Original Article

Dyslipidemia in Type 2 Diabetes Mellitus: A Case-Control Study

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ABSTRACT

Objective: To compare lipid parameters among cases having diabetes mellitus with healthy individuals.

Study Design: Case-control study

Place and Duration of Study: This study was conducted at the Department of Biochemistry, Quaid-e-Azam Medical College, Bahawalpur from August 2019 to January 2020.

Materials and Methods: A total of 40 confirmed cases of type-2 DM aged 18 to 60 years were enrolled for this study. An exact number of gender and age matched healthy controls were also included in this study. Body mass index, waist/hip ratio along with fasting plasma glucose and 2-hour postprandial glucose levels were calculated for all study participants. Serum cholesterol, serum triglyceride, serum very low density lipoprotein (VLDL), serum low density lipoprotein (LDL) and serum high density lipoprotein (HDL) levels were measured for all study participants.

Results: Significantly higher mean BMI (kg/m^2) was recorded among cases in comparison to controls (25.47+1.62 vs. 23.17+1.92, p<0.0001). Mean fasting plasma glucose (mg/dl) was significantly higher among cases (138.12+14.54 vs. 88.61+4.84, p<0.0001). Mean 2-hour postprandial glucose (mg/dl) was also significantly high among cases (171.14+24.6 vs. 124.50+11.8, p<0.0001). Among cases, mean serum cholesterol (mg/dl), mean serum triglyceride (mg/dl), mean serum VLDL (mg/dl) and mean serum LDL (mg/dl) were significantly raised while mean serum HDL (mg/dl) was significantly lower among cases when compared to controls (48.41+6.2 vs. 76.1+4.8, p<0.0001).

Conclusion: Significantly higher BMI were found among cases with diabetes mellitus type-2. Among patients with diabetes mellitus type-2, lipid parameters were significantly deranged.

Key Words: Diabetes mellitus, lipid parameters, BMI, plasma glucose

INTRODUCTION

In 2019, International Diabetes Federation (IDF) estimated around 463 million people to be living with diabetes mellitus (DM) worldwide.[1] IDF also projected this number to go up around 700 million by the year 2045. Pakistan is estimated to have more than 27 million adult cases of DM. [2]

DM is a chronic disease associated with high rates of mortality and increased risk for cardiovascular disease (CVD) because of different vascular etiologies.[3] Among patients with diabetes, CVD increases the risk of death as 2-4 folds when compared to those without DM.[4,5]

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Along with controlling blood glucose levels, keeping associated risk factors like blood-pressure, dyslipidemia, body weight and smoking in check is really important.[6] Comprehensive management of different cardiovascular risk factors among patients having DM have been found to decrease the risk of CVD up to 53% so it is vital to control these factors among patients with DM.[7]

Dyslipidemia has been known to be the most important risk factor for atherosclerosis and CVD irrespective of the presence of DM.[8] Insulin has substantial effects on vital steps regarding synthesis and metabolism of lipids and lipoproteins whereas lipids and lipoproteins are known to be deranged among individuals having DM which could be the reason why these individuals are at high risk of progressing into dyslipidemia.[9] Dyslipidemia is a crucial contributing entity to cardiovascular complications among patients of DM. Lipid abnormalities in DM might be depicted in the form of hypertriglyceridemia and decreased levels of high density lipoprotein cholesterol (HDL-C). This comparative study was planned to evaluate fasting plasma glucose and 2h-postprandial glucose along with lipid parameters among patients of DM.

MATERIALS AND METHODS

This case-control study was conducted at Department of Biochemistry, Quaid e Azam Medical College, Bahawalpur, from August 2019 to January 2020. A total of 40 confirmed cases of type-2 DM aged 18 to 60 years were enrolled for this study. Any patients using insulin or cholesterol lowering drugs were excluded. An exact number of gender and age matched healthy controls were also included in this study. None of the controls had diabetes, atherosclerosis, thrombotic disorders or ischemic heart disease. Approval from institutional ethical committee was sought for this study. Informed consent was taken from all the study persons and assurance was made for the confidentiality of the data acquired for the purpose of this study.

Body mass index and waist/hip ratio was estimated for all study participants. Blood samples as 5ml were collected in the morning for biochemical assay following a fasting period of at least 12 hours. Two-hour postprandial blood sample was taken after 120 minutes post-meal. Serum cholesterol, serum triglyceride, serum very low density lipoprotein, low density lipoprotein and high density lipoprotein levels were measured for all study participants. Institutional laboratory was used for all laboratory investigations.

SPSS version 26.0 was used for data entry and analysis. Quantitative data like BMI, waist/hip ratio, fasting blood glucose, 2-hour postprandial blood glucose and lipid parameters were represented as mean and standard deviation. Independent sample student t-test was used to compare study variables between cases and controls. P value less or equal to 0.05 was considered statistically significant.

RESULTS

Among a total of 80 study participants (40 cases and 40 controls), table I is showing comparison of BMI, waist/hip ratio and plasma glucose. Significantly higher mean BMI (kg/m^2) was recorded among cases in comparison to controls (25.47+1.62 vs. 23.17+1.92, p<0.0001). Mean fasting plasma glucose (mg/dl) was significantly higher among cases when compared to controls (138.12+14.54 vs. 88.61+4.84, p<0.0001). Mean 2-hour postprandial glucose (mg/dl) was also significantly higher among cases when compared to controls (171.14+24.6 vs. 124.50+11.8, p<0.0001).

Table 2 is showing comparison of lipid parameters between cases and controls. Among cases, mean serum cholesterol (mg/dl), mean serum triglyceride (mg/dl), mean serum VLDL (mg/dl) and mean serum LDL (mg/dl) were significantly raised when compared to controls (p<0.0001). Mean serum HDL (mg/dl) was significantly lower among cases when compared to controls (48.41+6.2 vs. 76.1+4.8, p<0.0001).

Table No.1: Comparison of BMI, Waist/Hip Ratio and Plasma Glucose between Cases and Controls

Characteristics	Cases (n=40)	Controls (n=40)	P-Value
Mean BMI (kg/m^2)	25.47+1.62	23.17+1.92	<0.0001
Mean Waist/ Hip Ratio	0.85+0.71	0.73+0.24	0.3144
Fasting Plasma Glucose (mg/dl)	138.12+14.54	88.61+4.84	<0.0001
2-hour Postprandial Glucose (mg/dl)	171.14+24.6	124.50+11.8	<0.0001

Table No.2: Comparison of Lipid Parameters between Cases and Controls

Lipid Parameters	Cases (n=40)	Controls (n=40)	P-Value
Mean Serum Cholesterol (mg/dl)	238.3+48.1	162.5+32.8	<0.0001
Mean Serum Triglyceride (mg/dl)	185.64+14.7	144.61+32.1	<0.0001
Mean Serum VLDL (mg/dl)	35.74+15.6	26.36+4.4	<0.0001
Mean Serum LDL (mg/dl)	161.82+35.7	53.70+24.6	<0.0001
Mean Serum HDL (mg/dl)	48.41+6.2	76.1+4.8	<0.0001

DISCUSSION

Increased BMI, central distribution of fat, decreased levels of physical activity and high amount of fat intake are known to be closely associated with DM.[10] Obesity has been considered an important factor linked with raised plasma free fatty acid levels causing peripheral and hepatic insulin resistance.[11] In the present study, we noticed DM cases to have significantly high BMI when compared to controls (25.47+1.62 vs. 23.17+1.92, p<0.0001). Narasimhaswamy KN et al from India also found cases of DM to have significantly raised BMI levels when compared to healthy controls (P<0.01).[12]

In the present study, among DM cases, mean serum cholesterol (mg/dl), mean serum triglyceride (mg/dl), mean serum VLDL (mg/dl) and mean serum LDL (mg/dl) were significantly raised while mean serum HDL (mg/dl) was significantly lower when compared to controls (p<0.0001). Derangement and over-stimulation of HMG-COA reductase by glucagon is known to be rate limiting for cholesterol synthesis.[13] Conversion of cholesterol in bile acids may also lead to raised levels of cholesterol. Higher levels of VLDL in the plasma are known to be the cause of hypercholesteremia as VLDL also carries around 20% of its total lipid contents as cholesterol.[14] Cholesterol absorption among type-2 DM patients is significantly low however cholesterol synthesis usually remains high. "Non-Esterified Fatty Acids (NEFA)" are known

to be cause of hepatic triglyceride synthesis while its discharge in the form of VLDL is assisted by insulin resistance. Higher production of VLDL is linked with clearance defects like lower fractional catabolic rates for VLDL and triglyceride.[15] LDL receptors are known to be up-regulated by insulin but these are doing less uptake of LDL among individuals having DM. With regards to significantly decreased levels of HDL among DM cases, this could be because of hyperactivity of "Lecithin cholesterol acyltransferase (LCAT)" which also causes hypertriglyceridemia. LDL rich cholesterol and phospholipids, LCAT hyperactivity encourages transferring activated fatty acids to cholesterol which results in the production of lysolecithin which goes on to cause triglyceride formation.[16] Our findings in terms of significant disturbances in lipid parameters among DM cases are quite similar to other regional findings noticed by Narasimhaswamy KN et al[12] as well as Bobby D et al.[17] Saydah SH et al also pointed out patients of DM with CVD to have significantly raised cholesterol levels.[18] Data from African-American DM patients also revealed that significantly high levels of triglycerides were noticed.[19] Keech et al comparing DM patients with pre-diabetic and normal individuals revealed that HDL levels were significantly lower among DM cases.[20]

There were few limitations of this study. Sample size of this study is quite small so out findings cannot be generalized. We could not assess influence of duration of diabetes on lipid parameters in the present study. We also did not record skin fold thickness or % fat in the body which could have further enlighten us about the differences found among DM cases and controls.

CONCLUSION

Significantly higher BMI was found among DM cases. Among DM cases, lipid parameters were significantly deranged.

Author's Contribution:

Concept & Design of Study:	Tayyaba Batool
Drafting:	Farooq Ahmad Malik, Zia Ullah
Data Analysis:	Saifullah, Ashfaq Ahmad
Revisiting Critically:	Tayyaba Batool, Farooq Ahmad Malik
Final Approval of version:	Tayyaba Batool

Conflict of Interest: The study has no conflict of interest to declare by any author.

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