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COMPARATIVE LIPID PROFILE STUDIES IN CARDIAC AND DIABETIC CONDITIONS

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ABSTRACT

Lipid profile in cardiac patients (myocardial infarction, angina pectoris, coronary heart disease, ischaemic heart disease), diabetic patients and normal humans was investigated. Total serum cholesterol, high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), triglycerides, blood glucose, calcium, potassium and sodium were determined, employing established methods and procedures. Higher level of total cholesterol, LDL-C and triglyceride were found in both cardiac and diabetic patients, however, cardiac patients had much lower level of HDL-C as compared to normal humans. Age wise comparison revealed that level of total cholesterol; triglyceride and LDL-C were elevating while the level of HDL-C were decreasing with the age in cardiac and diabetic patients. Sex wise comparison showed that females had higher HDL-C level than males and therefore had fewer incidences of heart diseases. The level of Ca^{++}, K^{+} and Na^{+} were similar in all age groups and sexes. No significant elevation in the level of these electrolytes was discovered.

INTRODUCTION

Cardiac diseases like myocardiac infarction, angina pectoris, coronary heart disease and ischaemic heart disease are very chronic in nature and have become a common problem. Abnormal lipid metabolism results in cardiac disease such as myocardial infarction, which leads to the death of the heart tissues (Guyton, 1991). In ischaemia there is a lack of oxygen due to less perfusion. Depositions of lipids in arteries lead to atherosclerosis. The arteries are blocked and supply of blood and oxygen become insufficient for the myocardial muscles resulting in ischaemia (Timmis *et al*., 1984). Certain plasma lipoproteins are linked to accelerate the atherogenesis (Nikkilla, 1983).

The heart diseases in all the countries including Pakistan have a relationship with food containing high content of triglycerides and cholesterol. Smoking habits, hypertension and diabetes mellitus also lead to cardiac diseases. Diabetes mellitus is a well known established risk factor for atherosclerosis, coronary heart disease (CHD), stroke and peripheral arterial disease (Nikkilla, 1983).

The most common type of lipid abnormalities encountered in a subject with diabetes mellitus are elevated plasma levels of triglycerides, very low density lipoprotein cholesterol (VLDL-C), low density lipoprotein cholesterol (LDL-C) and lower level of high density lipoprotein cholesterol (HDL-C) (Ramrez *et al.,* 1992). The stabilization of lipoprotein level decreases the incidence of atherosclerosis cardiac heart diseases.

The present research was planned to compare lipid profile amongst cardiac patients, diabetic patients and normal persons to find the effect of lipid in the progression of heart diseases.

MATERIALS AND METHODS

A total of one hundred subjects attending the Cardiac and Diabetic section of the Civil Hospital, D.I. Khan were selected with age ranging between 25-65 and divided in two groups on the basis of their age and sex as following.

40 cardiac patients (20 males and 20 females) 40 diabetic patients (20 males and 20 females) and 20 normal individuals (10 males and 10 females) Group-I ranging from 25-40 years and Group-II from 41-65 years of age in each case.

Complete history of the control was also regarded to exclude any disease. Data concerning dietary habits and smoking was also recorded. The biochemical parameters studied at the Department of Chemistry, Gomal University, D.I. Khan. The duration of the project was one year.

Venous blood samples were withdrawn after an overnight fast of 12-14 hours and sera were separated and stored at $0^{o}C$ till analysis. Biochemical parameters such as total cholesterol concentration, triglycerides, LDL-C, HDL-C and blood glucose in control subjects (normal volunteers), cardiac patients and diabetic patients were measured by enzymatic method using the kits supplied by Randox Laboratories Ardmore United Kingdom. LDL-C was calculated by a modification of the Fridwald formula; LDL cholesterol = Total chlorestrol-triglyceride/5-HDL chlorestrol-0.3LP and VLDL-C by the formula of Wilson (Delong, 1986 and Friedewld *et al.*, 1972).

Calcium ions were determined colarimetrically using O-cresolphthalein as a complexing agent (Zerwekh and Nicar, 1984).

The technique of flamephotometry was used for detecting Na^{+} and K^{+} (Linder and Dworsehak, 1966). Micro Lab-200 (Merck) was also used for the determination of Na^{+} and K^{+}.

The data was expressed as mean ± SEM (standard error of means) which were determined by the formula SEM s/vn. Student "t" test was used to check the significance of data for "t" value (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The results were expressed as mean +SEM and all statistical calculations were made by applying students "t" test and $P>0.05$ was regarded as a significant value between the two groups. Total cholesterol level in control subjects, cardiac and diabetic patients of age group-I ranging from 25-40 and Group-II from 41-65 years were determined and shown in Table-1.

Statistical evaluation of the indicated high difference in cholesterol level among the cardiac and diabetic patients when compared with the controls ones. Which is according to Murray *et al.* (1990), and the normal range for total cholesterol should be 150-200 mg dl^{-1}. In case of age group I and II the data showed that the cardiac patients had high cholesterol level than in the diabetic patients. The level of the cholesterol was in the order of Cardiac > Diabetic > Control subjects. Moreover, in age group-I the cholesterol level in cardiac as well as in diabetic patients had high cholesterol level in males than in the females, whereas in age group-II the cardiac patients had high cholesterol level in males than in the females and the diabetic patients had low cholesterol level than in the females.

Table 1
Variation of total cholesterol level of control subjects cardiac and diabetic patients of age Group-I and age Group-II

Total Cholesterol mg d1^{-1}	**Age Group-I (25-40 years)**		**Age Group-II (41-65 years)**	
Sex	**Male**	**Female**	**Male**	**Female**
Control Subjects	170.60 ± 3.24	135.88 ± 3.02	167.67 ± 4.91	175.66 ± 3.88
Cardiac Patients	*208.35 ± 2.45	*215.29 ± 3.31	*260.04 ± 2.70	*248.02 ± 4.36
Diabetic Patients	*200.66 ± 2.56	*154.79 ± 2.61	*172.84 ± 1.81	*193.83 ± 2.93

*P>0.05 statistically significant as compared to control subjects.

The results also indicated an increase in the cholesterol level with age, which could be observed in all the case of cardiac, diabetic and control subjects. It has been reported that hypercholestermia with little or no elevation of triglycerides is due to high LDL-C level and that the co-existence of an underlying genetic defect or the development of a disorder that affects LDL-C level may cause a greater increase in plasma cholesterol with age than any other factor. The main disorder that may produce a secondary increase in plasma LDL-C and total cholesterol level are hypothyroidism, diabetes millets, and nephrotic syndrome (Zilva *et al.,* 1992).

As shown in Table-2, significantly elevated values of triglycerides were observed in cardiac as well as in the diabetic patients as compared to the normal control persons. Moreover, triglycerides level was relatively less in the diabetic than those of cardiac patients, in male as well as in the female groups. The normal range of triglyceride concentration in serum is 50-160 mg dl^{-1} and the hyperglyceridemia may be due to increased VLDL-C or chylomicron or some other factors. The elevated triglyceride level (hyperglyceridemia) is usually secondary to other disorders of which the most common are obesity, diabetes mellitus, hypothyroidism, renal failure, estrogen therapy, oral contraceptives, etc (Murray *et al.,* 1990).

Table 2
Variation of Triglyceride in control subjects, cardiac and diabetic patients of age Group-I and age Group-II

Triglyceride mg d1^{-1}	**Age Group-I (25-40 years)**		**Age Group-II (41-65 years)**	
Sex	**Male**	**Female**	**Male**	**Female**
Control Subjects	124.62 ± 2.22	108.17 ± 2.25	148.53 ± 2.92	139.33 ± 2.44
Cardiac Patients	*220.29 ± 2.68	*203.04 ± 2.86	*252.56 ± 3.35	*200.31 ± 2.76
Diabetic Patients	*179.22 ± 2.49	*144.15 ± 2.35	*171.05 ± 1.81	*165.86 ± 2.77

*P<0.05 statistically significant as compared to control subject.

Table-3 significantly reduced level of HDL-C were present in both male and female cardiac as well diabetic patients of the both age groups when compared with those of the control (see

Table-3) group. Moreover, women have higher HDL-C level than men in all the groups. It has been reported (Voet and Voet, 1990) that lower level of serum HDL-C are associated with increased risks of developing coronary heart diseases. Cardiovascular diseases are correlated with high levels of LDL-C and lower levels of HDL-C. The higher plasma HDL-C levels are straggly correlated with lower incidence of cardiovascular disease (Sasaki, 1984). As women have higher HDL-C level than men therefore, they are less prone to various heart diseases.

Table 3
Variation of HDL-C and LDL-C in control subjects, cardiac and diabetic patients of age Group-I and age Group-II

HDL-C mg dl^{-1}	**Age Group-I (25-40 years)**		**Age Group-II (41-65 years)**	
Sex	**Male**	**Female**	**Male**	**Female**
Control Subjects	63.43 ± 1.86	67.39 ± 2.47	67.38 ± 2.63	69.49 ± 2.89
Cardiac Patients	34.71 ± 1.97	43.05 ± 2.38	37.27 ± 2.46	45.61 ± 2.58
Diabetic Patients	47.32 ± 2.21	53.73 ± 2.34	47.88 ± 2.25	52.92 ± 3.03
HDL-C mg dl^{-1}	**Age Group-I (25-40 years)**		**Age Group-II (41-65 years)**	
Sex	**Male**	**Female**	**Male**	**Female**
Control Subjects	106.61 ± 2.04	188.26 ± 2.97	111.59 ± 1.93	87.49 ± 3.04
Cardiac Patients	*207.94 ± 2.01	*188.73 ± 2.95	*228.18 ± 3.02	*213.62 ± 3.01
Diabetic Patients	*141.29 ± 2.57	*137.24 ± 1.94	*125.13 ± 2.12	*152.99 ± 2.17

*P<0.05 statistically significant as compared to control subjects.

As well as in Table-3 shows significantly higher values of LDL-C in case of cardiac diabetic patients as compared to the control group, which further increases with an increase in the age of the persons. This is in agreement with the above discussion. The diet consisting of saturated fats also raises the level of LDL-C, as the VLDL-C carries endogenous lipid from the liver to the cells and LDL-C formed in this way are carried into the cells which causes an elevation in the plasma LDL-C level. Approximately 80% of the cholesterol in the blood is carried out as LDL-C and a strong correlation exists between the blood levels of LDL-C and heart diseases. That is why higher LDL-C level are observed in the cardiac patients as compared to normal one.

It can be seen from the Table-4 that diabetic patients have significantly higher level of blood glucose, however there is no significant difference in the blood glucose level of cardiac patients and the control groups, irrespective of the age and sex. It is well known that diabetic mellitus is a well established risk factor for arteriosclerosis, coronary heart diseases, stroke and peripheral arterial diseases. Lipid disorders are very common in both insulin dependent and non-insulin dependent diabetic mellitus. Hypertriglyceridemia has long been recognized as the typical lipid disorder of diabetic (Albrink, 1974). It appears that there were two mechanisms for the development of hypertriglyceridemia in absolute insulin deficiency, associated with the development of ketoacidosis in IDDM. It is due to the defective removal of triglyceride from plasma as a result of a decrease in lipoprotein lipase activity (Weiland *et al*., 1980). The most common type of lipid abnormality encountered in a subject with diabetic mellitus are elevated

levels of triglycride and LDL-C, however it is not necessary that a cardiac patient may essentially be a diabetic patient, too.

Table 4
Variation of blood glucose level in control subjects, cardiac and diabetic patients of age Group-I and age Group-II

Blood Glucose mg dl^{-1}	**Age Group-I (25-40 years)**		**Age Group-II (41-65 years)**	
Sex	**Male**	**Female**	**Male**	**Female**
Control Subjects	101.15 ± 2.37	102.34 ± 3.41	107.57 ± 2.25	97.86 ± 2.72
Cardiac Patients	105.59 ± 2.63	104.40 ± 2.40	103.94 ± 2.31	100.75 ± 2.29
Diabetic Patients	*192.10 ± 2.47	*143.89 ± 2.10	*189.14 ± 2.52	*203.66 ± 2.01

*P<0.05 statistically significant as compared to control subjects.

With a few exceptions for Na^{+}, no significant difference was found in the blood level of Ca^{++}, K^{+} and Na^{+} among the normal persons, cardiac patients and diabetic patients of either age or sex, as shown in Table 5. This indicates that although higher blood level of Na^{+} may have some role in the cardiac and/or diabetic diseases, the blood level of electrolytes like Ca^{++}, K^{+} do not seem to have a significant role in these diseases.

Table 5
Variation of blood Ca^{++}, K^{+}, Na^{+} levels in control subjects, cardiac and diabetic patients of age Group-I and age Group-II

Age Group years	**Sex**	**Control**	**Cardiac**	**Diabetic**
Average Ca^{++} levels in blood				
25-40	Male	8.83	8.83	8.34
	Female	8.56	8.51	8.85
41-65	Male	8.26	9.29	8.41
	Female	8.98	8.25	8.76
Average K^{++} levels in blood				
25-40	Male	4.90	4.52	4.44
	Female	4.28	4.31	4.32
41-65	Male	4.49	4.21	4.32
	Female	4.29	4.44	4.54
Average Na^{+} levels in blood				
25-40	Male	138.20	141.61	141.27
	Female	140.54	142.18	142.53
41-65	Male	141.55	142.65	144.45
	Female	139.36	142.28	141.74

P<0.1 statistically non significant as compared to control subjects.

CONCLUSION

Comparing the lipid profile investigation of cardiac patients, diabetic patients and normal persons, it is concluded that as compared to normal persons, both the cardiac and diabetic patients have elevated level of total cholesterol, triglyceride and LDL-C, but lower level in HDL-C the age dependent manner.

Females have higher HDL-C level than men and therefore they are less prone to cardiac diseases. No significant elevation in the blood level of Ca^{++}, K^{+} and Na^{+} was discovered in cardiac as well as in diabetic patients.

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