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Scenario of Glycemic Index and Lipid Profile in Type 2 Diabetes Mellitus Patients

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Abstract

Diabetes mellitus a group of metabolic diseases characterized by hyperglycemia (high blood sugar) because of defects in insulin secretion, insulin action, or both (deficient/inefficient) and leading to elevated blood glucose levels. Glycated Hb (HbA1c) is an indicator of glycemic status over long term (over the previous eight to 12 weeks). Patients with type 2 diabetes have increased prevalence of the dyslipidemia. A timely intervention to normalize these circulating lipids might reduce chances of the cardiovascular diseases The current study was conducted to find out the correlation between glycemic control and lipid profile in patients with type 2 DM. Type 2 diabetes mellitus is often associated with abnormalities of lipids which give rise to the increased incidence of micro vascular and macro vascular complications. We evaluated total 100 cases visiting our department in a tertiary care hospital and medical college including fifty (50) type 2 diabetic patients between age group of 30-65 years with an age & sex matched along with fifty (50) healthy controls were selected as per the criteria. Samples of venous blood were collected from all the cases and healthy controls to analyze the biochemical parameters. HbA1c levels were used for classification of patients into good (< 6.5) and poor (≥ 6.5) glycaemic control and for comparing different lipid profile parameters in our study. The Mean±SD of cases and controls were FBS (169 ± 24.2) HbA1c(8.64 ± 2.32), TG(201.9±21.044), TC(251.6±32.7), HDL-.C(38.02 ± 8.07) and LDL-C(185.02 ± 36.8) and FBS(101 ± 12.05) HbA1c(5.5 ± 1.3), TC(145.6±2.4), TG(111.5±20.2), LDL-C(122.06 ± 18.13) and HDL-C(51.6 ± 10.4)respectively. The HbA1c showed positive correlation with TC, TG, & LDL-c and negative correlations was observed between HbA1C and HDL-c. Thus our study concludes that good sugar control is necessary in diabetic patients to maintain good lipid profile and avoiding any further cardiovascular complications from dyslipidaemia and early diagnosis of dyslipidemia can be used as a preventive measure for the development of cardiovascular disease in type-2 diabetics. So, HbA1c may be utilized for screening diabetic patient for risk of cardiovascular events and also for timely intervention with lipid lowering drugs.

Keywords: Type 2 Diabetes Mellitus, Lipid Profile, Sugar Control, HbA1c, Hyperglycemia

INTRODUCTION:

Type II diabetes mellitus (T2DM) is a non-communicable, chronic disorder and progresses slowly because of multifactorial etiology (genetic and environmental and lifestyle factors). T2DM is a leading cause of premature deaths worldwide, and its exceptional upsurge poses a severe threat and imposes a huge economic burden worldwide (825 billion dollars per year) **(1)**. According to a recent estimation of the

World Health Organization (WHO), 422 million people globally are affected from diabetes with a prevalence rate of 8.5% and 46.3% still remains undiagnosed and the number is projected to rise to 552 million in 2030. Furthermore, the maximum percentage lives in developing countries and comprises of 40–60 age group. India is called the diabetic capital of the world. Type 2 diabetes mellitus in Indians is being increasingly seen in younger and less obese persons than in western countries **(2)** In 2017 it was reported that India alone has 72 million people affected with T2DM and is projected to rise to 101.2 million in 2030 **(3, 4)**. Most of the Indian populations are unaware of that disease. The risk factors of T2DM are suggestively increased with changing lifestyle, blood pressure, central obesity, inadequate physical activity and unhealthy diet **(5)**. Fasting Blood glucose (FBG), 2-hour postprandial blood glucose (2hr-PP) and glycated hemoglobin (HbA1c) levels are most widely used as glycemic control markers which indicates the progression of the disease and development of its complications. T2DM is reported to be linked with lipid and lipoprotein irregularities, including reduced HDL cholesterol and raised triglycerides. **(6-9)**.

Changes in lipid-profile are a consequential event in diabetes mellitus. Due to these changes distribution and function of various fractions of lipids are affected. Many Studies have evaluated the risk factors for CHD in DM patients and observed high fasting blood sugar (FBS) and post prandial blood sugar (PPBS), total cholesterol (Chol), low density lipoproteins (LDL), triglycerides (TG) levels and low high density lipoproteins (HDL) levels when compared to controls **(10)**. Glycated heamoglobin. (HbA1c) is considered a gold-standard measure of chronic glycemia in diabeticpatients. It was studied that HbA1c was a better CHD predictor than fasting or 2-h glucose **(11).** HbA1c was strongly associated with atherosclerosis as measured by carotid IMT (intima-media thickness **(12, 13)** The ADA recommends measurement of HbA1c in patients with both type 1 and 2 diabetes, first to document the degree of glycemic control, then as part of continuing care **(14)**. Changes in lipid. profile is also well related with severity of DM as adjudged by HbA1c. Dyslipidemia (raised triglycerides, raised cholesterol, raised LDL, raised VLDL and low HDL) were common in type 2 diabetes mellitus, which is further associated with insulin resistance like hyperinsulinemia, hypertension with obesity collectively known as metabolic syndrome or Reaves's syndrome; strongly correlated with atherosclerosis. Atherogenic indices i.e. TC/HDL-C ratio (<5) and LDL-C/HDL-C (<3.5) is the main indicator of cardiovascular disease (CVD). TG/HDL-C which is considered as reliable as fasting serum insulin levels and is determined to assess insulin resistance status in type 2 diabetes **(15).** Dyslipidemia, especially high LDL, is common in. diabetes mellitus and strongly associated with poor glycemic control. Glycated hemoglobin (HbA1c) is main routinely used tool for measuring long term glycemic control **(16).** HbA1c is a main indicator for. mean blood glucose level; HbA1c predicts the risk of diabetic complications in diabetic patients. Thus, in the present study an attempt has been made to find any correlation of HbA1c with lipid profile in patients with type 2 diabetes mellitus. Thus, the aim of this study was to observe the Glycemic index and lipid parameters in type 2 diabetes mellitus patients and it's correlation between Lipid parameters and HbA1c.

MATERIALS AND METHODS:

This present study was a cross sectional, case control carried out in the Department of Biochemistry, Govt. Medical college Handwara during the period from January 2024 to May 2025. Randomly selected, 35 type 2 diabetic patients (age range of 30-65 years) with an age & sex matched along with 35 healthy controls were selected as per the inclusion and exclusion criteria. Venous blood samples were collected and blood glucose, glycated haemoglobin (HbA1c), total cholesterol(TC), triglyceride (TG), LDL-cholesterol, HDL-

cholesterol, VLDL-cholesterol were done on fully automated analyzer. The data were evaluated by SPSS statistical package version 18.0. Pearson's correlation test was performed to examine various correlations. All values were expressed as mean ± SD and student t-test and pearson's correlation coefficient to find the statistical significance. A P-value <0.05 was to be considered statistically significant.

Results

A total of 35 Type 2 Diabetic patients as cases and 35 Healthy subjects controls were included in this study. The mean age (Mean ± SD) of cases and controls were 42.6 and 36.9±10.23 years respectively. Table 1 shows the Mean ± SD of cases and controls were FBS (169 ± 24.2) HbA1c(8.64 ± 2.32), TG(201.9±21.044), TC(251.6±32.7), HDL-.C(38.02 ± 8.07) and LDL-C(185.02 ± 36.8) and FBS(101 ± 12.05) HbA1c(5.5 ± 1.3), TC(145.6±2.4), TG(111.5±20.2), LDL-C(122.06 ± 18.13) and HDL-C(51.6 ± 10.4) respectively. In this study, the level of FBS, HbA1c, TC, TG, LDL-c, were significantly increased (P<0.001) while HDL-c level was significantly decreased (P<0.001) as compare to controls.

Table 1: Comparison of Biochemical parameters between cases and Controls

Biochemical Parameters	Cases (50)	Controls (50)
	Mean ± SD	Mean ± SD
FBS(mg/dl)	169 ± 24.2	101 ± 12.05
HbA1c (%)	8.64 ± 2.32	5.5 ± 1.3
TG (mg/dl)	201.9±21.04	111.5±20.2
TC (mg/dl)	251.6±32.7	145.6±2.4
LDL-c(mg/dl)	185.02 ± 36.8	122.06 ± 18.13
HDL-c(mg/dl)	38.02 ± 8.07	51.6 ± 10.4

Statistically Significant at p value <0.05

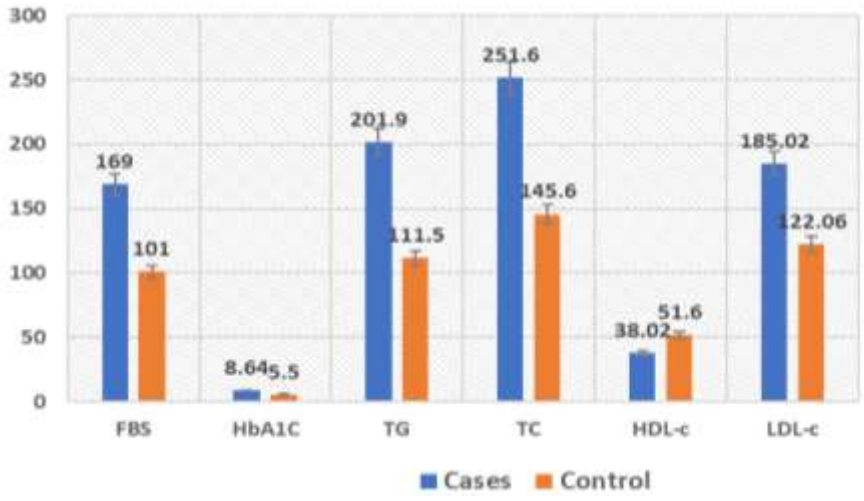

Table 2: Correlation between HbA1c and Lipid parameters type 2 diabetics patients

Parameters	Correlation Coefficient(r)	P- value
TC	+0.069	<0.001
TG	+0.137	<0.001

HDL-c	-0.035	*NS
LDL-c	+0.076	<0.001

NS: Statistically not Significant

There was a significant positive correlation between HbA1c and TC (r = +0.069, p =0.001). HbA1c also demonstrated a significant correlation with TG (r = +0.137, p =0.001). The correlation between HbA1c and HDL-C was negative and was found to be statistically not significant (r = -0.035, p =0.65). Furthermore, it was found that HbA1c was positively and significantly related to LDL-C (r = +0.076, p =0.001).

Discussion

Type 2 diabetes mellitus consists of an array of dysfunctions characterized by hyperglycemia and resulting from the combination of resistance to insulin action and inadequate/inefficient insulin secretion. Worldwide, people are suffering from T2DM and it is projected to increase from the present 415 million people to 642 million by 2040. In all developing countries, it was seen that the number of T2DM patients is increasing and 75% of people with T2DM are living in these developing countries **(17, 18)**. Lipid abnormalities are very common in DM patients and they are frequently seen in patients with deranged blood sugars in type-2 diabetic mellitus. The abnormal lipid profile observed in type 2 DM is said to be related to the insulin resistance as reported in many previous studies, which leads to the increased release of free fatty acids from fatty tissues, impaired muscle uptake of free fatty acids and an increased fatty acid release to the liver14 which has been closely associated with the diabetic dyslipedemia and hypertension **(19, 20)**. High prevalence of hypercholesterolemia, hypertriglyceridemia and high LDL-c & low HDL-c was found in type-2 diabetes which is well known risk factors for cardiovascular disease **(21)**. The cause of dyslipidemia in type 2 diabetes mellitus may be that, insulin is not working properly and which affects the liver apo lipoprotein production **(22)**. The apolipoprotein regulates the enzymatic activity of lipoprotein lipase and cholesterol ester transportprotein. A highly positive significant relationship of HbA1c with dyslipidemia was observed in our present study which supports the findings of Erciyas *et al* **(23).** Our findings also support the results of khan *et al* which showed that diabetes complication and control trail established HbA1c as Value ≤7.0% was said to be appropriate for reducing the risk of cardiovascular complications and diabetic patients with higher HbA1c value can exhibit a significant increase in TC, TG, LDL-c and HDL-c in comparison to cases with HbA1c value ≤7.0% which causes the severity of dyslipidemia increases in patients with higher HbA1c value which supported b **(24 25)**. As elevated HbA1c and dyslipidemia are independent risk factors of CVD, diabetic patients with elevated HbA1c and dyslipidemia can be considered as a very high risk group for CVD. Improving glycemic control can substantially reduce the risk of cardiovascular events in diabetes and also reported that reducing **(26, 27)** the HbA1c level by 0.2% could lower the mortality by 10%. Thus present study suggests the importance of glycemic control in prevention of cardiovascular disease in type-2 diabetics.

Conclusion

HbA1c and dyslipidaemia showed a positive correlation in our study as HbA1c showed positive correlation with TC, TG, & LDL-c and negative correlations with HDL-c, also very strong positive correlation was seen between FBS levels and HbA1C levels. These findings suggest that HbA1c level can be used as good parameter for predictor of dyslipidemia in type 2 diabetics in addition to as glycemic

control. Thus our study concludes that good sugar control is necessary in diabetic patients to maintain good lipid profile and avoiding any further atherogenic complications from dyslipidaemia and early diagnosis of dyslipidemia can be used as a preventive measure for the development of cardiovascular disease in type-2 diabetics. So, HbA1c may be utilized for screening diabetic patient for risk of cardiovascular events and also for timely intervention with lipid lowering drugs.

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