Original Article

PLASMA LIPID ALTERATIONS IN LEUKEMIA PATIENTS

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ABSTRACT

Neoplastic disease indicates a disease of new growth. Neoplasms or tumors may be divided into two categories; benign tumors and malignant tumors. Benign tumors are relatively innocent and remain localized. Malignant tumors are also called cancers and are distinguished from benign tumors by the properties of invasiveness and metastasis. Cancer of the leukocytes and their precursors is known as leukemia. Triglycerides, cholesterol, LDL-cholesterol and HDL-cholesterol constitute plasma lipid profile. Objective of the present study was to investigate relationship of plasma lipid profile (Triglycerides, Cholesterol, LDL-Cholesterol and HDL-Cholesterol) with leukemia. 180 subjects were included in the study. The subjects comprised of two groups; first as Controls (90 in number) and the second as Patients of Leukemia (also 90 in number). Fasting blood samples were collected for estimation of plasma lipid levels. Comparison between mean values of plasma lipid profile of control subjects and leukemia patients indicated that there was moderate decrease in all plasma levels of leukemia patients: triglycerides (31.29%, $P < 0.01$), cholesterol (27.15%, $P < 0.01$), LDL-cholesterol (23.28%, $P < 0.01$) and HDL-cholesterol (24.70%, $P<0.05$). As there is a change in plasma lipid profile of leukemia patients, the plasma lipid profile may be used as adjuvant for identification of the disease along with the standard diagnostics tools.

Key words: Cancers, Leukemia, Plasma lipid profile, Triglycerides, Cholesterol, LDL-Cholesterol and HDL-Cholesterol

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INTRODUCTION

Neoplastic disease indicates a disease of new growth. Fundamental to the origin of all neoplasms is loss of normal growth control. Neoplasms seem to behave as parasites and compete with normal cells and tissues for their metabolic need. A neoplasm is often referred to as a tumor. All tumors have two basic components: the parenchyma; made up of neoplastic cells, and the stroma; made up of non-neoplastic connective tissues and blood vessels.

Neoplasms or tumors may be divided into two categories; benign tumors and malignant tumors. Benign tumors are relatively innocent and remain localized. Malignant tumors are also called cancers and are distinguished from benign tumors by the properties of invasiveness and metastasis. Malignant tumors can be further classified into four major classes: carcinomas, sarcomas, lymphomas and leukemias. Cancers of epithelial cells are known as carcinomas, cancers of connective tissues are known as sarcomas, cancers of lymphoid tissues are known as lymphomas and the cancers of the leukocytes and their precursors is known as leukemias [1].

Lipids are heterogeneous group of compounds that provide energy to the body. Cholesterol and triglycerides, important lipid constituents of cell, are essential to carry out several vital physiological functions. Cholesterol is essential for maintenance of the structural and functional integrity of all biological membranes. Lipids are relatively insoluble in water. Thus they are carried in body fluids as soluble protein complexes known as lipoproteins. Low density lipoproteins (LDL) are responsible for the transport of cholesterol from liver to the cells and high density lipoproteins (HDL) are involved for the transport of cholesterol from cells to the liver [2, 3]. Triglycerides, cholesterol, LDL-cholesterol and HDL-cholesterol constitute plasma lipid profile [4, 5]. Workers have tried to investigate an association of plasma/serum lipids and lipoproteins with different cancers [6-9].

The objective of the present study was to investigate any relationship between plasma lipid profile (Triglycerides, Cholesterol, LDL-Cholesterol and HDL-Cholesterol) and leukemia.

MATERIALS AND METHODS

STUDY DESIGN

A prospective study was carried out in 180 individuals. Out of them 90 were control subjects, 45 males and 45 females; who had no complaint or any major illness in recent past. They were close relatives of the patients accompanying them during their hospitalization. The remaining 90 were patients of leukemia.

Selection Criteria: Only those patients were selected for the study that do not had a history of thyroid disease, diabetes or other major illness that could affect lipid metabolism. These patients were not treated with any chemotherapy, radiation or surgery before the sample collection.

Sample Collection: Blood samples were collected from Combined Military Hospital, Rawalpindi, Pakistan and NORI Hospital, Islamabad, Pakistan. The patients were fasted overnight before the sample collection. The plasma was stored at -20 ^{o}C and levels of plasma lipids were estimated within the 48 hours of sample collection.

ESTIMATION OF PLASMA LIPID PROFILE

Plasma levels of triglycerides, total cholesterol, LDL-cholesterol and HDL-cholesterol were estimated by using spectrophotometer. The method was used by Qadir *et al*. (2006, 2007, 2008) for estimation of plasma lipids [7-9].

TRIGLYCERIDES:

Triglycerides were determined by enzymatic method (GPO-PAP Method), using the commercially available kit manufactured by Human, Germany.

Procedure

Three Cuvettes were washed with distilled water and were labeled Blank, standard and sample. 20 µl distilled water, 20 µl standard and 20 µl sample, was pipetted in each cuvette respectively. Chromogen reagent, 2 ml was added to each cuvette. Contents of all the cuvettes were mixed thoroughly and incubated for 5 minutes at room temperature. The wavelength of spectrophotometer was set at 500 nm. Result command was given to spectrophotometer and after some time results were displayed. The blood triglycerides levels were calculated by applying the following formula.

$$\text{Triglycerides mg/dl} = \frac{\text{Absorbance of sample}}{\text{Absorbance of standard}} \times 200$$

TOTAL CHOLESTEROL:

Rapid enzymatic determination of the total cholesterol by CHOD-PAP method (10), was performed by using the commercially available kit manufactured by Human, Germany.

Procedure

Three Cuvettes were washed with distilled water and were labeled blank, standard and sample. 20 µl distilled water, 20 µl standard and 20 µl sample was pipetted in each cuvette respectively. Chromogen reagent, 2 ml was added to each cuvette. Contents of all the cuvettes were mixed thoroughly and incubated for 5 minutes at 37°C. The wavelength of spectrophotometer was set at 500 nm. Result command was given to spectrophotometer and after some time results were displayed. The blood cholesterol levels were calculated by applying the following formula.

$$\text{Cholesterol mg/dl} = \frac{\text{Absorbance of sample}}{\text{Absorbance of standard}} \times 200$$

LDL-CHOLESTEROL:

LDL-cholesterol was determined by precipitation method. Tests were performed by using the commercially available kit manufactured by Randox, Germany.

Procedure

For sample preparation; 100 µl sample and 1000 µl precipitant were placed in a tube. After through mixing the tube was allowed to stand for 15 minutes at room temperature and then was centrifuged at 1500 rpm for 15 minute. Supernatant was separated from the sediment and cholesterol was measured by the CHOD-PAP method. The LDL-cholesterol levels were calculated by applying the following formula.

LDL-cholesterol mg/dl = Total cholesterol – Cholesterol in supernatant.

HDL-CHOLESTEROL:

HDL-cholesterol was determined by using the commercially available kit manufactured by Randox, Germany.

Procedure

For sample preparation; 200 µl sample and 500 µl precipitant were placed in a tube. After through mixing the tube was allowed to stand for 10 minutes at room temperature and then was centrifuged at 4000 rpm for 10 minute. Supernatant was separated from the sediment and cholesterol was measured by the CHOD-PAP method.

STATISTICAL ANALYSIS

Computer program SPSS 11.0 version was used for statistical analyses. Student t-test was performed to compare mean values of the parameters. "*P*" value < 0.05 was considered to be statistically significant.

RESULTS

In the present study, plasma level of Triglycerides in control males was between 130-138 mg/dl with a mean value of 144.27±4.21. Plasma level of Cholesterol in control males was between 133-213 mg/dl with a mean value of 173.42±9.34. Plasma level of LDL-Cholesterol in control males was between 58-89 mg/dl with a mean value of 70.47±8.82. Plasma level of HDL-Cholesterol in control males was between 34-66 mg/dl with a mean value of 48.90±7.54.

Plasma level of Triglycerides in control females was between 125-179 mg/dl with a mean value of 152.18±7.06. Plasma level of Cholesterol in control females was between 135-205 mg/dl with a mean value of 170.93±8.47. Plasma level of LDL-Cholesterol in control females was between 52-95 mg/dl with a mean value of 72.16±10.05. Plasma level of HDL-Cholesterol in control females was between 40-71 mg/dl with a mean value of 50.30±5.23.

Comparison between mean values of plasma lipid profile of control males and control females showed statistically no significant difference. Thus mean of the two were taken as reference values. The reference value for triglycerides is 148.22±5.64 mg/dl, for cholesterol is 172.18±8.90 mg/dl, for LDL-cholesterol is 71.32±9.44 mg/dl and for HDL-cholesterol is 49.60±6.38 mg/dl.

In leukemia patients, plasma level of Triglycerides was between 64-155 mg/dl with a mean value of 101.83±5.33. Plasma level of Cholesterol was between 89-147 mg/dl with a mean value of 125.44±9.12. Plasma level of LDL-Cholesterol was between 36-66 mg/dl with a mean value of 54.71±7.21. Plasma level of HDL-Cholesterol was between 27-48 mg/dl with a mean value of 37.35±3.25.

Comparison between mean values of plasma lipid profile of control subjects and Leukemia patients is given in Table 1. There is moderate decrease in all plasma levels of Leukemia patients: triglycerides (31.29%, $P < 0.01$), cholesterol (27.15%, $P < 0.01$), LDL-cholesterol (23.28%, $P < 0.01$) and HDL-cholesterol (24.70%, $P<0.05$).

Table1: Plasma Lipid Profile of Control Subjects & Patients of Leukemia (Mean ± SD)

	Triglycerides (mg/dl)	Cholesterol (mg/dl)	LDL-Cholesterol (mg/dl)	HDL-Cholesterol (mg/dl)
Control Subjects	148.22±5.64	172.18±8.90	71.32±9.44	49.60±6.38
Leukemia Patients	101.83±5.33*	125.44±9.12*	54.71±7.21*	37.35±3.25**

* $P < 0.01$ as compared to control
** $P<0.05$ as compared to control

Graphical representation of comparison between mean values of plasma lipid profile of control subjects and leukemia patients is given in figure 1.

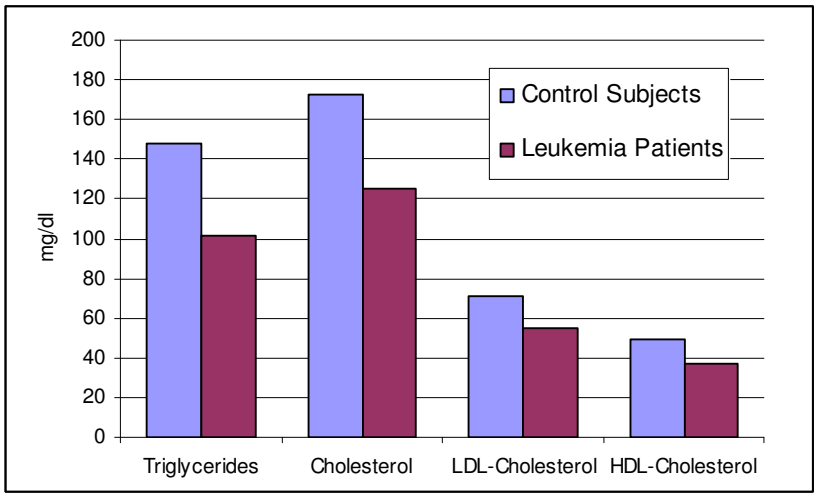

Figure 1: Comparison between plasma lipid profile of control subjects and leukemia patients

DISCUSSION

Several studies of plasma lipid alterations in animals with neoplasm have been conducted [11, 12]. The first correlation between plasma lipids and human malignancy was reported in women with breast cancer [13, 14]. The return of plasma lipids and lipoproteins towards normal limits during remission confirms the correlation of lipid alterations with primary disease activity [15, 16].

The results of our study suggest that all the plasma lipid components (triglycerides, cholesterol, LDL-cholesterol and HDL-cholesterol) of leukemia patients showed significant decrease, when compared with the normal control subjects. $P<0.01$ for triglycerides, cholesterol and LDL-cholesterol; and $P<0.05$ for HDL-

cholesterol were observed. These results are also in agreement with the reports of Musolino *et al.*, 2002 [17].

The patho-physiologic mechanism implicated in plasma lipid alterations during neoplasm has not been determined. Lipids are major cell membrane components essential for various biological functions including cell growth and division of normal and malignant tissues. Low levels of cholesterol in the proliferating tissues and in blood compartments could be due to the process of carcinogenesis.

CONCLUSION

This study has shown that plasma lipid levels are decreased in leukemia patients. As there is a change in plasma lipid profile of leukemia patients, the plasma lipid profile may be used as adjuvant for identification of the disease along with the standard diagnostics tools.

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