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Association of Lipid Profiles in Patients with Coronary Heart Disease (CHD)

A.K.M. Fazlul Kader[1], Haripada Roy[2], Abu Md. Towab[3], Md. Sharif Hasan[4], Anupam Kanti Thakur[5]

[1]*Junior Consultant (Cardiology), Belabo Upazila Health Complex, Belabo, Narasingdi, Bangladesh*
[2]*Junior Consultant (Cardiology), Kotalipara Upazila Health Complex, Kotalipara, Gopalgonj, Bangladesh*
[3]*Junior Consultant (Cardiology), Lalmonirhat 250 Bed Hospital, Lalmonirhat, Bangladesh*
[4]*Junior Consultant (Cardiology), Nalitabari Upazila Health Complex, Nalitabari, Sherpur, Bangladesh*
[5]*Junior Consultant (Cardiology), Phulpur Upazila Health Complex, Phulpur, Mymensingh, Bangladesh*
Corresponding Author: *A.K.M Fazlul Kader, Junior Consultant (Cardiology), Belabo, Upazila Health Complex, Belabo, Narasingdi, Bangladesh*
Email: *fazlulkadercmc@gmail.com*

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ABSTRACT

Background: Generally the lipid profile refers to a group of tests that are often done together to identify the risk factor of heart disease. These tests are some potential indicators of whether someone is likely to have a heart attack or stroke caused by the blockage of blood vessels or hardening of the arteries. Lipid profile is regarded as an important factor in the development of coronary heart disease. We have very few data on the relation between CHD and lipid profile.

Objective: To assess the association of lipid profiles in patients with coronary heart disease (CHD).

Methods: This comparative observational study was conducted in Dept. of Cardiology, Dhaka Medical College Hospital, Dhaka, Bangladesh from July to December 2020. Among total participants 70 People with CHD are Case Group and 41 healthy people are Control Group. Proper written consents were taken from all the participants before starting the main part of intervention. The age of the participants was 41 years and above. All the demographic and risk factors related information was collected from the patients record available in the hospital. A data collection sheet was designed to gather all the necessary information of the patients. The serum samples were analysed for lipid profile. The Patients were classified into CHD and Non CHD groups based on ECG changes. All necessary data were collected, analyzed and disseminated by several program of MS-Office and SPSS version 22.

Results: In this study, among Case Group (n=70) total 52 were male which was 74.28% and 18 were female which was 25.71%. Among male participants of Case Group 44.28%, 35.72% and the rest 20.00% were from 51-70, 41-50 and >70 years age group respectively. On the other hand, Among female participants of Case Group 44.23%, 36.54% and the rest 19.13% were from 51-70, 41-50 and >70 years age group respectively. In regression analysis between male and female participants of Case Group on the basis of age we found the p value was 0.242. So there had not been any significant correlation. In analyzing the age-wise distribution of serum cholesterol concentration between the groups we found, significant correlations between the Case and Control groups in all age groups and the p value were <0.0001 in every age group. In analyzing the age wise distribution of LDL concentration between the groups we found, significant correlations between the Case and Control groups in 41-50 and 51-70 years age groups where the p values were found, <0.0001 and 0.0002 respectively. But in >70 years' age group we did not find any significant correlation (p = 0.515).

Conclusion: In this study, it was found that, the total cholesterol, triglycerides and LDL cholesterol concentrations were significantly higher and HDL cholesterol concentrations is significantly lower in coronary heart disease (CHD) patients.

Key words: Lipid Profile, Coronary Heart Disease, CHD.

I. INTRODUCTION

Generally the lipid profile refers a group of tests that are often done to identify the risk of heart disease. These tests are some potential indicators of whether someone is likely to have a heart attack or stroke caused by the blockage of blood vessels or hardening of the arteries. For a person of about 68 kg typical total blood cholesterol synthesis is about 1g (1000mg) per day [1].The increased level of TC, TG and LDL is found to be associated with the higher risk of coronary artery disease (CAD) and ischemic stroke

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[2]. On the other hand, population based studies have consistently demonstrated an inverse association between HDL level with the risk of CAD [3].Accounting for nearly 30% of the total deaths based on the World Health Organization (WHO) statistics. The WHO reported that about 17.3 million people have died of CVD in 2016 and that this number will reach up to 23.3 million by 2030[4]. Currently, pharmacological therapies including antiplatelet agents, angiotensin-converting enzyme inhibitors/angiotensin receptor blockers, beta-blockers and lipid-lowering drugs play a crucial role in the secondary prevention of CVD [5-7]. However, a residual CVD risk remains, for which further management needs to be identified. LDL consists of more cholesterol than triglycerides and protein. Because it contains fewer lipids and more protein in comparison to VLDL, its density is greater. LDL is responsible for carrying cholesterol to cells that need it. The recent genetic analyses of a relatively common single nucleotide polymorphism (SNP) in the endothelial lipase gene and other SNPs associated with HDL cholesterol suggest that genetic mechanisms that raise plasma HDL do not decrease the risk of myocardial infarction [8]. In contrast, an earlier study of SNPs in the cholesterol ester transfer protein (CETP) that impact HDL levels indicated that SNPs associated with an increase in HDL corresponded with a lower risk of future myocardial infarction[9]. Numerous studies have demonstrated the role of the lipid profile in the progression of CVD. Increases in triglyceride (TG) and total cholesterol (TC) levels could affect the constriction and abstraction of vessels in the heart, which are significantly correlated with the risk of CVD [10]. Moreover, increases in the low-density lipoprotein cholesterol (LDL-C) level could induce arteriosclerosis owing to accumulation of LDL-C in the intima-media of the artery, which could then promote thrombocytopoiesis [11]. In human body, cholesterol is an essential component of cell membranes, which are the structures that border every cell [12]. Without cholesterol, T-cells (a type of white blood cell), for example, would not maintain their cell membranes, leading to rupturing of the cells. Cholesterol is also needed for the manufacture of steroid-based hormones, particularly sex hormones like testosterone and progesterone [13]. Other hormones, produced mainly by the adrenal gland, also require cholesterol for production. However, the CVD risk might be reduced in persons with increased high-density lipoprotein cholesterol (HDL-C) levels. Therefore, individuals with high HDL-C and low non-HDL-C may be protected against the risk of CVD.

II. MATERIALS & METHODS

This comparative observational study was conducted in Dept. of Cardiology, Dhaka Medical College Hospital, Dhaka, Bangladesh from July to December 2020.Among total participants 70 People with CHD are Case Group and 41 healthy people are Control Group. Proper written consents were taken from all the participants before starting the main part of intervention. The age of the participants was 41 years and above. All the demographic and risk factors related information was collected from the patient's record available in the hospital. A data collection sheet was designed to gather all the necessary information of the patients. The patients of Case Group (n=70) were selected with history of angina or surviving myocardial infarction or ischemic changes on ECG with or without DM and HTN, admitted and diagnosed in coronary care unit of the mentioned hospital. According to the exclusion criteria of the study, CHD cases with liver impairment, renal disease or thyroid disease were excluded. On the other clinically healthy subjects aged above 41 years who served as population-based controls were selected as the participants of Control Group. Blood sample was collected from the cubital vein of the arm of each patient by a 5cc disposable syringe, which was transferred quickly to a heparinized collecting tube and finally preserved into an ice pot. All these tubes were then transferred to a test tube, were allowed to stand overnight for the serum to separate. Then each serum sample was transferred to a separate Eppendorf tube and stored at -20º C in a refrigerator; lipid profile was performed within one week for each group of samples, after running the controls for confirmation of the accuracy of each test, according to the procedures provided with Bioconkits. Cholesterol was estimated by enzymatic colorimeter test. Estimation of HDL-C was done through phosphor-tungstic precipitation and LDL-C was also done through the same precipitation method. Estimation of Triglycerides (TG) was done by enzymatic colorimetric test. Serum of CHD patients were used for individual determinations of lipid profile for Cholesterol, HDL-C, LDL-C, and TG by using clinical laboratory kits. A base line ECG was taken in all cases irrespective of cardiac involvement. Patients with ischemic changes on ECG were considered as CHD group and those who were negative for changes on ECG were considered as Non CHD group. All necessary data were collected, analyzed

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and disseminated by several program of MS-Office and SPSS version 22.

III. RESULTS

In this study, among Case Group (n=70) total 52 were male which was 74.28% and 18 were female which was 25.71%. Among male participants of Case Group 44.28%, 35.72% and the rest 20.00% were from 51-70, 41-50 and >70 years' age group respectively. On the other hand, Among female participants of Case Group 44.23%, 36.54% and the rest 19.13% were from 51-70, 41-50 and >70 years age group respectively. In regression analysis between male and female participants of Case Group on the basis of age we found the p value was 0.242. So there had not been any significant correlation. In analyzing the age-wise distribution of serum cholesterol concentration between the groups we found, significant correlations between the Case and Control groups in all age groups and the p value were <0.0001 in every age group. On the other hand, in analyzing the age-wise distribution of triglyceride concentration between the groups we found, significant correlations between the Case and Control groups in 41-50 and 51-70 years age groups and in both age groups the p value was found, <0.0001. But in >70 years' age group we did not find any significant correlation and there the P value was 0.478. In analyzing the age-wise distribution of HDL concentration between the groups we found, significant correlations between the Case and Control groups in all age groups and the p value were < 0.0001 in every age group. On the other hand, in analyzing the age-wise distribution of LDL concentration between the groups we found, significant correlations between the Case and Control groups in 41-50 and 51-70 years age groups where the p values were found, <0.0001 and 0.0002 respectively. But in >70 years age group we did not find any significant correlation and there the p value was 0.515.

Table I: Age distribution among the participants of Case Group (n=70)

Age (Yrs.)	Male (M)		Female (F)		Total		p value
	n	%	n	%	n	%	(M-F)
41-50	19	36.54	6	33.33	25	35.72	0.242
51-70	23	44.23	8	44.45	31	44.28	
>70	10	19.13	4	22.22	14	20.00	
Total	52	100	18	100	70	100	

Table II: Age-wise distribution of serum total cholesterol concentration between the groups.

Age (Yrs.)	Case (n=70)		Control (n=41)		p value
	Mean	SD	Mean	SD	
41-50	197.16	28.85	168.92	25.24	< 0.0001
51-70	207.11	18.65	118.75	17.15	< 0.0001
>70	263.91	23.73	193.81	20.88	< 0.0001

Table III: Age-wise distribution of triglyceride concentration between the groups.

Age (Yrs.)	Case (n=70)		Control (n=41)		p value
	Mean	SD	Mean	SD	
41-50	167.13	26.83	109.33	20.44	< 0.0001
51-70	210.71	42.17	125.64	31.71	< 0.0001
>70	152.56	34.64	157.74	37.73	0.4783

Table IV: Age wise distribution of HDL concentration between the groups.

Age (Yrs.)	Case (n=70)		Control (n=41)		p value
	Mean	SD	Mean	SD	
41-50	40.52	5.77	50.71	6.39	< 0.0001
51-70	47.44	5.91	75.32	9.19	< 0.0001
>70	43.73	8.93	86.74	10.48	< 0.0001

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Table V: Age wise distribution of LDL concentration between the groups.

Age (Yrs.)	Case (n=70)		Control (n=41)		p value
	Mean	SD	Mean	SD	
41-50	99.88	20.73	75.87	12.56	< 0.0001
51-70	104.71	21.95	90.11	11.84	0.0002
>70	107.66	22.74	97.82	15.77	0.515

IV. DISCUSSION

The results suggested that in patients with CHD, increased TG was associated with a reduced risk of MACE. Moreover, low HDL-C was associated with an increased risk of MACE, all-cause mortality, and cardiac death. Finally, high lipoprotein (a) was associated with an increased risk of MACE in patients with CHD.CHD refers to a group of a closely related syndrome caused by the imbalance between the myocardial oxygen demand and the blood supply. Depending on the rated severity of coronary artery narrowing and the myocardial response, which is divided into angina pectoris (chest pain), acute myocardial infarction, sudden cardiac death and chronic ischemic heart disease [14]. The most common risk factors of CHD are hypertension [15], smoking, obesity [16], diabetes, stress, gender, age and dyslipidemia [17, 18]. These are high levels of total cholesterol, Tri acyl glycerol's (TAG), low-density lipoprotein cholesterol (LDL-C) and very low-density lipoprotein (VLDL) and with low levels of High density lipoprotein cholesterol (HDL-C) [19] that considered as one of the most common modifiable risk factors for CHD [20].The key role of cholesterol in CHD have given rise to the universally accepted cholesterol-diet-CHD hypothesis. According to this hypothesis, increased plasma cholesterol concentrations increase the risk of CHD and decreasing plasma cholesterol levels decreases the risk of CHD. In our study, in analyzing the age-wise distribution of triglyceride concentration between the groups we found, significant correlations between the Case and Control groups in 41- 50 and 51-70 years age groups and in both age groups the P value was found, <0.0001. But in >70 years' age group we did not find any significant correlation and there the p value was 0.478. In analyzing the age-wise distribution of HDL concentration between the groups we found, significant correlations between the Case and Control groups in all age groups and the p value were <0.0001 in every age group. On the other hand, in analyzing the age-wise distribution of LDL concentration between the groups we found, significant correlations between the Case and Control groups in 41-50 and 51-70 years' age groups where the p values were found, <0.0001 and 0.0002 respectively. But in >70 years age group we did not find any significant correlation and there the p value was 0.515.Clinical studies based on extensive literature supports the inverse relationship between HDL-C levels and atherosclerosis. HDL enhances the reverse cholesterol transport and has anti-oxidative, anti-inflammatory, antithrombotic, and vasoprotective effects [21]. In this study among male participants of Case Group 45%, 36% and the rest 19% were from 51-70, 41-50 and >70 years age group respectively. On the other hand, Among female participants of Case Group 46%, 31% and the rest 23% were from 51-70, 41-50 and >70 years' age group respectively. So middle age may be considered as a potential risk factor. Arteriosclerosis is not clinically evident until middle age or later, when the arterial lesions precipitate the organ injury [22]. The incidence of myocardial infarction increase fivefold between the ages ranging from 40-70 [23]. In addition, men are much prone to develop atherosclerosis and its consequences than women [24]. Myocardial infarction, CHD and atherosclerosis is uncommon in premenopausal women. It is said that, the incidence of atherosclerosis-related disease increases, probably owing to a decrease in natural estrogen levels. Generally, the frequency of myocardial infarction in both sexes equalizes by the seventh to eighth decade of life. Dietary and life style are also potential factors for CHD. Epidemiologic studies have linked the intake of high levels of dietary fat rich in cholesterol and saturated fats, with increased plasma cholesterol levels. Therefore, restriction of saturated fat and cholesterol is the cornerstone of dietary therapy to lower down the elevated blood cholesterol levels [25]. Despite the wide literature on the relationship between lipid and lipoprotein particles to CHD incidence, there has been controversial evidence on the specific association of TAG with CHD. The Framingham study demonstrated that TAGs are independently related in women at all ages but missing statistical significance in the multivariate studies in men. According to two meta-analysis, TAGs were independent risk factors for CHD, even after adjustment with HDL-C, which is strongly and inversely correlated with TG [26]. Studies have

also consistently demonstrated that HDL-C is inversely associated with the risk of CHD. Thus, an increase in HDL-C is linearly associated with a reduction in cardiovascular risk. In line with these findings, present study demonstrated a significant decrease in the HDL-C levels in patients with CHD when compared to controls [27]. The National Cholesterol Education Program (NCEP) recommends an LDL-C goal of<100 mg/dl in patients with established CHD and in those who are CHD risk-equivalent. Aggressive LDL-C reduction is associated with less atherosclerosis progression, lower rates of revascularization, and fewer ischemic events compared with moderate LDL-C reduction or conventional treatment [28]. Finally, we noted LDL-C was not associated with the risk of MACE, all-cause mortality, and cardiac death in CHD patients. The potential reason for this could be CHD patients with strictly lipid profile management strategies to prevent the progression of major adverse cardiovascular outcomes.

V. CONCLUSION AND RECOMMENDATIONS

In this study, it was found that, the total cholesterol, triglycerides and LDL cholesterol concentrations were significantly higher and HDL cholesterol concentrations is significantly lower in coronary heart disease (CHD) patients. Hence we conclude that a regular follow up with lipid profile will helps in reducing the morbidity due to CHD. These findings may be helpful in the treatment arena of CHD and in similar further studies. We had some limitations in this study. This was a single centered study with a small sized sample. So the findings of this study may not reflect the exact scenario of the whole country. For getting more specific information we would like to recommend for conducting more studies in several places with larger sized sample.

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