Dyslipidemia In Type 2 Diabetes Mellitus Patients

Saba Abbas[1], Irsa Tabasum Khan[2], Sheikh Junaid Ali[3], Warda Munir[4], Hafiz Khawar[5]*, Zeemal Seemab Amin[6], Hafiza Nida Shehzadi[7]

[1]Lecturer, School of Medical Laboratory Technology, Minhaj University, Lahore
[2,3,4,5]*Institute of Industrial Biotechnology Government College University, Lahore
[6]School of Biochemistry, Faculty of Applied Sciences, Minhaj University, Lahore
[7]School of Medical Laboratory Technology, Minhaj University, Lahore

***Corresponding Author:** Hafiz Khawar
*Institute of Industrial Biotechnology Government College University, Lahore
Email: khawarkhubaib322@gmail.com

Abstract
Diabetes mellitus is a class of metabolic diseases marked by hyperglycemia induced directly by defect in insulin production, insulin action, or both. The long-term damage, dysfunction, and failure of several organs, particularly the eyes, kidneys, nerves, heart, and blood vessels, is linked to diabetes chronic hyperglycemia. This Observational Cross-sectional study was designed to determine the incidence of dyslipidemia in Type 2 Diabetes Mellitus using total 158 samples collected and processed for Biochemical analysis. Out of total 158 cases, 96 were found to have Type 2 Diabetes Mellitus and 62 cases were Negative. The total number of 75(47%) males and 83(53%) females were included in this study with 45 Males and 51 females of type 2 diabetes mellitus between the age group of 40-70 years. These cases were screened for dyslipidemia and 62 Healthy cases in this study were considered as a control group with 30 males and 31 females. Percentage of type 2 diabetes mellitus was higher in females than males. Correlation of Type 2 diabetes mellitus was done with parameters including Cholesterol, Triglyceride, HDL, LDL and VLDL. In association with Type 2 diabetes mellitus, the levels of Triglyceride, LDL and VLDL were high whereas, HDL levels were low in this study with least significant parameter.The strong positive association between Type 2 diabetes mellitus.

Keywords: HDL, LDL, VLDL, Cholesterol, Triglyceride

1. INTRODUCTION

Diabetes mellitus is a severe health issue that has been dubbed "among the most important health problems of the twenty-first century". The worldwideprevalence of diabetes and poor glucose tolerance in individual has risen in currentdecade (Shaw, Sicree and Zimmet, 2010) (Guariguata*et al.*, 2014). The worldwide frequency of diabetes among adults aged 18 years was predicted to be 8.5 % in 2014, with around 422 million diabetics globally. In 2012, diabetes claimed the lives of approximately 15 million people (da Rocha Fernandes, 2016).

More than 387 million cases were reported worldwide in 2014, with the figure rising to 592 million by 2035. Diabetes mellitus affects 346 million people globally, according to the World Health Organization (WHO) (Guariguata*et al.*, 2014). Without any meddling, the number exceeds 2030. Diabetes affects over 80% of people in low and middle-income nations (Zhang*et al.*, 2010). Accurate estimates of the existing and future burden of diabetes are required for allocating community and health resources, as well as developing strategies to combat escalating trends (Guariguata et al., 2014).
DM can be further divided into two categories. The T1D, often known as juvenile-onset diabetes, is a complete insulin secretion failure (Sapra and Bhandari, 2019).Serological evidence of an autoimmune pathologic process in the pancreatic islets, as well as genetic markers, may usually identify people who are at a higher risk of developing this kind of diabetes. Islet cell autoantibodies, glutamic acid decarboxylase (GAD65) autoantibodies, insulin autoantibodies, and autoantibodies to the tyrosine phosphatases IA-2 and IA-2 are all markers of beta-cell immune destruction (Knip, Siljander, Ilonen, Simell and Veijola, 2016).

which is why the majority of people with this kind of diabetes are obese (Neeland *et al.*, 2012). Ketoacidosis is unusual in this type of DM, and when it does develop, it's Usually as a result of another illness's stress, like infection (Linfoot and Bergstrom, 2005). Insulin production is diminished in these patients as a result, and it is inadequate to overcome for insulin resistance (DeFronzo *et al*.,2015). Although weight loss and hyperglycemia pharmacological therapy can improve insulin resistance, it hardly ever returns to normal (DeFronzo *et al*.,2015).The risk of developing this type of DM is increased by age factor, weight gain and inadequate physical activity (Tian *et al.*, 2022). Women who have previously gestational diabetes mellitus (GDM6) are more likely to get it and in people who have hypertension or dyslipidemia (Chiefari, Arcidiacono, Foti and Brunetti, 2017).

Dyslipidemia is a significant developing risk factor of atherosclerosis, which is characterized by the formation of lipid-rich plaque in arteries over time (Begum and Irfan, 2019). Dyslipidemia is defined as high levels of total cholesterol and TG in the bloodstream, as well as an increase in the number of small danse LDL and low levels of HDL-C (Kopin and Lowenstein, 2017).

Increased oxidative stress from dyslipidemia leads to increased ox-LDL production, immune cell activation, and over-expression of ICAM-1c, MCP-1 and VCAM-1 all of which encourage the development of foam cells (Kopin and Lowenstein, 2017). Apoptosis occurs in foam cells, resulting in the formation of a necrotic core. The buildup of apoptotic foam cells and cholesterol crystals causes the formation of atherosclerotic lesions (Kopin and Lowenstein, 2017). These pathogenic events cause VSMC proliferation and migration, resulting in the formation of liposome necrotic cores that induce atherosclerotic lesions and atherosclerotic cardiovascular disease (Hasheminasabgorji and Jha, 2021).

Patients with DM have a 2-4 times increased risk of CAD, which is partly due to hyperglycemia (Henning, 2018). Other factors play a role as well; the most prevalent is dyslipidemia, which is a major risk factor for CAD (Chaudhury and Aggarwal, 2018). The East West study considers diabetes to be a CAD counterpart. We started this study because of the high prevalence of diabetes in Pakistan, the high prevalence of dyslipidemias that worsen the consequences of diabetes, and the unavailability of studies on these topics in Pakistan. The target of this study is to appraise the study for dyslipidemia in T2DM and to quantify the independent effects of sociodemographic factors on dyslipidemia.

2. MATERIALS AND METHODS

Requirements

Yellow top vials were used to collect the sample for the screening of Diabetes mellitus and dyslipidemia and processed on the Roche Diagnostic Cobas C311 analyzer which is automated software-controlled analyzer for clinical chemistry analysis. The Cobas C311 analyzer performs photometric assays and ion selective electrode measurements and uses serum/plasma.

Sample Collection

The blood samples were drawn from median vein from 4-10 pm. In the study, samples were collected in gel vial also known as Red/Yellow top vial for estimation blood total cholesterol. Only the patients older than 40 years of age having the complain of DM were taken as object for studywhile the patients with any other ailment like heart diseasew and fcing the complecation of DM after transplant were excluded. Pregnant and DM type I patients were also excluded

Biochemical Analysis

Total cholesterol parameters including Cholesterol, Triglyceride (TG), High density lipoprotein (HDL), Low density lipoprotein (LDL) and very low-density lipoprotein (VLDL) were obtained by using the Roche Diagnostic Cobas C311. It is designed for both quantitative and qualitative in vitro determinations using a large variety of tests for analysis. The Cobas C311 analyzer performs photometric assays and ion selective electrode measurements and uses serum/plasma.

3. RESULTS

Out of total 158 cases, 96 were found to have Type 2 Diabetes Mellitus and 62 cases were Negative. The total number of 75(47%) males and 83(53%) females were included in this study with 45 Males and 51 females of type 2 diabetes mellitus between the age group of 40-70 years. These cases were screened for dyslipidemia and 62 Healthy cases in this study were considered as a control group with 30 males and 31 females. Percentage of type 2 diabetes mellitus was high in females than males. Correlation of Type 2 diabetes mellitus was done with parameters including Cholesterol, Triglyceride, HDL, LDL and VLDL.

In association of dyslipidemia with Type 2 diabetes mellitus, the levels of Triglyceride, LDL and VLDL were high whereas, HDL levels were low in this study with least significant parameter. Our data evaluations represent that Cholesterols, Triglyceride, LDL and VLDL were strong positive and were significantly high while HDL was weak positive parameter with least significance.

4. STATISTICAL ANALYSIS

Statistical analysis was done by using SPSS

Table 4.1	COMPARISON OF LIPID PROFILE PARAMETERS BETWEEN CONTROL AND DM TYPE 2 PATIENTS

Parameters	Control(n=62) Mean ± S. D	Disease(n=96) Mean ± S. D	P-Value (P≤0.05)
Cholesterol (mg/dL)	157.55 ± 26.730	210.73 ± 42.965	0.000
Triglyceride (mg/dL)	112.90 ± 28.874	272.02 ± 139.386	0.000
HDL	41.66 ± 15.852	43.72 ± 9.045	0.35
LDL	94.76 ±24.817	122.61 ±40.763	0.000
VLDL	22.61 ± 5.738	52.68 ± 25.478	0.000
Normal Ranges: cholesterol=<200mg\dL,triglyceride=<150mg\dl,HDL=>60mg/dl, LDL=<100mg/dl, VLDL=<30mg/dl			

Data evaluation in above table implies clear cut representation of different variables oflipid

Profile status distressed by type 2 diabetic patients. Serum lipid profilestatus exposes in type 2 diabetes mellitus patients that Cholesterol, Triglycerides, LDL and VLDL level elevates respectively *(210.73±42.965)*, *(*272.02 ± 139.386*)*, *(*122.61 ±40.763*)* and *(*52.68 ± 25.478*)* as compare to normal (non-diabetic) individuals and statistics shows that it is highly significant *(P=0.000<0.05).*

Table 4.2	RATIO OF MALES AND FEMALE'S PARTICIPANTS

Gender	Frequency	Percentage
Males	75	47%
Females	83	53%

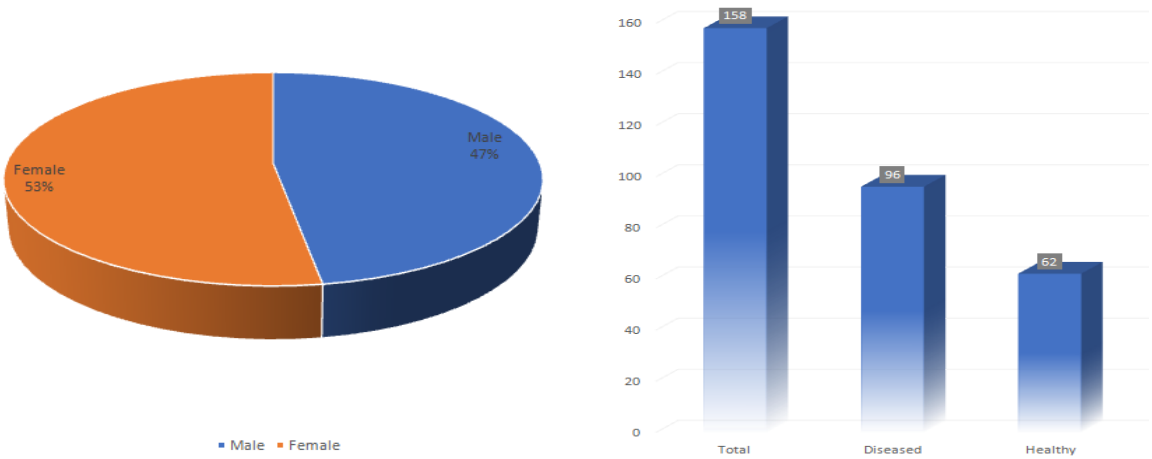

Figure 2: (a) Frequency of Males and Females participant (b)Total number of diseased and healthy participants

Table 4.3	PEARSON'S CORRELATIONS OF DIFFERENT VARIABLES ESTIMATED IN TYPE 2 DIABETIC PATIENTS

Parameters	Correlation (r)	P-Value
Cholesterol Vs Triglyceride	.395**	0.000
Cholesterol Vs HDL	.353**	0.000
Cholesterol Vs LDL	.800**	0.000
Cholesterol Vs VLDL	.367**	0.000

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).
There is a strong positive correlation between cholesterol and triglycerides, HDL, LDL and VLDL

Table 4.4	PEARSON'S CORRELATIONS OF DIFFERENT VARIABLES ESTIMATED IN TYPE 2 DIABETIC PATIENTS

Parameters	Correlation (r)	P-Value
Triglyceride Vs Cholesterol	.395**	0.000
Triglyceride Vs HDL	-.127**	0.111
Triglyceride Vs LDL	.106	0.184
Triglyceride Vs VLDL	.935**	0.000

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).
There is weak positive correlation between Triglycerides, HDL and LDL while there is strong positive correlation between Triglycerides, Cholesterol and VLDL.

Table 4.5	PEARSON'S CORRELATIONS OF DIFFERENT VARIABLES ESTIMATED IN TYPE 2 DIABETIC PATIENTS.

Parameters	Correlation (r)	P-Value
HDL Vs Cholesterol	.353**	0.000
HDL Vs Triglyceride	-.127	0.111
HDL Vs LDL	.253**	0.001
HDL Vs VLDL	-.148	0.063

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).
There is weak positive correlation between HDL, Triglycerides, VLDL and LDL while there is strong positive correlation between HDL and Cholesterol.

Table 4.6	PEARSON'S CORRELATIONS OF DIFFERENT VARIABLES ESTIMATED IN TYPE 2 DIABETIC PATIENTS

Parameters	Correlation (r)	P-Value
LDL Vs Cholesterol	.800**	0.000
LDL Vs Triglyceride	.106	0.184
LDL Vs HDL	.253**	0.001
LDL Vs VLDL	.063	0.434

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).
There is a weak positive correlation between LDL, Triglycerides, VLDL and LDL while there is strong positive correlation between LDL and Cholesterol

Table 4.7	PEARSON'S CORRELATIONS OF DIFFERENT VARIABLES ESTIMATED IN TYPE 2 DIABETIC PATIENTS

Parameters	Correlation (r)	P-Value
VLDL Vs Choles	.367**	0.000
VLDL Vs Triglyceride	.935**	0.000
VLDL Vs HDL	-.148	0.063
VLDL Vs LDL	.063	0.434

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).
There is a weak positive correlation between VLDL, HDL and LDL while there is strong positive correlation between VLDL, Cholesterol and triglycerides.

5. DISCUSSION

Dyslipidemia is one of the major risk factors for cardiovascular disease in diabetes mellitus. The characteristic features of diabetic dyslipidemia are a high plasma triglyceride concentration, low HDL cholesterol concentration and increased concentration of small dense LDL-cholesterol particles (Mooradian, 2009). The present study was conducted in pathology lab of sir Ganga Ram hospital Lahore during the period of six months from February to July 2022. All the samples were analyzed to determine the frequency of dyslipidemia in type 2 Diabetes Mellitus patients.

According to the present study, out of total 158 cases, 96 were found to have Type 2 Diabetes Mellitus and 62 cases were Negative. The total number of 75(47%) males and 83(53%) females were included in this study with 45 Males and 51 females of type 2 diabetes mellitus between the age group of 40-70 years. These cases were screened for dyslipidemia and 62 Healthy cases in this study were considered as a control group with 30 males and 31 females.

Percentage of type 2 diabetes mellitus was high in females than males. Correlation of Type 2 diabetes mellitus was done with parameters including Cholesterol, Triglyceride, HDL, LDL and VLDL. In association with Type 2 diabetes mellitus, the levels of Triglyceride, LDL and VLDL were high whereas, HDL levels were low in this study with least significant parameter.
Our data evaluations represent that Cholesterols, Triglyceride, LDL and VLDL were strong positive and were significantly high while HDL was weak positive parameter with least significance.

Dyslipidemia is an established marker for endothelialdysfunction and cardiovascular risk in diabetes. (Shahwan, Jairoun, Farajallah and Shanabli, 2019) Dyslipidemia is highly prevalent among diabetic population particularly in those with poorly controlled diabetes. (Narindrarangkura, Bosl, Rangsin and Hatthachote, 2019) Studies have reported increased risk of ischemic stroke with elevated low-density lipoprotein cholesterol (LDL-C) levels and increased risk of cardiovascular mortality independent of LDL-C levels in type 2 diabetes mellitus (T2DM) patients. These results also correlate with the present conducted study.

ASCVD events in T2DM.
(Das and Banik, 2019) presents early detection and treatment of dyslipidemia can avoid risk for cardiovascular disorder in diabetic patients. The prevalence of dyslipidemia in Bangladesh is significantly high, which indicates the urgency of lifestyle intervention strategies to prevent and manage this important health problem and risk factor.
(Hirano, 2018) suggested serum triglyceride (TG) is a leading predictor of atherosclerotic cardiovascular disease, comparable to low-density lipoprotein (LDL)-cholesterol (C) in populations with type 2 diabetes, which exceeds the predictive power of hemoglobinA1c. Atherogenic dyslipidemia in diabetes consists of elevated serum concentrations of TG-rich lipoproteins (TRLs), a high prevalence of small dense low-density lipoprotein (LDL), and low concentrations of cholesterol-rich high-density lipoprotein (HDL)2-C.

6. CONCLUSION

Dyslipidemia is an important risk factor influencing the public health with Type 2 Diabetes Mellitus patients especially in insulin resistant individuals which is leading to Myocardial Infarction and chronic heart diseases. Untreated and sever dyslipidemia can lead to other conditions including peripheral artery disease and coronary artery disease. So, the great awareness is needed in type 2 diabetes mellitus patients with hypertriglyceridemia and reduced LDL levels with the combinations of pharmacologic and non-pharmacologic therapies.

7. Suggestions

- Patients under 30 years can included
- Patients with Heart diseases, Stress, Obesity and Hypertension can be included
- Type 1 diabetic patients could be evaluated
- Patients with diabetic family history

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