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(RESEARCH ARTICLE)

HbA1c is associated with hypertriglyceridimea in type 2 diabetes mellitus

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Abstract

Background: Hypertriglyceridimea is defined as Triglyceride level in blood greater than 150 mg/dl, Type 2 diabetes mellitus one of which results from obesity is characterized by hyperglycemia resulting from insulin resistance. HbA1c level will be high in condition of type2 diabetes one of the markers that displays progression of disease in the patient. Many metobolic pathways are impaired in hyperglycemia which results into dyslipidemia

Methods: 186 patients diagnosed with type 2 diabetes mellitus were enrolled for this study out of them 131 were female and 55 were males, the blood sample of the patient were taken and other parameter of the patient such as BMI, total cholesterol and triglyceride.

Inclusion criteria: Patient who are diagnosed with diabetes with blood sugar level greater than 200mg and regularly visitng their physician for the update of their disease.

Exclusion Criteria: Patients suffering from cardiovascular disease, thyroid disorders, renal problems and other endocrinopathies and those taking lipid-lowering agents.

Results: On comparing parameter gender wise, females exhibited higher values for Basal Metabolic Index, HbA1c, and TG. The HbA1c level were not found significant in any other parameter reference for HbA1c (good glycemic index <7%, and poor but glycemic index >7%) but TG ($p=0.020$) and HbA1c ($p<0.001$) showed significant correlation. Linear regression analysed value indicated that Hb TGs ($p=0.020$) and were independent of age, BMI, TC.

Conclusion: The glycated Hb was associated with TGs, and no significant association was found with age, BMI, TC.

Keywords: Glycated Hemoglobin; Diabetes mellitus; Glycemic Control; Dyslipidemia; Lipid Profile

1. Introduction

Type 2 diabetes is the condition of insulin resistance where features of hyperglycemia is observed in the patient that influences many metabolic pathways of lipid metabolism or deficiency that affects key enzymes and pathways in lipid metabolism which results into dyslipidemia [1,2] In type 2 diabetes glucose level will be so high that causes hyperglycemic effect which is co- related with cardiovascular disease in type diabetes mellitus. Therefore it is suggested that strict control of hyperglycemia and dyslipidemia can prevent many vascular related complication or risk of cardiovascular disease. studies have shown that HbA1c is independent risk factor of coronary heart disease, it is also observed that 1% increase in HbA1c level also increases 18% risk of cardiovqscular disease [3,4].

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T2DM patients are having highest chance to develop dyslipidemia which puts them to microvacular and microvascular disease, macrovascular disease includes stroke, Coronary artery disease peripheral vascular disease, while that of microvascular disease involves retinopathy neurpathy and nephropathy [5,6].

Glycated haemoglobin level is continuously measured in diabetes to monitor their glycemic control, the aim of which is to achieve its percentage below 7% the levels of which can be affected by several factor such as sugar intake exercise and adherence to medication

Glycated hemoglobin (HbA1c) levels are routinely measured in diabetics to monitor their glycemic control. The goal is to achieve a level below 7%. Levels of HbA1c can be affected by multiple factors, including sugar intake, exercise and adherence to medications. Some studies have reported that HbA1c could potentially be utilized as a possible biomarker for predicting dyslipidemia.

This study aims to investigate HbA1c association with TG level in type 2 diabetes, so that future HbA1c potentially could be utilized as a biomarker for predicting hypertriglyceridimea concluding that HbA1c could be a sign of TG levels and that it may predict CVD risk factors in T2DM.

2. Methods

The present cross-sectional study was accomplished in tertiary care hospital of chitwan district. Before start of procedure consent form of the patient was taken from all participants in which they were informed about the nature of the study and confidentiality of it was maintained. Blood sample were withdrawn from each individual to measure HbA1c and lipid profile parameter in the morning after 10 to 12 hours of fasting from the participant.

Anthropometric parameters such as age gender, Height, weight were taken from the patient. From Height and Weight BMI was calculated.

Reference value for glycemic control was characterized as poor (HbA1c >7%) or good (HbA1c <7%).
Patient having history of chronic disease like Thyroid cardiovascular disease and under statin the lipid lower drugs were not included.

SPSS version 21 (IBM Corp., Armonk, NY, USA) was employed to compute the data.
Linear regression test was computed to find the association between the variablesHbA1c and other considered parameters of this study (p value less than 0.05).

3. Results

A total of 186 T2DM patients were selected for the study (131 females and 55 males). The participants' basic characteristics were analyzed and compared according to gender (Table 1). on analysis female showed superior value on all measured parameter that is BMI, Total cholesterol, and HbA1c, though the age of male were higher than the females.

Table 1 Gender-wise comparison of basic characteristics of type 2 diabetes mellitus patients

Parameters	**SD± Mean**	**Mean ± SD Females (N=131)**	**Mean ± SD Males (N=55)**	***p*-value**
Age (yrs)	60.46±13.54	58.53±14.19	64.66±10.99	<0.001*
BMI (Kg/m^2)	30.8±6.1	31.59±6.56	29.08±4.58	0.002*
HbA1C (%)	7.65±1.78	7.86±1.86	7.20±1.53	0.009*
Total cholesterol (mg/dl)	170.14±40.9	174.40±39.8	152.35±40.2	<0.001*
Triglyceride (mg/dl)	143.48±86.8	142.82±77.94	147.79±103.6	0.57

Correlation regression between HbA1C and age, BMI, TC,TG and linear regression analysis of T2DM patients showing dependency of HbA1C on other variables

The result analyzed from Regression showed that HabA1c is associated with TG (p=0.20)

But, independent age, BMI and total cholesterol.

Table 2 Correlation analysis (between HbA1C and Age, BMI, Total cholesterol and Triglyceride and linear regression analysis of T2DM patients showing dependency of HbA1C on other variables

Parameter Coefficient	p-value	Correlation Unstandardised regression	Regression analysis p-value
Age (yrs)	−0.066	0.346	0.56
BMI (Kg/m2)	0.035	0.614	0.63
Total cholesterol (mg/dl)	0.132	0.06	0.47
Triglyceride (mg/dl)	0.164	0.02*	0.02*

4. Discussion

Type 2 diabetes a chronic endocrinopathies is the most problematic condition that cause micro and macrovascular problem such as that of coronary artery disease, it can be used as a biomarker to understand the complication by HbA1c level [9,10].

Routine measurements are schedulic procedure to observe glycemic control in diabetes, the aim is to achieve HbA1c level below 7%. Several factors such as exercise sugar consumption and drugs adherence affect the level.

In this study, Triglyceride is correlated with HbA1c and found significant positive relationship but non-significant correlation with Total Cholesterol. In agreement to this study several other study has also displayed positive relationship between HbA1c with High TG [11].

Thus, the finding of this study indicates that HbA1c is direct indicator of TG and indirectly help to assess the type 2 diabetes mellitus to prevent micro and macro vascular complication.

Patient suffering from type 2 diabetes have higher CVD compared with subject not having diabetes therefore it is necessary to detect diabetes condition early in early time to reduce CV D, insulin resistance which prevail in diabetes plays central role in development of CVD insulin resistance also enhances hepatic secretion of very low-density lipoprotein (VLDL) along with the late removal of TG-rich lipoproteins, mainly due to increased substrate levels of TG synthesis, the reason of insulin resistance in obesity is due to release of free fatty acid from fat cell that led to diabetes thus promotes Triglyceride production if the cell has adequate glycogen storage

5. Conclusion

The conclusion derived from this study is HbA1c could be one of useful biomarker for predicting hypertriglyceridemia that instigate cardiovascular disease.

The gold standard reference of glycemic control is HbA1c, which is not only the factor determining blood sugar regulation but also the marker determining diabetes related complication and mortality that results due to increased TG, Therefore, HbA1c test in blood can be utilized for predicting High TG level, that is relatively inexpensive method.

Compliance with ethical standards

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Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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