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Original research article: HbA1c as a screening biomarker of dyslipidemia in type 2 diabetes mellitus patients

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Abstract
Background: Patients with diabetes are considered to be at high risk for Dyslipidemia and Hypertension and therefore vulnerable to cardiovascular diseases. This study describes the possible role of Glycated Hemoglobin (HbA1c) and serum lipid profile as a biomarker for detecting cardiovascular diseases.
Aim: The Aim of our present work is to study the role of HbA1c as a screening biomarker for Dyslipidemia in patients with Type 2 Diabetes Mellitus (DM)
Methodology: Our study consists of 140 Type 2 DM patients between age 40-60 years along with age and sex matched healthy controls. Fasting Blood samples were collected from all participants for measuring Lipid Profile, Blood Sugar (FBS) and HbA1c.
Results: In our experimental group, the Mean Concentration of Fasting Blood Glucose(mg/dl), S.Cholesterol (mg/dl), S.Triglyceride (mg/dl), S.HDL (mg/dl) and HbA1c(%) is 142.5±5.2, 256.5±9.5, 215.9±5.2 33.5±6.3 and 9.7±1.0 respectively while in Control group it is 91.5±6, 145.3±8.5, 116.5±7.3,44.5±3.2 and 5.4±0.5 respectively.
Conclusion: HbA1c can be used as a potential biomarker for the prediction of Dyslipidemia and CVD.

Keywords: dyslipidemia, HbA1c, type 2 dm

1. Introduction

Diabetes is of global endemic occurance with rapidly increasing prevalence in both developing and developed countries. The American Diabetes Association has recommended glycated hemoglobin (HbA1c) as a possible substitute to fasting blood glucose for diagnosis of diabetes. HbA1c is an important indicator of long-term glycemic control with the ability to reflect the cumulative glycemic history of the preceding two to three months. [1, 2]. HbA1c not only provides a reliable measure of chronic hyperglycemia but also correlates well with the risk of long-term diabetes complications. Elevated HbA1c has also been regarded as an independent risk factor for Coronary Heart Disease and Stroke in subjects with or without diabetes. The valuable information provided by a single HbA1c test has rendered it as a reliable biomarker for the diagnosis and prognosis of diabetes. This review highlights the role of HbA1c in diagnosis and prognosis of diabetes patients [3-5].

Dyslipidemia and obesity are the most common complex metabolic disorders accounting for the highest toll of health resources globally by its increasing incidences. This consequently leads to Type 2 Diabetes Mellitus (T2DM) and Cardiovascular Disorders (CVDs) with variable reports about the role of metabolic factors on glycemic control. The current study is designed to determine the association of Dyslipidemia and Obesity with glycated hemoglobin (HbA1c) in T2DM and non-diabetic subjects [6].

HbA1c reflects the average plasma glucose control over a period of 2-3 months therefore effectively used as a marker for evaluating glucose level.1 It is the non-enzymatic binding of hemoglobin with glucose 9-11 The Diabetes Complications and Control Trials (DCCT) recommended HbA1c to be a standard test for glycemic control, with levels ≤7% consider suitable for lowering the possibility of vascular complications.12 However, this association between chronic hyperglycemia and macrovascular complications is not confirmed and defined. Several observational studies demonstrated that a higher HbA1c level was associated with increased risks of cardiovascular diseases and deaths.13-15 On the other hand, a meta-analysis study showed that 1% HbA1c reduction was associated with a lowered major cardiovascular risks by glycemic control, but was not associated with lowered stroke and death risks.16 Growing evidence supports the finding that HbA1c levels point towards an independent risk factor for cardiovascular events, regardless of the diagnosis of diabetes [7, 8].

2. Materials and Methods

This retrospective study was conducted at the Department of Biochemistry at PDU Medical college with attached Civil Hospital in Rajkot, Gujarat, India from 2015-2016.

Study includes 140 Type 2 Diabetes mellitus patients belonging to age group 40-60 years who had visited the Medicine OPD of our hospital along with 140 age and sex matched healthy Controls.

Fasting venous blood samples were collected from all participants. Samples were centrifuged at clinical biochemistry laboratory at 3000 RPM for a period of 10 minutes. Serum was separated from all samples. An Uniq was given to all participants. Lipid profile, Blood sugar (FBS) and HbA1c was

measured from all samples by colorimetric method.
Blood Sugar was estimated by Glucokinase method, Glycated hemoglobin (HbA1C) by turbidimetry method, Lipid profile (total cholesterol, triglycerides, HDL-C and LDL-C) out of which total Cholesterol (TC), Triglycerides (TG) and HDL-C were estimated by different enzymatic end–point methods. LDL-C estimation was done by Precipitation method.
Adult Treatment Panel III (ATP III) guideline was used which defined hypercholesterolemia (total cholesterol >200mg/dl), high LDL-C when value >100mg/dl, hypertriglyceridemia when value >50 mg/dl and low HDL-C when value 40 mg/dl.
Obtained results of case group were compared with control group for determination of difference of significance.
P-value was calculated by using online student t-test calculator. p-value less than 0.05 was considered as significant.

3. Result and discussion

All Participants were divided according to their age. (Table 1)
Comparison of various biochemical parameter between case group and control group was done by calculating p-value. (Table 2)
Correlation of HbA1C with lipid profile of diabetes type 2 patients is mentioned in Table 3**.**

Table 1: Age wise distribution of participants

Group	Number(n)	Age Group(yr)	Mean Age
Group 1(Case)	140	40-60	53.5 ± 4
Group 1(Control)	140	40-60	51.6 ± 6

Table 2: Comparison of various biochemical parameter case group and control group, S: Significant, NS: Non-significant

Parameter	Group 1(Case)[n=140]	Group 1(Control)[n=140]	p-Value
Fasting blood glucose(FBS)(mg/dl)	142.5±5.2	91.5±6	<0.05(S)
S.Cholesterol(mg/dl)	256.5±9.5	145.3±8.5	<0.05(S)
S.Triglyceride(mg/dl)	215.9±5.2	116.5±7.3	<0.05(S)
S.HDL(mg/dl)	33.5±6.3	44.5±3.2	<0.05(S)
S.VLDL(mg/dl)	43±4.2	23.2±5.6	<0.05(S)
S.LDL(mg/dl)	180.2±10.5	77.2±8.5	<0.05(S)
HbA1c (%)	9.7±1.0	5.4±0.5	<0.05(S)

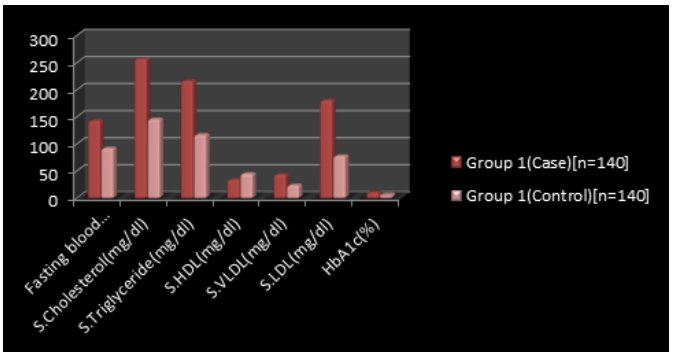

Fig 1: Graphical presentation of Comparison of various biochemical parameter case group and control group

Table 3: Correlation of HbA1C with lipid profile of diabetes type 2 patients, S: Significant, NS: Non-significant

Parameter	Corelation coefficient	p-value
S.Cholesterol(mg/dl)	+0.58	<0.05(S)
S.Triglyceride(mg/dl)	+0.92	<0.05(S)
S.HDL(mg/dl)	-0.19	>0.05(NS)
S.LDL(mg/dl)	+0.57	<0.05(S)
S.VLDL(mg/dl)	+0.31	<0.05(S)

In the present study, it was found that Serum Total Cholesterol, Triglycerides, VLDL and LDL-C were significantly higher in Type 2 Diabetes group than Control group and were in borderline high risk range. While serum HDL-C was significantly lower in Type 2 DM group than Control group and was towards lower range of normal value. Thus the study showed the high prevalence of Dyslipidemia, a well-known risk factor for cardiovascular disease [6]. Thus the findings were in consistent with previous studies [9].
The cause of Dyslipidemia in Type-2 DM might be due to insulin insensitivity or resistance affecting the apoprotein production by the liver which regulates the enzymatic activity of lipoprotein lipase and cholesterol ester transport protein. A highly positive significant relationship of HbA1C with Dyslipi-demia was observed in the present study. Erclays *et al* also re-ported positive correlation of HbA1C level with Total Cholesterol and Triglycerides level in Diabetic persons [10, 11].
A highly significant correlation between HbA1c and FBG in this study is similar to previous studies [12, 13]. Significant correlation between HbA1c and TC, LDL-C are also observed. In various studies HbA1c was found to have positive correlation with TC, LDL-C and TG in diabetic patients [20-21]. In the present study the association between HbA1c with various Lipid parameters and LDL-C-HDL-C ratio, suggests the importance of glycemic control in order to control Dyslipidemia. The diabetes complications and control trail (DCCT) established HbA1c as gold standard of gylcemic control.

4. Conclusion

Patients with Type-2 DM are considered to be at more risk of Dyslipidemia and Hypertension, hence targets for CVD and complications. The key findings of this study demonstrated that most of the microvascular and macrovascular complications in Type-2 DM patients arise with an increase in HbA1c, dyslipidaemia and hypertension. HbA1c can potentially be used as a potential biomarker for the predictor of Dyslipidemia and CVD.

5. References

1. Arshag D Mooradian. Dyslipidemia in type 2 diabetes mellitus. Nature Clinical Practice Endocrinology and Metabolism. 2009; 5(3):150-59.
2. Allain CC, Poon IS, Chan CHG, Richmond W. Enzymatic determination of serum total cholesterol. Clin. Chem. 1974; 20:470-71.
3. Anjana RM, Pradeep R, Deepa M, *et al*. Prevalence of diabetes and prediabetes (Impaired fasting glucose and /or impaired glucose tolerance) in urban and rural india

:phase 1 results of the Indian Council of Medical Research –Indian Diabetes(ICMR=INDIAB) study:Diabetologia. 2011; 54(12):3022-7.
4. Chandramohan P, Mohan V. High prevalence of Diabetes and Metabolic Syndrome Among policeman JAPI NOV. 2008; 56:837-38.
5. Grundy SM. Hypertriglyceridemia, insulin resistance, and the metabolic syndrome. Am J Cardiol. 2006; 83:25-9.
6. Peterson KP, Pavlovich JG, Goldstein D, Little R, England J, Peterson CM. What is hemoglobin A1C? An analysis of Glycated hemoglobins by electospray ionization mass spectrometry. Clin Chem. 1998-2008; 44(9):1951-8.
7. Mohan V, Shah S, Saboo B. Current glycemic status and diabetes related complications among Type 2 diabetes patients patients in India: Data from the achieve study. JAPI. 2013; 61:13-5.
8. Sultan A, Thuan JF, Avignon A. Primary Prevalence of cardiovascular events and type 2 diabetes should we prioritize our interventions? Diabetes Metab. 2006; 32:559-567.
9. Selvin E, Marinopoulos S, Berkenblit G, Rami T, Brancati FI, Powe NR. Metaanalysis: glycosylated hemoglobin and cardiovascular disease in diabetes mellitus. Ann Intern Med. 2004; 14:421-431.
10. Erclays F, Taneli F, Arslan B, Uslu Y. Glycemic control, oxidative stress and lipid profile in children with type 1 diabetes mellitus. Arch. Med. Res. 2004; 35:134-140.
11. McTernan CL, McTernan PG, Harte AL, Levick PL, Barnett AH, Kumar S. Resistin, central obesity, and type 2 diabetes. Lancet. 2002; 359:46-7.
12. Wildler E. What is the consequence of an abnormal lipid profile in patients with type 2 diabetes or the metabolic syndrome? Atherosclerosis Supple. 2005, 11-14.
13. Charitha B, Senghor AR, Shivashekar M, William E. Glycated Hemoglobin as a Dual Marker: In Control of Glycemic Status and Diabetic Dyslipidemia. International Journal of Pharmaceutical and Clinical Research. 2013; 5(3):111-3.