# A cross sectional study of correlation between HbA1c levels and lipid profile in type 2 diabetes mellitus patients

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Abstract Background: The world is witnessing an epidemic of Diabetes, with rapidly increasing prevalence in both developing and developed countries. In developing countries like India, fast industrialization and modern lifestyle is causing more number of Diabetes patients daily. The number of Diabetes patients are likely to reach 80 million by the end of 2030. Diabetes mellitus is characterized by rise in blood sugar levels and subsequent lethal patho-physiological changes in all the body systems. It is classified into two types, type 1 and type 2. The type 2 diabetes is more prevalent and occurs either when the  $\beta$ -cells of pancreas do not produce enough insulin. Type 2 diabetes mellitus is often associated with abnormalities of lipoproteins which give rise to the increased incidence of micro vascular and macro vascular complications. Background: A cross sectional study was been carried out to evaluate the correlation of lipid profile and HbA1c levels. Method: We evaluated total 400 diabetic patients with type two DM visiting our department in a tertiary care hospital and medical college. HbA1c levels were used for classification of patients into good (< 7) and poor ( $\geq$  7) glycaemic control and for comparing different lipid profile parameters in our study. Result: Majority (54.25%) of the patients were from the age group of 50 to 69 years. There was significant association between age and HbA1c levels (p= 0.026). Majority (56.50%) patients had the disease for more than 10 years, and there was significant association between the duration of diabetes and HbA1c levels (p=0.046). Mean HbA1c level in study population was 8.61 ± 1.82, showing overall poor glycaemic control in study population, similarly the mean levels of lipids showed a deranged pattern in most of the patients. Very strong correlation was seen between FBS levels and HbA1c (p<0.0001). Positive correlation was seen between HbA1c levels and LDL and VLDL while negative correlation was seen between HbA1c and HDL levels. **Conclusion:** The study concludes that to maintain good lipid profile, better sugar control is required. Key Words: HbA1c.

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# **INTRODUCTION**

Diabetes Mellitus (DM) comprises of a group of common disorders that share the phenotype of hyperglycemia. It is a globally endemic disease with rapidly increasing prevalence in both developing and developed countries<sup>1</sup>. India is also having an endemic of Diabetes mellitus. In India, fast industrialization and modern lifestyle is causing more number of Diabetes patients daily, which is estimated to reach 80 million by the end of  $2030^2$ . Diabetes mellitus is characterized by rise in blood sugar levels and subsequent lethal patho-physiological changes in the whole body. Diabetes is clinically classified into two types, type 1 and type 2. Type 1 diabetes is basically immune mediated and it requires daily administration of insulin while type 2 diabetes is more prevalent and occurs either when the  $\beta$ -cells of pancreas do not produce enough insulin or when body cannot utilize insulin effectively, type 2 diabetes can be managed by oral hypoglycaemic drugs. Type 2 diabetes mellitus is often

How to cite this article: Sanjay Thorat, Tejas Rane, Aniket Avhad, Akshay Kulkarni. A cross sectional study of correlation between HbA1c levels and lipid profile in type 2 diabetes mellitus patients. *MedPulse International Journal of Medicine*. July 2018; 7(1): 16-19. https://www.medpulse.in/Medicine/

associated with both qualitative and quantitative abnormalities of lipoproteins which give rise to the increased incidence of micro vascular and macro vascular complications<sup>3</sup>. Glycated haemoglobin (HbA1c) is routinely used everywhere in the world as a diagnostic tool for measuring long term glycemic control, it gives an idea about average blood sugar levels over the period of past 2-3 months. HbA1c also is a predictor of the risk for the development of diabetic complications in diabetes patients. Good glycemic control with decreased level of the HbA1c is most likely to reduce the risk of complications<sup>4</sup>. For each 1% increase in absolute HbA1c value in diabetic patients, the estimated risk of Cardio Vascular Diseases (CVD) has been shown to be increased by 18%<sup>5</sup>. Not only in Diabetic patients but also in nondiabetic cases with HbA1c levels within the normal range, positive relationship has been demonstrated between HbA1c and  $\text{CVD}^{6,7}$ . Lipid profile abnormality present in type 2 diabetes mellitus patients is shown by abnormal high level of triglycerides (TG), low density lipoprotein (LDL-C), very Low density lipoprotein (VLDL-C) and the low levels of high density lipoprotein (HDL-C)<sup>8-9</sup>. Altered lipid profile, especially high LDL-C, is very common in diabetes mellitus and it is strongly associated with poor glycemic control. Glycated haemoglobin (HbA1c) is the main tool for measuring long term glycemic control<sup>10</sup>. HbA1c is the main indicator for mean blood glucose level; HbA1c predicts the risk of diabetic complications. Thus, in our study we tried to find out any correlation of HbA1c with lipid profile in patients with type 2 diabetes mellitus.

## **MATERIALS AND METHODS**

**Study Site:** Tertiary care hospital and teaching institute in western Maharashtra, department of Medicine.

**Study Population:** All patients diagnosed with Type 2 Diabetes Mellitus, either visiting the OPD or admitted in the department of Medicine.

**Study Duration:** One year, March 2017 till February 2018.

**Sample Size:** A total of 400 patients were included in the study.

**Methods:** Complete history and clinical examination of the patients was done, they were investigated for fasting blood glucose level, HbA1c, Lipid Profile. Data was entered in Microsoft Excel 2013, and was analysed with Epi Info version 7.2.

## **Inclusion Criteria**

- Patients of age  $\geq 18$  years of both genders
- Patients diagnosed as type 2 DM

#### **Exclusion Criteria**

- Patients with known diagnosis of type-1 DM
- Patients already on lipid lowering drugs.

- Hypertensive patients using beta blockers or thiazide diuretics
- Other disease conditions where lipid profile is altered due to pathophysiologic conditions or drugs.

## **RESULTS**

We studied 400 cases of type 2 DM visiting the Medicine department of our medical college. The cases were classified according to the glycemic control by HbA1c levels. Patients were classified into two groups based on HbA1c levels with HbA1c < 7 considered as good control while HbA1c  $\geq$  7 as poor Glycaemic control. 68 out of total 400 patients (17%) had good glycemic control (HbA1c < 7), while the rest 332 patients (83%) had poor glycaemic control (HbA1c  $\geq$  7).

Table 1:	Age	categories	and HbA1c levels	

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Age	HbA1c < 7	HbA1c ≥ 7	Total N (%)		
<50 yr	18	69	87 (21.75%)		
50- 69 yr	27	190	217 (54.25%)		
≥ 70 yr	23	73	96 (24%)		
Total	68	332	400 (100%)		
$X^2 = 7.33 p = 0.026$					

When we categorised patients according to the age groups of less than 50 years, 50 to 69 years and more than 70 years, maximum number of patients (54.25%) were from the age group of 50 to 69 years. There was significant association between age and HbA1c levels. (p= 0.026)





Out of total 400 patients, 43.50% patients had diabetes for less than 10 years while rest of the 56.50% patients had the disease for more than 10 years. There was significant association between the duration of diabetes and HbA1c levels. (p=0.046- Fig 2)



Figure 2: Duration of diabetes and HbA1c levels (With  $X^2 = 3.97$  and p= 0.046)

The mean levels of the tests including HbA1c, Fasting Blood Glucose, Total Cholesterol, Triglycerides, LDL, VLDL and HDL are as follows-

 Table 2: Mean and Standard Deviation values for different study parameters

Sr. No	Tests	Mean ± Standard Deviation
1	HbA1c (%)	8.61± 1.82
2	FBS (mg/dl)	185.02± 77.0
3	Total Cholesterol (mg/dl)	167.13± 48.15
4	Triglycerides (mg/dl)	155.63± 97.24
5	LDL (mg/dl)	93.91± 44.54
6	VLDL (mg/dl)	41.87± 20.17
7	HDL (mg/dl)	44.52± 14.50

The mean HbA1c levels in our study population was 8.61  $\pm$  1.82, which shows the mean glycaemic control on a poor side. (HbA1c >7). The Mean FBS level observed in study population was 185.02  $\pm$  77.0 mg/dl. The mean total cholesterol levels in our study population was 167.13  $\pm$  48.15 mg/dl. The mean triglycerides level was 155.63  $\pm$  97.24 mg/dl while the mean LDL, VLDL and HDL levels were 93.91  $\pm$  44.54 mg/dl, 41.87  $\pm$  20.17 mg/dl and44.52  $\pm$  14.50 mg/dl respectively. The overall mean levels of lipid profile in the study population shows that the lipid profile is altered with levels more than expected normal values.

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Sr. No	Parameter	HbA1c < 7 (n= 68)	HbA1c ≥ 7 (n=332)	p value	
1	HbA1c (%)	6.24 ± 0.36	8.42 ± 1.20	<0.0001	
2	FBS (mg/dl)	150.57 ± 58.14	192.07 ± 78.81	<0.0001	
3	Total Cholesterol (mg/dl)	163.79 ± 49.41	167.81 ± 7.94	0.53	
4	Triglycerides (mg/dl)	148.48 ± 72.49	157.10 ± 101.6	0.50	
5	LDL (mg/dl)	83.52 ± 43.85	96.03 ± 44.45	0.035	
6	VLDL (mg/dl)	34.92 ± 13.87	43.29 ± 20.96	0.002	
7	HDL (mg/dl)	51.20 ± 11.7	43.16 ± 14.65	0.001	

Significant correlation was observed in our study between different parameters and HbA1c levels. (Table 2) Very strong correlation was seen between FBS levels and HbA1c levels (p<0.0001). Indicating mean FBS levels on lower side in the patients with good Glycaemic control (HbA1c < 7). Significant positive correlation was observed between HbA1c levels and LDL (p= 0.035), VLDL (p= 0.002) and negative correlation with HDL (p = 0.001). There was no correlation between total cholesterol and triglycerides. Yet because of correlation between LDL and VLDL and HDL the decreasing in the levels of cholesterol can improve other parameters.

#### DISCUSSION

A study conducted by Baljinder Singh Bal *et al* showed no significant association between age groups and HbA1c levels which is in contradiction with the current study. While the study showed correlations between HDL, LDL similar to current study.<sup>11</sup> A study conducted by Rosmee and Shyamal Koley showed similar findings as of current study, with a positive correlation of HbA1c levels and FBS and LDL cholesterol and negative correlation with HDL cholesterol. It was concluded from the results of their study that type 2 diabetic patients are more prone to dyslipidaemia, which is also seen in our study<sup>12</sup>. There were other studies which showed similar findings<sup>13</sup>. The HbA1c value <7.0% reduced the risk of cardiovascular diseases and value >7.0% leads to dyslipedemia to the patients.<sup>14</sup>

#### **CONCLUSION**

Significant association between age, duration of diabetes and HbA1c levels was seen in our study. A positive correlation between HbA1c and dyslipidaemia was observed in our study. Similar positive correlation of HbA1c level was also seen in previous studies<sup>15</sup>. HbA1c showed positive correlations with LDL and VLDL and negative correlations was found between HbA1c and HDL levels. Very strong positive correlation was observed between FBS levels and HbA1c levels in our study population. 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.

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Source of Support: None Declared Conflict of Interest: None Declared