Relationship between Lipid Profiles and Serum Electrolytes in Cardiac Patients: A Gender Perspective

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Abstract

Cardiovascular diseases (CVD), include ischemic heart disease, peripheral vascular disease and stroke, which are the primary causes of death in the majority of high, low, and middle-income countries. Cardiovascular disease incidences are resulted by the hereditary as well as environmental factors. Disparity of the lipid profile and electrolytes imbalance poses serious risk to CVD. The study aims to find the gender-based relationship between lipid profile and serum electrolytes in cardiac patients. 45 cardiovascular patients were recruited in this cross-sectional study. The lipid profile and serum electrolytes were assessed using serum samples. On the basis of statistical analysis, 66.6% of cardiac patients had dyslipidaemia, while 33.4% showed no such symptoms. Meanwhile 28.8% of cardiac patients had electrolyte imbalance and 71.2% of patients had normal electrolyte values. Statistically significant variations were noted for TC ($p = 0.028$) and HDL ($p = 0.024$) with males exhibiting lower levels of TC and HDL in comparison to females indicating that gender may influence lipid metabolism and associated cardiovascular risk. The study recommended that dyslipidemia was a chief contributing factor in the etiology of cardiovascular diseases being prominent in males.

Keywords: *Cardiovascular disease, Electrolytes, Cholesterol, Triglycerides, Dyslipidemia.*

1. Introduction

Cardiovascular diseases (CVD) include disorders such as stroke, peripheral vascular disease and ischemic heart disease (IHD), are the leading causes of deaths worldwide. Sedentary lifestyle, obesity, dyslipidemia, hypertension and a family history of early atherosclerosis are the key risk factors for the etiology of CVD. According to WHO (2021), about 17.9 million deaths had been reported so far in 2019 making up 32% of all deaths worldwide.

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A major risk factor for CVD is dyslipidemia and it is characterized by increased concentration of lipids mainly cholesterol and triglycerides and lipoproteins in the blood (Nelson, 2013; Oguejiofor, Onwukwe, & Odenigbo, 2012). Atherosclerosis, which can result in stroke, heart failure, and renal failure, is largely influenced by lipids during its initiation and advancement. Atherosclerosis starts with dysfunction or damage in the endothelial cells of the body. Atherogenic dyslipidemia includes high values of low density lipoprotein (LDL), low valuess of high density lipoprotein (HDL) along with increased concentrations of triglycerides (TG) that can cause CVD (Lusis, 2000).

Cholesterol deposition in arterial intima causes lesions of endothelial cell triggering oxidative stress and impairing ventricular function. The assembly of lipids also leads to cell proliferation of smooth muscle and the activation of inflammatory cells, eventually leading to plaque formation, necrosis and the development of atherosclerosis (Lusis, 2000; Nepal et al., 2018). Hypertriglyceridemia and high LDL significantly increases the chances of CAD. In Pakistan, one out of four people of middle-aged has prevalent CAD and the perils are highly significant for women and young adults (Jafar, Jafary, Jessani, & Chaturvedi, 2005). In order to evaluate cardiovascular risk, clinical lipid profiles comprising of measurements of total cholesterol (TC), triglycerides (TG), LDL and HDL are crucial.

Serum electrolytes - sodium, potassium, and chloride- have a substantial role in regulation of fluid balance in the body. Sodium is the major cation in extracellular fluid and plays a vital role in balancing the blood pressure and regulating body fluid. It is also involved in the electrical transmission of nerves impulses and in muscles, including the myocardium. However, excessive use of sodium is associated to an increased risk of hypertension leading to CVD (Bennett, Deslippe, Crosby, Belles, & Banna, 2020).

Potassium on the other hand, is the primary intracellular cation, involved in keeping normal cardiac rhythm and muscle contractions. Adequate potassium levels can counteract the adverse effects of sodium, thereby contributing to lower blood pressure and a reduced risk of arrhythmias. Conversely, hypokalemia can lead to severe cardiac complications, including arrhythmias and sudden cardiac death (Jayedi, Ghomashi, Zargar, & Shab-Bidar, 2019). Imbalance of electrolytes' levels specially sodium and potassium can cause arrhythmias, hypertension or heart failures., it is essential to maintain the balance between the sodium and potassium intake to regulate the blood pressure.

To reduce the incidence and epidemiology of the CVD globally, the lifestyle changings, right medical care can play a crucial role in diminishing the key contributing players including diabetes, obesity, hypertension and dyslipidemia (Tham, Bernardo, Ooi, Weeks, & McMullen, 2015). Lifestyle changes like cutting off the processed food and added sugars and balancing the intake of saturated fats and lipids to maintain the normal levels of lipid in the blood will help to avoid the cardiovascular pathologies. It is also needed to balance the levels of electrolytes in daily life routines. The current study aims to assess the gender base distribution of cardiac diseases by monitoring the lipid and electrolytes level in the blood of cardiac patients.

2. Material and Methods

2.1 Sample Collection

The cross-sectional study was conducted from May 2023 to November 2023 at Jinnah Hospital, Lahore, Pakistan. The study comprised cardiac patients from both genders with nephritis, liver cirrhosis, any form of malignancy, or diabetes mellitus were excluded from the study, Written and informed consent was given to each patient, and the research was approved ethically by the institution's ethics committee.

2.2 Estimation of Lipid profile and electrolytes

Blood samples from 45 cardiac patients were obtained for the estimation of lipid profiles including total cholesterol (TC), triglycerides (TG), low density lipoprotein (LDL), and high density lipoprotein (HDL) and serum electrolytes including serum sodium and serum potassium. A completely automated biochemistry analyzer was used to conduct each test, and specific reagents were needed for each assay. The reference range used was up to 200 mg/dl for TC, 150 mg/dl for TG, 45-65 mg/dl for HDL, 100-130 mg/dl LDL, 135-150 mmol/L for Sodium and 3.5-5.1 mmol/L for potassium ions.

2.3 Statistical Analysis

A statistical package for social sciences (SPSS) software was used to analyze the data. The Mean ± SD was measured for quantitative variables. Independent samples t-test was applied for the comparison of quantitative variables while Pearson's Correlation was applied to find association and p values < 0.05 was deemed significant.

3. Results

3.1 Analysis of Lipid Profile and Electrolytes

This study, involving 45 patients, included 15 female and 30 male patients. The mean age of all the patients was 64.09 ± 14.46. All the parameters including total cholesterol (TC), triglycerides (TG), low density lipoprotein (LDL), high density lipoprotein (HDL) and serum electrolytes (sodium and potassium) were analyzed separately. According to the study, 66.6% of cardiac patients had dyslipidemia, while 33.4% of patients did not show any symptoms of dyslipidemia. 28.8% of cardiac patients had electrolyte imbalance, while 71.2% of patients had no electrolyte imbalance (Table 1).

Table 1. *Lipid Profile and Serum Electrolytes of Cardiac Patients*

Parameters	Reference Range	Mean±SD (n=45)
TC (mg/dL)	200	170.82 ± 68.94
TG (mg/dL)	150	198.02 ± 198.609
HDL (mg/dL)	45-65	38.36 ± 10.203
LDL (mg/dL)	100-130	102.51 ± 43.99
Sodium (mmol/L)	135-150	136.07 ± 3.453
Potassium (mmol/L)	3.5-5.1	4.525 ± 0.56

TC: Cholesterol, TG: Triglycerides, HDL: High density lipoprotein, LDL: Low density lipoprotein.

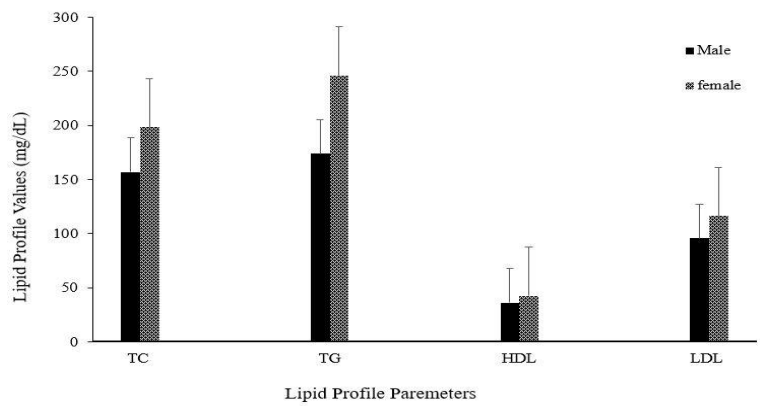

Figure 1: Lipid profile and serum electrolytes of cardiac patients

3.2 Gender Base Analysis

Lipid profile and serum electrolytes were analyzed on gender-base distribution (Table 2). It was observed that values of TC were lower in males as

compared to females while TG was higher in females as compared to males. Similarly values of HDL and LDL were lower in males while females had normal values (Figure 1). However, values of serum sodium and potassium fell within the reference range for both the genders.

3.3 Statistical Analysis

An independent samples t-test analysis revealed significant variances amid the genders in TC ($p = 0.028$), and HDL ($p = 0.024$), where males exhibited lower levels. Males also had significantly higher sodium levels ($p = 0.009$) compared to females. Yet, no significant alterations were observed in TG, LDL, or potassium values between the two groups.

TC had moderately positive correlations with serum sodium and high positive relationships with both LDL and TG, according to Pearson's correlation analysis (Table 3). There was a modest positive association found between TG and LDL and a high positive correlation with TC. LDL exhibited TC and TG substantial positive relationships. There was a little negative connection between HDL and salt. With HDL, sodium had a slight negative link, but with LDL, it showed a substantial negative correlation. Potassium displayed strong negative correlation with sodium.

4. Discussion

Cardiovascular illnesses, which afflict around 60 million people worldwide, are characterized by high rates of morbidity and mortality, low quality of life, and a substantial financial load on the healthcare system (Roth et al., 2020). The study is based on exploring gender base relationship between dyslipidemia and electrolyte imbalance in CVD individuals. The results revealed that 66.6% of the cardiac patients had dyslipidemia. This high prevalence is consistent with previous research indicating the prevalence of abnormalities of lipids in CVD patients (Zhao, Wang, & Qin, 2021). In contrary 33.4% of the patients had no such symptoms attributing to lipid management by medications, diet or lifestyle interventions.

The study found that 28.8% of patients had electrolyte imbalance, while 71.2% maintained normal electrolyte levels. This finding is critical, as electrolyte disturbance can have serious implications for cardiac function and overall health. Monitoring these levels is essential in managing cardiac patients effectively.

The gender-based analysis revealed prominent differences in lipid profiles, with males exhibiting lower TC and HDL levels as compared to females. These differences were statistically significant for TC ($p = 0.028$) and HDL ($p = 0.024$),

suggesting that gender may play a role in lipid metabolism and cardiovascular risk. These findings are consistent with other study which found that HDL-C was significantly lower in males in comparison to females (Wei et al., 2014). The higher triglyceride (TG) levels observed in females could be attributed to hormonal influences which are known to affect lipid metabolism (Ali, Bashir, & Sherwani, 2016). Hokanson and Austin (1996) also reported higher HDL levels in females, possibly due to the protective effects of estrogen.

TC showed strong positive correlations with LDL and TG, which is consistent with established understanding that elevated TC often accompanies high LDL and TG levels (Goldstein & Brown, 2015). The negative correlations between HDL and sodium, and the moderate negative correlation between LDL and sodium, mentioned the composite interaction between electrolyte balance and lipid metabolism. These results recommend that electrolyte imbalance may influence lipid metabolism and vice versa (Xi et al., 2015).

5. Conclusion and Recommendations

The study emphasizes the high incidence of dyslipidemia among male cardiac patients, with significant differences in lipid profile. These results indicate a need for tailored monitoring and management strategies that consider gender differences in lipid metabolism and electrolyte balance. Further studies should focus on increased size of sample and longitudinal studies to better understand the implications of these findings and to develop targeted interventions for dealing dyslipidemia and electrolyte inequalities in cardiac patients.

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