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PREVALENCE OF HYPERLIPIDEMIA AND ITS ASSOCIATED FACTORS AMONG ADULT PATIENTS WITH CARDIOVASCULAR DISEASE ATTENDING JAKAYA KIKWETE CARDIAC INSTITUTE

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**ABSTRACT**

**Background:** Hyperlipidemia is a significant risk factor for life-threatening illnesses like cardiovascular disease (CVD). It is modifiable and common in patients with obesity, hypertension, and diabetes. It interacts with other risk factors to increase the risk of developing CVD. An unhealthy diet and physical inactivity cause increased body fat.

**Objective:** This study aimed to determine the prevalence of hyperlipidemia and its associated factors among patients with cardiovascular disease attending the Jakaya Kikwete cardiac (JKCI) clinic.

**Methodology:** A cross-sectional study on 424 adult patients with cardiovascular disease was conducted at the JKCI clinic. It collected data on demographics, Body Mass Index (BMI), Blood pressure (BP), waist-hip ratio, and lipid profiles for analysis at the JKCI laboratory. Dyslipidemia cut-off points were based on the European Society of Cardiology (ESC) guideline. The study used SPSS 25 for data analysis, and results were presented using tables and text. Chi-square was used to determine significant associations ( $P \leq 0.05$ )

**Results:** A total of 424 participants were involved in the study. The majority of them were aged above 40 years 338 (79.7%). There was a female predominance of 222 (52.4). The prevalence of Dyslipidemia was found to be 223(52.6%), with 70 (16.5%) participants having high levels of total cholesterol, followed by high low-density lipoprotein(LDL)67 (15.8%) participants, then 48 (11.3%) with hypertriglyceridemia, and low high-density lipoprotein (HDL) 38 (9%). Diabetes and hypertension were found to be statistically significantly associated with

**dyslipidemia, p value=0.039 and 0.027, respectively. Conclusion: This study reveals a high prevalence of dyslipidemia among adult patients with cardiovascular diseases, which is associated with diabetes and hypertension.**

## INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of death globally. Approximately 17.9 million people died of CVDs in 2019, representing 32% of all global deaths; of these deaths, 85% were due to heart attack and stroke. Over  $\frac{3}{4}$  of CVD deaths take place in low and middle-income countries(1). Substantial changes in population health are occurring in Africa, marked by the rising burden of cardiovascular diseases (CVDs), which are set to cause a higher disease burden than infectious diseases. By the year 2030, CVD will be the leading cause of morbidity and mortality in lower- and middle-income countries. This epidemiological shift is driven by unhealthy lifestyles promoted by urbanization growth and Westernization cultures adopted among many African countries. In countries such as Tanzania, with a population with poor income, the burden of diseases such as hypertension, diabetes, and obesity, dyslipidemias are exponentially increasing hand in hand with an increase in CVD. (2)

Hyperlipidemia or hypercholesterolemia is an elevation of serum cholesterol level above normal ( $> 200$  mg/dl) (3). It is strongly associated with an increased risk for cardiovascular diseases (Coronary Artery Diseases, Cerebral Vascular diseases, structural heart diseases, and Peripheral Artery Diseases). The two main types of Hyperlipidemias include primary or genetic hyperlipidemia and secondary or acquired hyperlipidemia. Genetic mutations of the low-density lipoprotein (LDL) receptor gene

account for 85% of familial causes. Other factors include defective apolipoprotein B, proprotein convertase subtilisin/kexin type 9 gene gain-of-function mutations, LDL receptor adaptor protein mutation, and polygenic hypercholesterolemia (HC) (4). Secondary causes of hyperlipidemia have also been identified, such as diabetes, hypothyroidism, nephritic syndrome, medications (beta blockers, antiretroviral agents (ARVs)), and estrogens contained medications. (5).

Hyperlipidemia is known to be significantly associated with hypertension and atherosclerotic cardiovascular disease (ASCVD). Higher levels of cholesterol and triglycerides can accumulate and build up in arteries, leading to the development of atherosclerosis. Atherosclerosis is the next step after endothelial cell injury promoted by dyslipidemias. The oxidative process of the low-density lipoprotein cholesterol (LDLc) causes foamy cell formation and promotes angiogenic/fibroblastic cells and inflammation processes within the layers of the blood vessels (6,7). The result of this process is the formation of white plaque that leads to narrowing or blockage of the vessels. The patient will suffer from coronary artery disease, ischemic stroke, and peripheral artery disease, which then lead to sudden cardiac death or amputation of the limbs. (8)

Hyperlipidemia impairs the bioavailability of nitric oxide, the sympathetic nervous system, sodium and fluid homeostasis and ion transport /signal transduction. This can secondarily raise blood pressure and increase the chances of stroke or heart attack. (9)

It is reported that among individuals aged 40 to 90 years, treating hypertension only reduces coronary heart disease (CHD) risk by 25%. Treating hyperlipidemia in patients with hypertension reduces residual CHD risk by 35%, and concomitant treatment of both hypertension and hyperlipidemia reduces CHD by > 50% and decreases residual risk observed when only hypertension is addressed. (9)

Type 2 diabetes mellitus, hypertension, and dyslipidemias are metabolic syndromes. Most of the time, patients with a diagnosis of diabetes Mellitus (DM) and hypertension will have elevated serum cholesterol. These three diagnoses will fuel each other for the development of CVD and premature mortality (10–12). It has been estimated that the frequency of elevated plasma lipid levels in diabetic patients is between 20 and 90 per cent, depending on the degree of diabetic control and the type of diabetes. Past data indicated that patients with type 2 diabetes mellitus were also obese with elevated serum cholesterol levels. (13). Current data from the US among adults show that people without a diagnosis of diabetes mellitus, their total body fat and lean mass were strongly associated with elevated glycated hemoglobin (HbA1c ) (14). Raised cholesterol is a major cause of disease burden in both the developed and developing world and is a risk factor for cardiovascular diseases, including ischemic heart disease and stroke. In 2008, the Global prevalence of raised total cholesterol among adults was 39% (37% for males and 40% for females)(15) In the African adult population, the prevalence of elevated total cholesterol was 25.5%, low levels of **high-density lipoprotein cholesterol** (HDLc) at 37.4%, elevated LDLc at 28.6%, and triglycerides at 17.0%. (16)

In Tanzania, a study was conducted among red meat consumers in the Maasai area in

Ngorongoro documented a 24% prevalence of hyperlipidemia. (17)

The burden of CVD is increasing in sub-Saharan African countries by 13%, however, we still have a paucity of data. The Jakaya Kikwete Cardiac Institute (JKCI) is a tertiary hospital dedicated to treating CVD. No documented data for dyslipidemia is available. Therefore, this study aimed to document the prevalence of hypercholesterolemia and its associated factors.

## METHODOLOGY

A cross-sectional study was conducted involving 424 adult patients with cardiovascular disease at the JKCI clinic. The research gathered data on demographics, body mass index (BMI), blood pressure (BP), waist-hip ratio, and lipid profiles, which were analyzed at the JKCI laboratory. The dyslipidemia cut-off points were established according to European Society of Cardiology (ESC) guidelines. Data analysis was performed using SPSS version 25, and the findings were presented in both tables and narrative text. Chi-square tests were employed to assess significant associations, with a significance threshold set at  $P \leq 0.05$ .

The study included all patients with cardiovascular disease attending the JKCI clinic, while excluding individuals with mental illnesses, those currently on statin medications, and those who opted out of participation.

The study used a self-administered questionnaire to collect data on socio-demographics, lipid values, and risk factors such as body mass index (BMI), hypertension, diabetes, smoking, alcohol use, and a 10-year cardiovascular disease risk assessment.

The independent variables encompass age, gender, sex, employment status, education

level, and related factors. Hypertension was evaluated through blood pressure measurements with cutoff points of systolic blood pressure  $\geq 140$  mmHg and diastolic blood pressure  $\geq 90$  mmHg. Clients were also asked about their diabetes, alcohol use, and smoking habits. Body Mass Index (BMI) was calculated using electronic machines and categorized as follows: Non-obese ( $< 25$  kg/m<sup>2</sup>), Overweight (25-29.9 kg/m<sup>2</sup>), Class I Obesity (30-34.9 kg/m<sup>2</sup>), and Class II/III Obesity ( $\geq 35$  kg/m<sup>2</sup>).

The dependent variables in this study encompass lipid values: total cholesterol, triglycerides, LDL, and HDL, all measured from patient serum tests. The interpretation criteria were as follows: HDL cholesterol:  $< 1.55$  mmol/L (60 mg/dL), LDL cholesterol:  $> 3.36$  mmol/L (130 mg/dL), Total cholesterol:  $> 5.2$  mmol/L (200 mg/dL), Triglycerides:  $> 1.7$  mmol/L (150 mg/dL)

The 10-year risk for each patient was estimated using the World Health Organisation/International Society of Hypertension (WHO/ISH) prediction charts, taking into account factors such as systolic blood pressure, smoking status, diabetes, age, and sex. The risk levels were classified as follows: Low risk:  $< 9.9\%$ , Moderate risk:  $10\% - 19.9\%$ , High risk:  $20\% - 29.9\%$ , Very high risk:  $> 30\%$ .

#### *Ethical Consideration:*

Ethical clearance was obtained from the Muhimbili University of Health and Allied Sciences (MUHAS) Institutional Review Board. A permission letter with reference number DA 25/111/01D/65 was issued. Informed consent was obtained where the nature and purpose of the study were explained to the participants. No penalty to those who refused to participate in the study. The study did not involve any procedures. The information obtained was only used for research purposes to ensure the privacy of the data.

## RESULTS

#### *Socio-Demographic Factors*

A total of 424 participants were involved in the study. The majority of these participants were over 40 years of age, accounting for 338 (79.7%) of the group. There was a notable female predominance, with women constituting 222 (52.4%) of the participants. Most individuals were married 329 (77.6%), and 159 participants (37.5%) reported having a maximum level of Secondary education. Furthermore, 154 participants (36.3%) were employed. This information is summarized in Table 1.

**Table 1**

*Socio-demographic characteristics, N=424*

VARIABLE		FREQUENCY (n)	PERCENTAGE
Age group	Below 40	86	20.3%
	Above 40	338	79.7%
Gender		202	47.6%
	Female	222	52.4%
Marital status	Married	329	77.6%
	Single	45	10.6%
	Widow/Widower	48	11.3%

Education	Divorced	2	0.5%
	No formal education	11	
Occupation	Primary	111	
	Secondary	159	
	High Education	143	2.6%
			26.2%
			37.5%
	Businessman/woman	7	33.7%
	Employed	154	
	Retired	122	
	Small-scale and medium-sized entrepreneur	85	1.7%
	Peasant	33	36.3%
Housewife	8	28.8%	
Students	15	20.0%	
		7.8%	
		1.9%	
		3.5%	

#### *Associated factors of Dyslipidemia*

In the study, only 72 participants (16.7%) were diabetic, and 270 participants (63.7%) were hypertensive. However, a significant number of participants reported not using tobacco (412

participants, 97.2%) or consuming alcohol (359 participants, 84.7%). Most participants had a Body Mass Index (BMI) ranging from 25 to 29, with 189 participants (44.6%) falling within this category.

**Table 2**  
*Associated Risk Factors N=424*

VARIABLE		FREQUENCY (n)	PERCENTAGE
Diabetes status	Diabetic	72	17.0%
	Non-Diabetic	352	83.0%
Hypertension	Hypertensive	270	64.0%
	Non hypertensive	154	36.0%
Smoking status	Tobacco use	11	3.0%
	Non-tobacco use	413	97.0%
Alcohol consumption	Consumes alcohol	65	15.0%
	Don't consume alcohol	359	85.0%
BMI	Non obese (< 25kg/m <sup>2</sup> )	105	25.0%

	Overweight (25-29kg/m <sup>2</sup> )	188	44.0%
	Class I obese (30-34.9kg/m <sup>2</sup> )	67	16.0%
	Class II obese (>35kg/m <sup>2</sup> )	64	15.0%

### Prevalence of Dyslipidemia

In this study, the prevalence of dyslipidemia was 52.6%. Among these participants, 70 individuals (16.5%) had elevated total cholesterol levels. This was followed by 67

participants (15.8%) with high LDLc levels, 48 participants (11.3%) with hypertriglyceridemia, and 38 participants (9%) with low HDL levels.

**Table 3**

*Prevalence of Dyslipidemia n =223*

LIPID VALUES	FREQUENCY (n)	PERCENTAGE
High TC (>5.2mmol/l)	70	16.5%
Low HDL (<1.04mmol/l)	38	9.0%
High LDL (>3.34mmol/l)	67	15.8%
High TG (>1.69mmol/l)	48	11.3%
Total	223	52.6 %

TC - Total Cholesterol, HDL – High Density Lipoprotein, LDL – Low Density Lipoprotein, TG - Triglycerides

### Association between Dyslipidemia and Socio-Demographic Characteristics.

None of the socio-demographic factors were found to have a statistically significant association with dyslipidemia.

**Table 1**

*Dyslipidemia with social demographic characteristics*

	VARIABLE	LDL (>3.34mmol/l) n (%)	P-value	TG (>1.69mmol/l) n (%)	P-value
Age group	< 40yrs	8 (1.9)	0.642	5 (1.2)	0.071
	>40yrs	59(14)		43(10.1)	
Gender	Male	27(6.4)	0.069	25(5.9)	0.086
	Female	40(9.4)		23(5.4)	
Marital status	Married	52(13)	0.527	39(9.2)	0.068
	Single	3(0.9)		1(0.23)	
	Widow/Widower	12(1.9)		8(1.9)	
	Divorced	0		0	
Education	No formal education	2(0.5)	0.643	2(0.5)	0.706
	Primary	21(5.0)		15(3.5)	
	Secondary	21(5.0)		16(3.7)	
	High Education	23(5.4)		15(3.5)	

	Businessman/woman	0		0	
	Employed	22(5.2)		19(4.5)	
	Retired	25(5.7)		19(4.5)	
Occupation	Small & Medium scale entrepreneur	12(0.8)	0.687	7(1.7)	0.307
	Peasant	5(1.2)		3(0.71)	
	Housewife	1(0.24)		0	
	Student	2(0.47)		0	

### Factors Associated with dyslipidemia

Table 5: Shows that diabetes and hypertension were statistically significantly associated with high levels of total cholesterol in serum.

Furthermore, hypertension was statically significantly associated with high serum levels of LDLc.

**Table 2**

*Dyslipidemia and other related risk factors*

	VARIABLE	TC (>5.2mmol/l) n (%)	P-value	HDL (<1.04mmol/l) n (%)	P-value
Diabetes	Diabetic	15 (3.5)	0.039	5 (1.2)	
	Not Diabetic	55 (12.7)		33(7.8)	0.78
Hypertension	Hypertensive	53(12.5)		25(5.9)	
	Not hypertensive	17(4)	0.029	13(3.1)	0.863
	Cigarette	9(2.4)		1(0.24)	
Tobacco use	Bhang/Khat	1(0.24)	0.295	1(0.24)	0.530
	Not using Tobacco	60(16.5)		36(8.5)	
Alcohol use	Yes	11(2.6)	0.522	3(0.7)	0.240
	No	59(13.9)		35(3.3)	
	Non-Obese	15(3.5)		5(1.2)	
	Overweight	30(7.1)	0.685	21(5)	
BMI	Class I obese	14(3.3)		6(1.4)	0.327
	Class II obese	11(2.6)		6(1.4)	
	VARIABLE	LDL (>3.34mmol/l) n (%)	P-value	TG (>1.69mmol/l) n (%)	P-value
Diabetes	Diabetic	16 (3.8)	0.216	8 (1.9)	
	Not Diabetic	51 (12)		40 (9.4)	0.938
Hypertension	Hypertensive	50 (11.8)		42(9.9)	
	Not hypertensive	17 (4)	0.027	6(1.4)	0.230
	Cigarette	1(0.24)		2 (0.5)	

Tobacco use	Bhang/Khat	0 (0)	0.750	0	0.721
	Not using Tobacco	66 (15.6)		46(10.8)	
Alcohol use	Yes	12 (2.8)	0.579	5 (1.2)	0.398
	No	55 (13)		43 (10.1)	
	Non-Obese	14 (3.3)		6 (1.4)	
	Overweight	28 (6.6)	0.541	22 (5.2)	
BMI	Class I obese	14 (3.3)		9 (2.1)	0.140
	Class II obese	11 (2.6)		11 (2.6)	

## DISCUSSION

Hyperlipidemia is a worldwide health problem that is linked to cardiovascular diseases. (18) This study assessed the prevalence of hyperlipidemia and related factors among Tanzanian adults with cardiovascular diseases. It provided valuable insights into dyslipidemia and its risk factors in this population.

### *Prevalence of dyslipidemia*

Dyslipidemia was highly prevalent in the study population, affecting 52.6% of adult patients with cardiovascular diseases. This percentage reflects the combined levels of triglycerides (TG), low-density lipoprotein (LDL), high-density lipoprotein (HDL), and total cholesterol (TC) measured in the study. This prevalence value is almost identical to studies conducted among adults in Samara City, Iraq (54%) and Saudi Arabia (54%) (3,19). This similarity with Arabic countries may be attributed to socio-demographic factors and systemic diseases, such as diabetes mellitus. (3) In North Africa, Asia, and some Arab countries, the prevalence of dyslipidemia is lower than what is documented by our study. For instance, Egypt has a lower rate of 38%. Kerala, India, 33.2%, Oman 15.6% (20–22), Kuwait 10.6%, Sudan 7.8% and Korea 1.2%. Differences in social life and other comorbidities may lead to low rates of dyslipidemia in these areas.

Compared to the results of this study, in Europe, Asia, and West Africa, the prevalence of dyslipidemia was higher than what we documented. For example, in Poland, India, and Nigeria, the prevalence is high at 62.4%, 86% and 70% respectively (23–25). The higher rates in these countries may be attributed partly to comorbidities, social life, and economic variations.

### *Aging and dyslipidemia*

The prevalence of dyslipidemia was higher among participants older than 40 years. However, no statistically significant differences were observed among the various age groups. In a study conducted in Uganda, a high rate of dyslipidemia was found among patients with cardiovascular diseases who were over 40 years old. (18). Based on these observations, ageing, dyslipidemia, and cardiovascular diseases lead to increased morbidity and mortality rates.

### *Gender and dyslipidemia*

This study found a higher prevalence of dyslipidemia in females than in males. This finding aligns with studies conducted in Kenya and Mozambique (25,26). From a clinical perspective, aside from other risk factors, this may contribute to early cardiovascular diseases and increased mortality among females.

### *Dyslipidemia and associated factors*

In the study group, dyslipidemia was statistically significantly associated with

diabetes and hypertension, with p-values of < 0.039 and < 0.027, respectively. Moreover, elevated serum LDLc was statistically significantly associated with hypertension. The study conducted in Saud Arabia also noted a statistically significant association between diabetes and dyslipidemia(19). Diabetes and hypertension coexist and fuel each other to accelerate early morbidity and mortality (13). Therefore, a multi-professional approach is important to prevent premature death.

### Limitations of the study

This study was conducted in a tertiary hospital; therefore, the data cannot be generalised to the general population.

### CONCLUSION AND RECOMMENDATION

The prevalence of dyslipidaemia among patients with a diagnosis of cardiovascular diseases was high, associated with diabetes and hypertension. Regular check-ups for lipid levels among patients with cardiovascular diseases are highly recommended.

### Author Contributions

All authors contributed to this manuscript. SJ Rweyemamu and A. Misidai conceived the study and led. D.A. Tesha collected and analysed data. T. K. Waane helped interpret results and draft. R.P. Kisenge made critical revisions and approved the final version. All reviewed and approved.

### Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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