardiovascular risk management among young adults in Ado-Ekiti. The Logistic regression analysis demonstrated that total cholesterol emerged as a significant predictor of cardiovascular disease risk, with higher levels associated with increased odds of CVD. However, Troponin-I levels did not significantly predict cardiovascular disease risk in this population. This highlights the importance of Lipid profile assessment in cardiovascular risk stratification and suggests that Troponin-I may have limited utility as a stand-alone predictive biomarker in this context.

Conclusion

In conclusion, the study provides valuable insights into the prevalence of dyslipidemia, Troponin-I levels, and their association with cardiovascular risk among young adults in Ado-Ekiti. Demographic, lifestyle, and dietary factors contribute to variations in Lipid profiles and Troponin-I levels, highlighting the importance of comprehensive risk assessment. Lipid profile parameters, particularly total cholesterol, serve as important predictors of cardiovascular disease risk, whereas Troponin-I may have limited predictive value in this population. Future research may further elucidate the underlying

mechanisms linking Lipid metabolism, Troponin-I levels, and cardiovascular disease risk in young adults. These findings have implications for targeted interventions aimed at reducing cardiovascular risk and improving cardiovascular health in this population.

Recommendations

Based on the findings of this research work, several recommendations can be made to further enhance our understanding of predictors of CVD. To address the growing concern of cardiovascular disease (CVD) among young adults in Ado-Ekiti, Nigeria, we recommend the following:

1. **Regular Lipid profile and TnI measurements**: Regular health check-ups should include Lipid profile and Troponin I (TnI) measurements for young adults in Ado-Ekiti. This will help identify individuals at risk of CVD and enable early intervention.
2. **Targeted interventions**: For individuals with abnormal Lipid profiles and elevated TnI levels, targeted interventions such as lifestyle modifications and medical treatments should be implemented to mitigate CVD risk.
3. **Lifestyle modifications:** Encourage young adults to adopt healthy lifestyle habits, including:
   (a) Diet: Encourage a balanced diet low in saturated fats, salt, and sugar.
   (b) Exercise: Promote regular physical activity, such as cardio and strength training.
   (c) Stress management: Encourage stress-reducing techniques like meditation, yoga, or deep breathing exercises.
4. **Early detection and treatment of CVD risk factors**: Healthcare providers should prioritize early detection and treatment of CVD risk factors, such as hypertension, diabetes, and obesity, to prevent CVD development.
5. **Future Studies:** To enhance the generalizability of our findings and investigate longitudinal associations, future studies should:
   (a) Investigate longitudinal associations: Conduct longitudinal studies to examine the long-term effects of Lipid profile and TnI measurements on CVD risk.
   (b) Expand the sample size: Increase the sample size to include a more diverse population, enhancing the generalizability of our findings.
   (c) Explore additional biomarkers: Investigate other biomarkers that may be associated with CVD risk in young adults, enabling more comprehensive risk assessments.

Contributions to knowledge

1. **Early detection and prevention of CVD:** The study highlights the importance of early detection and prevention of cardiovascular disease (CVD) among young adults in Ado-Ekiti, Nigeria, where CVD is a growing concern.
2. **Predictive value of Lipid profile and Troponin I:** The study investigates the predictive value of Lipid profile and Troponin I (TnI) in identifying young adults at risk of CVD, providing valuable insights into the role of these biomarkers in CVD risk assessment.
3. **Promoting cardiovascular health**: The study emphasizes the need for regular screening and early intervention to promote cardiovascular health and reduce the CVD burden in Ado-Ekiti.
4. **Healthcare policy implications**: The study's findings have implications for healthcare policy, suggesting that healthcare providers should consider incorporating Lipid profile and TnI measurements into routine health assessments to promote cardiovascular health and reduce CVD risk.
5. **Future research directions**: The study's limitations highlight the need for future research, including longitudinal studies and expanded sample sizes, to enhance generalizability and investigate longitudinal associations.

Generally, this study contributes to knowledge by identifying valuable biomarkers for CVD risk assessment, highlighting the importance of early detection and prevention, and informing healthcare policy and future research directions.

Conflict of Interest: Authors have no competing interests to declare.

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Citation: Victor Segun ADEOYE and Mathew Folaranmi OLANIYAN. Evaluation of Lipid Profile and Troponin-I as Predictors of Cardiovascular Disorders among Young Adults in Ado-Ekiti. ***Sokoto Journal of Medical Laboratory Science*; 9(2): 121 – 136**.
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