

Original Article

A Study on Correlation between HbA1C and Serum Lipid Profile among Type 2 Diabetes Mellitus

Neha J Dutt¹, Mit J Panchani¹, Vandana K Dhangar², Vinod A Dange³

Authors' affiliations: ¹Resident Doctor; ²Associate Professor; ³Assistant Professor, Dept. of General Medicine, Surat Municipal Institute of Medical Education and Research, Surat, Gujarat.

Correspondence: Dr. Vandana Dhangar, Email: vandanadhangar@yahoo.com, Mob. No.:9925027718

ABSTRACT

Objective: To study correlation between HB1C and serum lipid profile among type 2 diabetes mellitus.

Methods: The cross-sectional study was carried out on 146 patients above the age of 30 years presenting with type 2 diabetes in OPD/wards of medicine department at Tertiary Care Center, South Gujarat.

Result: In study the parameters Fasting blood sugar (FBS), Glycated hemoglobin (HB1AC), triglycerides (TG), total cholesterol (TC), high density lipoprotein (HDL), low density lipoprotein (LDL), very low-density lipoprotein (VLDL) were studied. LDL, TC, were high in poor glycemic control group (HB1C>7) as compared to good glycemic control group (HB1C<7), HDL is significantly low in poor glycemic control group.

Conclusion: HB1AC is significantly correlated with lipid profiles. Type 2 diabetic patients are more prone to dyslipidaemia. Hba1c is significantly correlated with lipid profiles. So hba1c can be used as an indirect indicator of dyslipidaemia in type 2 diabetes in addition to as glycemic control biomarker.

Keywords: Type 2 diabetes mellitus, HB1AC, lipid profile

INTRODUCTION

In the ancient Sanskrit Indian literature, Diabetes Mellitus (DM) was described as “honey-urine disease” and has been associated with gross emaciation and wasting. Type 2 DM comprises a cluster of common metabolic disorders. It is a global endemic having a rapidly increasing prevalence in developing countries.¹ Diabetes mellitus is becoming more and more prevalent in our country India, it is estimated that approximately around 2% of the Indian population i.e. around 15 million peoples are suffering from diabetes and the number of cases is said to be alarmingly rising day by day by around 5%-6% each year. Also, an estimated 300,000 peoples die from diabetes due to its severe complications because of uncontrolled hyperglycemia. There are around 3.5 crore diabetic patients in India and the number will rise up to 5.2 crores by 2025.² Keeping in view of the alarming increase in the incidence and prevalence of diabetes in India, WHO has declared the developing country, India as the –Diabetic Capital of the World.³ Glycated hemoglobin (HbA1c) is routinely used as a diagnostic tool for screening and measuring long term control in diabetic patient. It is an indicator for the mean blood glucose level in diabetic patients, HbA1c predicts the risk for the development of severe diabetic complications in diabetic patients. The UKPDS study has shown that, in patients with Type 2 diabetes mellitus, the risk of diabetic complications were strongly associated with uncontrolled hyperglycemia. Control of hyperglycemia with decreased level of HbA1c is likely to reduce the risk of severe complications.⁴ Thus, the study was planned to observe the relationship among Glycated hemoglobin (HbA1c), Fasting blood sugar and Lipid profile in Type 2 diabetics of Surat, Gujarat.

MATERIAL AND METHOD

Study comprised a total of 146 patients who were examined in study of HbA1c in type 2 diabetic patients. There were 86 males and 60 females. Informed consent was taken from the subjects. Ethical clearance was taken from ethical committee of Surat Municipal Institute Of Medical Education And Research Hospital during the period of 18 months between January 2019 to July 2020 were taken up for the study. The age of patients ranges between 30 to more than 70 years, whose fasting glucose concentration ≥ 126 mg/dl includes both men and women.

All the patients were categorized into five age groups: 31-40,41-50,51-60,61-70,>70 years. Venous blood samples from all the subjects were collected in serum separator tubes. The sera were analyzed for glycated hemoglobin (HbA1c), fasting blood glucose (FBS), total cholesterol (TC), triglycerides (TS) and high-density lipoprotein cholesterol (HDL) using an auto analyzer Hitachi 17. The level of low density lipoprotein cholesterol (LDL) was determined using the formula: $LDL = (Cholesterol - TG) / (2,2 HDL)$. The impact of glycemic control on various parameters was evaluated by categorizing all the patients into 2 categories on the basis of HbA1c levels: HbA1c < 7% (good glycemic control, HbA1c > 7% (poor glycemic control)⁵.

Hypercholesterolemia is defined as TC > 200 mg/dl, high LDL when value > 100 mg / dl, hypertriglyceridemia as TG > 150 mg/dl and low HDL when value < 40 mg/dl. Dyslipidemia was defined by presence of one or more than one abnormal serum lipid concentration⁶.

Statistical analysis was done by using student's unpaired 't' test using Graph pad software¹¹. Pearson's correlation coefficient was also calculated using online calculator to find the correlation between HbA1c and lipid parameters⁵. Value of HbA1c was given as percentage of total haemoglobin and values of all other parameters were given in mg/dL. All Values are expressed as mean \pm SD. The results were considered non-significant when $P > 0.05$.

RESULTS

Out of 146 patients, 66 patients had HbA1c values less than or equal to seven (Good Glycaemic control) while rest of 80 patients had HbA1c values more than seven (Poor Glycaemic Control). Strong positive correlation was observed between FBG and HbA1c as shown by pearson's correlation coefficient. Similarly, values of TC, TG, LDL & VLDL in Good Glycaemic Control group were significantly lower than Poor Glycaemic Control group. Values of

TG had Moderate positive correlation with HbA1c values while TC, LDL & VLDL values had only weak positive relationship. HDL levels were significantly high in Good Glycaemic Control group as compared to Poor Glycaemic Control group and demonstrated a weak negative correlation. However, the low Hb found in good glycemic control compared to poor glycemic control.

Table 1: Distribution of cases according to duration of DM

Duration of DM (years)	Patients (n=146) (%)
<1	3 (2.05)
1-5	76 (52.06)
6-10	43 (29.45)
>10	24 (16.44)
Mean Duration of DM	6.07 \pm 4.22

Table 2: Correlation of biochemical parameters with HbA1C

Biochemical parameters	Hb1AC <7% (n=66)	Hb1AC >7% (n=80)	P value
Hb (gm/dL)	10.66 \pm 1.91	11.63 \pm 2.91	0.0057
Total count (cmm ³)	9227.1 \pm 3809.05	10691.53 \pm 5941.12	0.0858
Platelet count (cmm ³)	212375.0 \pm 119445	238947.6 \pm 134767.1	0.2142
S. creatinine (mg/dL)	0.81 \pm 0.29	0.86 \pm 0.28	0.2924
S. Bilirubin (mg/dL)	1.2 \pm 0.74	1.09 \pm 1.11	0.4922
SGPT (IU/L)	21.1 \pm 6.39	20.98 \pm 7.37	0.9174
SGOT (IU/L)	21.0 \pm 8.57	22.22 \pm 7.52	0.3613
Total Protine (mg/dL)	6.27 \pm 0.72	6.43 \pm 0.64	0.1576
Total cholesterol (mg/dL)	166.6 \pm 36.27	190.98 \pm 41.25	<0.0001
Triglyceride (mg/dL)	74.6 \pm 46.88	160.08 \pm 53.35	<0.0001
HDL (mg/dL)	65.60 \pm 20.58	47.17 \pm 18.97	<0.0001
LDL (mg/dL)	112.3 \pm 44.13	110.95 \pm 33.92	0.8348
S. TSH (mIU/L)	3.71 \pm 0.29	3.76 \pm 0.28	0.2924

DISCUSSION

In this study, association of glycated haemoglobin and lipid profile among diabetic patients has been studied. There is majority of patients duration of diabetes between 6 to 10 years. A good number of diabetic patients have hypercholesterolemia, hypertriglyceridemia, high LDL and low HDL levels and these are risk factors for cardiovascular diseases.

There is a positive corelation between glycated haemoglobin and lipid profile. Khan et al., also reported that severity of dyslipidaemia increases in patients with higher HbA1c value¹⁶. Khaw et al has reported that reducing the HbA1c level by 0.2% could lower the mortality by 10%¹⁷. The glycaemic control is important in prevention of cardiovascular diseases in type 2 diabetics.

CONCLUSION

There is a greater association of HbA1c with lipid profile in type 2 diabetes mellitus and showed positive correlations with TC, TG, LDL & VLDL and negative correlations between HbA1c and HDL levels is found. HbA1c level can be used as good parameter for predicting the lipid profile of both male and female diabetic patients¹¹. Timely intervention with lipid lowering drugs can be done in patient

with elevated glycated haemoglobin screened for type 2 diabetes mellitus to reduce the risk of cardiovascular diseases¹².

REFERENCES

- Berry C, Tardif JC, Bourassa MG. Coronary heart disease in patients with diabetes: part I: recent advances in prevention and noninvasive management. *J Am Coll Cardiol.* 2007; 49(6):631-642.
- Singh G, Kumar A. Relationship among HbA1c and Lipid Profile in Punjabi Type2 Diabetic Population. *Journal of Exercise Science and Physiotherapy.* 2011; 7(2): 99-102.
- Gupta V. Diabetes in Elderly Patients. *JK Practitioner.* 2002; 91(4): 258-259.
- Irene M Stratton, Amanda I Adler, H Andrew W Neil, David R Matthews, Susan E Manley, Carole A Cull. Association of glycemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. *BMJ.* 2000; 321(7258): 405-412.
- Jain Meenu, Jadeja Jayendrasinh M, Mehta Neeta. Correlation Between HbA1c Values And Lipid Profile In Type 2 Diabetes Mellitus. *International Journal of Basic and Applied Physiology* 2013 vol 2(1):47-50

6. Khaw KT, Wareham N, Bingham S, Luben R, Welch A and Day N. Association of hemoglobin A1c with car-diovascular disease and mortality in adults: the Euro-pean Prospective In-vestigation into Cancer in Norfolk. *Ann Intern Med* 2004; 141: 413-420.
7. Gligor Ramona et al. Relationship between glycosylated he-moglobin and lipid metabolism in patients with type 2 diabe-tes. *Studia Universitatis "Vasile Goldiș", Seria Științele Vieții* 2011;21(2): pp. 313-318
8. Goldberg IJ. Lipoprotein lipase and lipolysis: central roles in lipoprotein metabolism and atherogenesis. *J Lipid Res* 1996; 37: 693-707.
9. Erciyas F et al. Glycemic control, oxidative stress and lipid profile in children with type 1 Diabetes Mellitus. *Arch. Med. Res.* 2004; 35: 134-140
10. Khan, H.A. et al. Association between glycaemic control and serum lipids profile in type 2 diabetic patients: HbA1c predicts dyslipidaemia. *Clin. Exp. Med.* 2007; 7: 24- 29.
11. Berry C, Tardif JC, Bourassa MG. Coronary heart disease in patients with diabetes: part I: recent advances in prevention and noninvasive management. *J Am Coll Cardiol.* 2007; 49:631–642.
10. Wattanakit, K., Steffes, M.W., Coresh, J. and Sharrett, A.R. 2006. HbA1c and peripheral arterial disease in diabetes: the Atherosclerosis Risk in Communities study. *Diabetes Care* 29: 877-882.
12. D.J., Grant, R.W., Meigs, J.B., Nathan, D.M. and Cagliero, E. 2005. Sex disparities in treatment of cardiac risk factors in pa-tients with type 2 diabetes. *Diabetes Care*, 28: 514-520
13. Wareham, N., Luben, R., Bingham, S., Oakes, S., Welch, A., 2001. Glycated haemoglobin, diabetes, and mortality in men in Norfolk cohort of European Prospective Investigation of Cancer and Nutrition (EPIC-Norfolk). *Br. Med. J.* 322: 15-18
14. Brimberry, J.L., Langford, D., Nakashima, A., Sepe, S.J., Teutsch, S.M. and Mazze, R.S. 1984. An Epidemiologic model for diabetes mellitus: incidence, prevalence & mortality. *Diabetes Care* 7: 367-371