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Original Research Article

Correlation of HbA1c with Serum Lipid Profile in Patients with Type 2 Diabetes Mellitus in Mithilanchal Area

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Abstract

Background: Diabetes mellitus is a diverse set of diseases caused by a variety of etiologies, genetic and environmental factors operating in concert. These diseases are characterised by a state of persistent hyperglycemia. The gold-standard indicator of chronic glycaemia in diabetes individuals is glycated haemoglobin (HbA1c). The key indicator of mean blood glucose level is HbA1c. Dyslipidemia, particularly elevated LDL, is prevalent in diabetes mellitus and is closely linked to inadequate glycemic control.

Objective: to determine the relationship between HbA1C and lipid profile in Mithilanchal area patients with Type 2 Diabetes Mellitus.

Method: Present study was conducted at Department of Physiology, DMC, Laheriasarai, Bihar. A total of 60 confirmed cases of type 2 diabetes mellitus were obtained from DMCH, Medicine Department. Males and females were included in the samples (40 -60 YR). As a control, 60 people of a similar age range without diabetes were used. Between the case and control groups, the following parameters were examined and compared: FBS, PPBS, HbA1c, TG, Chol., HDL, LDL, and VLDL.

Result: The case group had significantly higher FBS, PPBS, and HbA1C levels. HDL is much lower than the control group, but LDL, CHOL, and TG were high in this case. Patients' values for HbA1C/LDL, HbA1C/HDL, and HbA1C/CHOL are statistically strongly significant when compared to controls. Significant correlation exists between lipid profiles and HbA1c.

Conclusion: Patients with type 2 diabetes are more likely to develop dyslipidaemia. Significant correlation exists between lipid profiles and HbA1c. Therefore, in addition to serving as a biomarker for glycemic control in type 2 diabetes, HbA1c can also be employed as an indirect predictor of dyslipidaemia.

Keywords: Type 2 diabetes mellitus, HbA1c, lipid profile.

Introduction

Diabetes mellitus is a diverse set of diseases caused by a variety of etiologies, genetic and environmental factors operating in concert. These diseases are characterised by a state of persistent hyperglycemia. The hormone insulin, which regulates the metabolism of glucose, fat, and amino acids, is the fundamental cause of diabetes. Diabetes mellitus (DM)-related metabolic dysregulations lead to secondary pathophysiological alterations in numerous organ systems, which place a heavy burden on the diabetic patient as well as the healthcare system.

Type 1 and type 2 diabetes mellitus are two broadly defined forms of diabetes (DM). DM of type 2 is more prevalent than DM of type 1. The diabetic capital of the world is said to be India. In Indians, type 2 diabetes mellitus is more frequently found in younger, less fat individuals than in western nations. When compared to people of other races and ethnicities, Indian diabetics are also more likely to have the majority of chronic macro and micro vascular problems. According to recent studies, the prevalence of coronary heart disease (CHD) in Indian diabetics may be on par with that of migrants [1].

Changes in the lipid profile are a result of DM. These modifications have an impact on the function and distribution of different lipid fractions. Numerous studies have assessed the risk factors for CHD in DM patients and found that these patients had higher levels of total cholesterol, low density lipoproteins (LDL), triglycerides (TG), and high density lipoproteins (HDL) when compared to controls, as well as higher levels of fasting blood sugar and postprandial blood sugar [2].

The gold-standard indicator of chronic glycemia in diabetic individuals is glycated haemoglobin (HbA1c). HbA1c was found to be a better predictor of CHD than fasting or 2-hour glucose levels in studies [3]. According to carotid IMT, HbA1c was substantially related with atherosclerosis (intima-media thickness) [4,5]. The ADA advises measuring HbA1c in patients with type 1 and type 2 diabetes to first document the level of glycemic control and then as part of ongoing management The severity of DM as determined by HbA1c is also closely correlated with changes in lipid profile.

Dyslipidemia (raised triglycerides, cholesterol, LDL, VLDL, and low HDL) is a common complication of type 2 diabetes mellitus, which is also linked to hyperinsulinemia, hypertension, and obesity, all of which are collectively referred to as metabolic syndrome or Reaves' syndrome and are strongly correlated with atherosclerosis. The primary indicator of cardiovascular illness is atherogenic indices, specifically the TC/HDL-C ratio (<5) and LDL-C/HDL-C (<3.5). (CVD). TG/HDL-C is used to evaluate the degree of insulin resistance in type 2 diabetes and is thought to be as reliable as fasting serum insulin levels [7] In diabetes mellitus, dyslipidemia, particularly elevated LDL, is prevalent and closely related to inadequate glycemic control. The primary frequently used metric for gauging long-term glycemic control is glycated haemoglobin (HbA1c) [8]. 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.

Material and Methods

Present study was done at Department of Physiology, Darbhanga Medical College, Laheriasarai, Bihar. A total of 60 confirmed cases of type 2 diabetes mellitus were obtained from DMCH Medicine Department from February 2020 to July 2020. The samples comprised both males and females. All diabetes patients ranged in age from 40 to

60. Each diabetes patient who took part in the study freely signed the informed consent form. 60 healthy individuals were used as the control group. In both the case and control groups, the following variables were examined: FBS, PPBS, HbA1c, TG, Chol, HDL, LDL, and VLDL.

Biochemical Parameter Measurement A disposable syringe was used to collect about 5 cc of venous blood after an overnight fast. Following the collection of the blood sample, the serum was separated using centrifugation at 3000 rpm for 10 minutes. Within 30 to 1 hour of sample collection, fasting blood glucose levels were assessed. The manufacturer's recommendations were followed for measuring the lipid profile (total cholesterol, triglycerides, and high density lipoprotein) using the automatic blood analyzer Cobas C 111. Low density lipoprotein and very low density lipoproteins were measured using the Friedewald's formula (given below)

Low density lipoprotein = Total Cholesterol – (High density lipoprotein – Triglycerides/5)

VLDL= Triglycerides/5

The Glycated hemoglobin (HbA1c) were measured with a radioimmunoassay (HbA1c LD-500 Analyzer)

Analytical Statistics For directly measured variables, standard descriptive statistics (mean standard deviation) were calculated. The associations between anthropometric factors, FBG, Hba1c, lipid profiles, and atherogenic indices were established using an unpaired t test. Version 20.0 of SPSS (Statistical Package for Social Science) was used to analyse the data. Statistical significance was denoted by a p-value < 0.05.

Results

The demographic breakdown between the patient and control groups is shown in Table 1. P<0.05 is used to match the age, gender, and BMI of the samples. The outcomes of the patients' and the control group's FBS, PPBS, and HbA1c levels are shown in Table 2 as Mean±SD. All three indicators rise in patients when compared to controls, which is statistically significant (p <0.05).

The results of the lipid profile levels of the patients and the control group are presented in Table 3 as Mean± SD. While HDL exhibited a statistical drop, there is a highly significant increase in TG, LDL, and cholesterol levels in patients compared to controls. No discernible difference in case's VLDL levels from control's. The findings of the correlation between HDL, LDL, Chol, and HbA1c (HbA1c/HDL, HbA1c/LDL, and HbA1c/Chol) levels in patients and the control group are presented in Table 4.

When patients are compared to controls, the HbA1c/HDL, HbA1c/LDL, and HbA1c/Chol ratios reveal statistically significantly significant results. The study's FBS, PPBS, HbA1c, TG, Chol, HDL, LDL, and VLDL findings are shown in tabular form.

Table 1

	Cases	Control	P Value
Age	50.10± 12.86	49.05± 9.66	<0.05
Male	38	36	<0.05
Female	22	24	<0.05
Total	60	60	
H/o dm (in years)	5±1.7	Nil	
BMI	22.38±4.2	25.1±1.83	<0.05

Table 2

Parameters	Case	control	P VALUE
FBS	200.03±49.67	96.20±8.28	<0.05
PPBS	259.50±50.39	108.20±19.2	<0.05
HbA1C	7.73±0.76	5.11±0.27	<0.05

Table 3

Lipid Parameter	Case	Control	P Value
Total Cholesterol	177.07±9.92	169.20±4.57	<0.05
Triglyceride	156.10±9.16	120.60±8.25	<0.05
LDL	135.63±9.57	100.85±2.11	<0.05
VLDL	42.20±6.07	40.80±4.9	> 0.05
HDL	42.47±6.08	46.05±6.64	<0.05

Table 4

Parameters	Case	Control	P Value
Hba1c/CHOL	0.07±0.08	0.29±0.01	T=6.8,P<0.05
Hba1c/HDL	0.28 ±0.04	0.15±0.03	T=5.5,P<0.05
Hba1c/LDL	0.10±0.07	0.05±0.04	T=8.7,P<0.05

Discussion

The current study demonstrates patient FBS & PPBS values above the upper limit, which are well linked with the clinical diagnostic. In diabetes mellitus, HbA1c is used to track blood glucose control. HbA1c has a favourable link with DM duration and is a reliable indicator of cardiovascular disease risk for developing diabetes complications, according to a number of studies [9]. Well-known risk variables for DM complications such coronary heart disease include HDL, LDL, TG, and Chol. In a study by H. Surekha Rani *et al*., it was shown that compared to controls, the levels of FBS and PPBS, Chol, VLDL, LDLs, and TGs were high and the levels of HDLs were low [10].

Small, thick, undesirable (more atherogenic) kind of LDL and high TG are frequently found together in diabetic dyslipidemia patients' blood (even though their LDL level may be normal). In the current investigation, we discovered significantly lower levels of HDL and significantly higher levels of TG and VLDL. LDL and HDL cholesterol were found to be substantially correlated with HbA1c by Elizabeth *et al*. In people with diabetes who had been diagnosed, HDL cholesterol was negatively correlated with HbA1c while LDL cholesterol was positively correlated [11]. In the current study, the HbA1c/LDL and HbA1c/Chol ratios between patients and controls varied significantly. The HbA1c/HDL ratio likewise showed a significant difference (p 0.05), demonstrating that HDL levels and HbA1c levels are inversely related. This is similar to study done by Mahantesh Patil *et al* [12].

Patients with type-2 diabetes mellitus typically experience lipid problems, which are common in diabetic patients. According to previous studies, insulin resistance, which results in increased release of free fatty acids from fatty tissue, impaired insulin dependent muscle uptake of free fatty acids, and increased fatty acid release to the hepatic tissue, is related to the abnormal lipid profile seen in type 2 Diabetes mellitus [13]. It carries a high risk of developing cardiovascular illnesses, hypertension, and diabetic dyslipedemia [14]. Apolipoproteins

get glycated as a result of chronic hyperglycemia, which also disrupts the normal processes of lipoprotein metabolism [15]. Patients with diabetes often experience complications, such as high levels of LDL and triacylglycerol and low levels of HDL. The findings of the current study supported those of Wexler *et al*. from 2005, which found that diabetes patients had higher lipid profiles [16]. HbA1c and lipid profiles showed a significantly significant positive correlation in the current investigation (TC, TG and LDL). HbA1c significantly positively correlates with FBG, TC, TG, LDL-C, and LDL/HDL-C ($p<0.016$-0.001) [17]. In individuals with type-2 diabetes, Erciyas *et al*. (2004) also reported a positive connection between HbA1c and TC and TG [18]. HbA1c has become recognised as the gold standard for diabetic control because to the Diabetic Complication and Control Trial (DCCT). Cardiovascular disease risk is decreased by a HbA1c score below 7.0%, whereas a value above 7.0% causes patients to develop dyslipidemia [19]. Glycemic level management can dramatically reduce diabetes-related cardiovascular disease risk. According to Khawetal, lowering the HbA1c level by 0.2% could reduce mortality by 10%, therefore the current study emphasises the significance of glycemic control in type 2 diabetes prevention of cardiovascular illnesses [20].

Conclusion

The findings of this study led to the conclusion that type 2 diabetic patients are more likely to have dyslipidaemia. Significant correlation exists between lipid profiles and HbA1c. Therefore, in addition to serving as a biomarker for glycemic control in type 2 diabetes, HbA1c can also be employed as an indirect predictor of dyslipidaemia. Thus, early dyslipidaemia detection can be employed to stop the progression of cardiovascular disease (CVD) in people with type 2 diabetes mellitus. Patients should learn how to regularly check their lipid profiles and, if they are discovered to be abnormal, how to properly control their blood sugar and cholesterol.

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