COMPARISON OF LIPID PROFILE OF OBESE AND NON-OBESE TYPE 2 DIABETES MELLITUS PATIENTS.

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ABSTRACT: *The present study was conducted to observe the effect of diabetes on lipid profiles in obese and non-obese type 2 diabetes mellitus (T2DM) patients and their comparison with control subjects. The blood samples of obese and non-obese T2DM patients were collected from Services Hospital Lahore and blood samples of control subjects were collected from different areas of Lahore. The study included 67 obese T2DM patients, 20 control subjects and 68 non-obese T2DM patients, 26 control subjects. All samples were tested by enzymatic photometric assay technique to estimate the levels of serum cholesterol, triglycerides, and HDL-C, LDL-C, VLDL-C, and total lipids. It was found that the levels of serum cholesterol, serum triglycerides, and LDL-C, VLDL-C and total lipids were significantly higher in obese T2DM patients and non-significantly higher in non-obese T2DM patients, while levels of serum HDL-C was significantly lower in obese T2DM patients and non-significantly lower in non-obese T2DM patients. Results were discussed in light of previous reports of different populations. These results suggested that T2DM patients are more prone to develop hyperlipidemia, particularly obese T2DM patients, and it can predispose these patients to develop atherosclerosis and other complications of cardiovascular disease.*

Key Words: Obesity, T2DM, Lipid profile**.**

INTRODUCTION

Diabetes mellitus is the syndrome of impaired carbohydrate, fat, and protein metabolism caused by either lack of insulin secretion or decreased sensitivity of the tissues to insulin [1]. Diabetes mellitus is the most common metabolic disorder all over the world. In the United States, 5.9% of the population has diabetes. More than 171 million people globally are affected by DM [2]. The incidence of DM is showing an alarming rise in developing countries. The relative prevalence of diabetic patients in the UK by classification is T1DM 25% of cases, T2DM 70% of cases, types 3&4 DM 5% of cases [3]. It is thought that 20000 people per year die prematurely because of diabetes-associated disease. The number of people dying prematurely in the diabetic population is double that of the non-diabetic population [4]. Uncontrolled diabetes with increased blood glucose is strongly correlated to causing long-term microvascular complications such as nephropathy, retinopathy, neuropathy, muscular dystrophy and atherosclerosis [5-9].

T2DM is strongly associated with higher body weight or obesity [1]). T2DM also called obesity dependent diabetes mellitus or diabesity [10]. T2DM arises as a result of beta-cell failure combined with associated insulin resistance [11]. Free fatty acids (FFA) and obesity in T2DM plays an important role in the development of insulin resistance and beta (β) cell dysfunction. Elevated FFAs concentrations are linked with the onset of peripheral and hepatic insulin resistance. Adipocytokines have an important role in the development of obesity-related T2DM. Adipocyte releases fatty acids, mediators of inflammation and various adipocytokines [12,13]. Important adipocytokines in this regard include leptin, adiponectin, resistin, and visfatin [12,14].

Lipid profile of obese and non-obese T2DM patients has been described in many previous studies and compared with control subjects. Some previous studies demonstrated that the levels of TC, TG, LDL-C increased and the level of HDL-C decreased in obese and non-obese T2DM patients as compared to control subjects [15-18]. However, other studies demonstrated that the levels of TG increased while levels of TC, LDL-C, and HDL-C decreased in obese and non-obese T2DM patients as compared to control subjects [19]. Another study demonstrated that the levels of TC and LDL-C increased and levels of HDL-C and TG decreased in obese T2DM patients as compared to control subjects [20]. The aim of the present study was to observe the variations in the lipid profile of obese and non-obese T2DM patients compared to control subjects in our local population.

MATERIALS AND METHODS

The present study was based on 67 obese T2DM patients, 20 control subjects and 68 non-obese T2DM patients, 26 control subjects having the age of 25 to 70 years. Blood samples were taken in the fasting state of each of the T2DM patients from services hospital Lahore Pakistan and control subjects from the different areas of Lahore. The patients of diagnosed cases of T2DM were taken for study. According to the WHO Report 2012 [21], BMI was calculated as kg/m^2 using the information of height and weight at the time of blood sample collection. The subjects having BMI $\geq$ 30 kg/m^2 were considered obese and the subjects having BMI $\leq$ 30 kg/m^2 were considered as non-obese. The venipuncture method was used to draw the blood of diabetics and healthy subjects. Blood samples were allowed to clot for 20-25 minutes and then for the separation of serum, they were centrifuged at 4000 rotations per minute. The serum was separated out from the top of the clotted blood and then used. Glucose determined by enzymatic reaction (glucose oxidase and peroxidase = GOD-POD) [22]. Serum total cholesterol was determined by an enzymatic (CHOD-PAP) colorimetric method [23]. Triglycerides were determined by an enzymatic (GPO-PAP) method [24]. HDL-cholesterol was estimated by a precipitant method [25]. LDL-cholesterol was estimated by using Friedewald formula [LDL-cholesterol = Total cholesterol – (HDL cholesterol + Triglycerides/5)] [26]. To get the value of VLDL-C, if triglycerides are less than 100 then it was divided by factor 5. And if serum triglycerides value is greater than 100 then it was multiplied by 0.16 to get the value of VLDL-C in blood serum. Mean ± S.D of serum samples of obese and non-obese T2DM patients and their control subjects were calculated. Statistical analysis of the data was carried out by

employing a Student 't' test. The 'P' value of less than 0.05 was considered significant.

RESULTS

The study included 67 obese T2DM patients, 20 control subjects and 68 non-obese T2DM patients, 26 control subjects. The age ranges from 25 to 70 years for T2DM patients and control subjects.

Table 1. Comparison of lipid levels of obese T2DM patients and control subjects.

Lipids	Obese T2DM	Control	P value
Cholesterol	117.85 ± 4.49	193.94 ± 15.33	< 0.001
Triglyceride	161.05 ± 3.10	209.68 ± 12.50	< 0.05
HDL-C	47.65 ± 1.60	41.50 ± 3.80	< 0.01
LDL-C	110.60 ± 5.08	167.53 ± 11.04	< 0.01
VLDL-C	32.21 ± 1.96	42.43 ± 2.57	< 0.001
Total Lipid	560.16 ± 22.25	678.94 ± 18.96	< 0.01

Table 2. Comparison of lipid levels of non-obese T2DM patients and control subjects.

Lipids	Non-obese T2DM	Control	P value
Cholesterol	178.07 ± 7.86	179.22 ± 4.86	> 0.05
Triglyceride	157.69 ± 9.61	171.30 ± 12.54	> 0.05
HDL-C	44.96 ± 1.56	40.64 ± 2.72	> 0.05
LDL-C	105.19 ± 11.95	107.59 ± 6.06	> 0.05
VLDL-C	31.90 ± 1.98	34.81 ± 2.60	> 0.05
Total Lipid	567.63 ± 22.27	600.40 ± 21.24	> 0.05

Table 1 shows the mean values with the standard error of various lipid fractions of obese T2DM patients and controls subjects. Mean total cholesterol levels in obese T2DM patients were higher as compared to control subjects (193.94 vs 117.85 mg/dl, $P < 0.001$). Mean TGs levels in obese T2DM patients were higher as compared to control subjects (209.68 vs 161.05 mg/dl, $P < 0.05$). Mean HDL-C levels in obese T2DM patients were lower as compared to control subjects (41.5 vs 47.65 mg/dl, $P < 0.01$). Mean LDL-C levels in obese T2DM patients were higher as compared to control subjects (167.53 vs 110.6 mg/dl, $P < 0.01$). Mean VLDL-C levels in obese T2DM patients were higher as compared to control subjects (42.43 vs 32.21 mg/dl, $P < 0.001$). Mean total lipid levels in obese T2DM patients were higher as compared to control subjects (678.94 vs 560.16 mg/dl, $P < 0.01$).

Table 2 shows the mean values with a standard error of various lipid fractions of non-obese T2DM patients and control subjects. Mean total cholesterol levels in non-obese T2DM patients were higher as compared to control subjects (179.22 vs 178.07 mg/dl, $P > 0.05$). Mean TGs levels in non-obese T2DM patients were higher as compared to control subjects (171.30 vs 157.69 mg/dl, $P > 0.05$). Mean HDL-C levels in non-obese T2DM were lower as compared to control subjects (40.64 vs 44.96 mg/dl, $P > 0.05$). Mean HDL-C levels in non-obese T2DM patients were higher as compared to control subjects (107.59 vs 105.19 mg/dl, $P > 0.05$). Mean VLDL-C levels in non-obese T2DM patients were higher as compared to control subjects (34.81 vs 31.9 mg/dl, $P > 0.05$). Mean total lipid levels in non-obese T2DM patients were higher as compared to control subjects (600.40 vs 567.63 mg/dl, $P > 0.05$).

DISCUSSION

The present study was conducted to observe the complete lipid profile (serum total cholesterol, triglycerides, HDL-C, LDL-C, VLDL-C, and total lipid) in obese and non-obese type 2 diabetes mellitus (T2DM) patients and their comparison with control subjects.

Our results indicated that fasting serum levels of total cholesterol, triglycerides, LDL-C, VLDL-C, and total lipids were significantly higher and levels of HDL-C were significantly lower in obese T2DM patients as compared to control subjects. Our results also indicated that fasting serum levels of total cholesterol, triglycerides, LDL-C, VLDL-C, and total lipids were non-significantly higher and levels of HDL-C were non-significantly lower in non-obese T2DM patients as compared to control subjects. These results are comparable with some previous studies which described higher levels of total cholesterol, triglycerides, LDL-C, VLDL-C, and total lipid and lower levels of HDL-C in obese T2DM patients as compared to control subjects [27-31] and in non-obese T2DM as compare to control subjects [32].

Higher levels of cholesterol in T2DM patients are due to insulin resistance. Insulin resistance in T2DM patients occurs as a result of other acquired or genetic conditions that impair insulin signaling in peripheral tissues concentration of glucose. The excess of fatty acids in the plasma associated with insulin resistance also promotes the liver conversion of some of the fatty acids into cholesterol [1]. The other possible reasons for higher levels of cholesterol are obesity, increase calorie intake, lack of muscular exercise and inhibition of cholesterol catabolism in obese T2DM patients [33-35].

An increase in triglycerides levels in obese T2DM patients is due to insulin deficiency which results in faulty glucose utilization, causes hyperglycemia and mobilization of fatty acids from adipose tissue. In obese T2DM patients, blood glucose is not utilized by tissue resulting in hyperglycemia. The fatty acid from adipose tissue is mobilized for energy purpose and excess fatty acid is accumulated in the liver, which is converted to triglyceride, hence levels of triglyceride rise in T2DM patients [36]. Higher levels of serum triglycerides in obese T2DM patients are due to obesity [33-35].

Genetic factors and obesity are the reasons for lower HDL-C in T2DM patients. People having T2DM have increased the risk of having abnormal lipids increases the risk of cardiovascular disease. Lower HDL-C is associated with insulin resistance. As insulin resistance develops and progresses in a person with T2DM the levels of HDL-C decrease [1].

Insulin resistance causes a rise in LDL-C in T2DM patients. Insulin increases the number of LDL receptor, so chronic insulin deficiency might be associated with a diminished level of LDL-C receptor, that causes the increase in LDL-C particles and results in the increase in LDL-C value in T2DM patients (Suryawanshi *et al.*, 2006). The higher levels of LDL-C in obese T2DM patients are due to obesity [33-35]. LDL-C can build up on the walls of our arteries and increase our chance of getting heart disease. It is also referred to as bad cholesterol [37].

Two factors may increase VLDL-C production in T2DM patients in the liver the return of more fatty acids due to

increased actions of hormone-sensitive lipase in adipose tissue and insulin action directly on apoB synthesis [1].

The higher levels of total lipids in obese T2DM patients are due to obesity [33-35]. The contribution of lipids to energy expenditure was higher in obese humans, resulting in a decrease in carbohydrate metabolism which may lead to alterations in glucose tolerance [38].

CONCLUSION:

T2DM patients are more prone to develop hyperlipidemia, particularly obese T2DM patients, and hyperlipidemia can predispose patients to develop atherosclerosis and their complications of cardiovascular diseases. Good glycemic control can prevent the development and progression of common lipid abnormalities in T2DM patients like raised cholesterol, TGs, LDL-C, VLDL-C, total lipids, and low HDL-C.

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