

Correlation of HbA1c Levels and Hypertriglyceridemia in Prediabetes: Assessment of Future Diabetic Risk

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ABSTRACT

Background: The adverse consequences of hyperglycemia have been reported to occur at much lower glucose level than what is currently defined as Type 2 Diabetes Mellitus (T2DM). Hypertriglyceridemia is quite prevalent in T2DM.

Objectives: The study aimed to correlate the level of HbA1c with Triglyceride levels and assess their role in assessment of future diabetic risk.

Materials and Methods: The biochemical parameters of 60 Prediabetics were compared with 60 age and sex matched normoglycemic healthy controls (30-60 yrs). Fasting blood glucose, HbA1c and lipid profile were assessed as per standard laboratory methods. Prediabetes was defined according to American diabetic association (ADA 2011) criteria. 8 year Diabetic risk was assessed using Framingham risk score.

Results: Triglyceride level was in borderline high range (150-199mg/dL) in Prediabetics. Positive Correlation ($r = 0.435$, $p = 0.000$) was observed between HbA1c and TG levels. TG levels also showed positive correlation ($r = 0.656$, $p = 0.000$)

with 8 year Diabetic risk. Regression equations for Prediabetics were also calculated.

Conclusion: The study recognized the preponderance of Borderline hypertriglyceridemia in Prediabetics and its positive correlation with 8-year Diabetic risk.

Key words: Prediabetes, HbA1c, Hypertriglyceridemia, Diabetic Risk.


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INTRODUCTION

Prediabetes is the term used to describe elevated blood glucose that has not reached the threshold of Type 2 Diabetes Mellitus. It is a high risk state for development of Diabetes with yearly conversion rate of 5-10%.¹ Many studies have suggested an association of Prediabetes with the complications of Diabetes, amongst which dyslipidemia is very common. Hypertriglyceridemia is linked to high glucose levels and increased risk of type 2 Diabetes.²

In our study, correlation of HbA1c with triglyceride levels signifies HbA1c as a direct marker of hypertriglyceridemia and of future Diabetic risk.

MATERIALS AND METHODS

The study was carried out in the Department of Physiology, Gandhi Medical College, Bhopal (M.P.) in collaboration with the Department of Medicine.

The study was approved by the Ethics Committee of Gandhi Medical College, Bhopal (No.1666-67). The study was conducted from October 2010 to December 2011. Informed consent was obtained from the each participant.

Study Design

It was an observational study. Sample Size was based on the reported prevalence of 3.6% of Prediabetes in India. Sample size was calculated by using the formula.³ 230 first degree relatives (117 males, 113 females) of T2DM patients attending the Diabetic Clinic who gave consent to participate in the study were selected. On the basis of fasting plasma glucose (FPG 100-125mg/dL) 60 subjects were identified as Prediabetes as per ADA 2011 criteria.⁴ 60 age and sex matched healthy normoglycemic employees of institute served as control. All the subjects included in study had no known endocrinal, renal and cardiovascular disorder. Subjects having FPG >126 mg/dl, family history of dyslipidemia, abnormal ECG, taking hormonal therapy, hormonal contraceptive, lipid lowering drugs or drugs to control blood sugar level were excluded from the study. Baseline clinical characteristics, anthropometric measurements and biochemical data were recorded as per the standard procedures.

12 hour fasting blood samples were collected for analyzing fasting plasma glucose, HbA1c, total cholesterol, triglyceride (TG), High density lipoprotein cholesterol (HDL) and low density lipoprotein

cholesterol (LDL) in Autoanalyzer (Merck 300). HbA1c was assessed by Microcolumn method.

Dyslipidemia was assessed according to National Cholesterol education program NCEP-ATP IV criteria (2013). The 8 year Diabetic risk was assessed using Framingham risk scoring.

Data analysis was done through SPSS version 20. Pearson correlation test (r) was used to evaluate the relationship between HbA1c and Triglycerides. Chi-square was used for association between HbA1c with various cut-off values and high triglyceride levels. The p-value < 0.05 was considered statistically significant.

Scatter diagrams were plotted to show relationship between variables.

RESULTS

Hba1c level in the Prediabetic group was significantly higher as compared to control group. Serum Triglyceride level was significantly higher in Prediabetic group (158.1 ± 21.8 mg/dL) as compared to Control group (116.7 ± 27.2mg/dL). Thus Prediabetic state was observed to be associated with borderline Hypertriglyceridemia (150-199mg/dL).

Table 1: Comparison of parameters between case and control group

Group Statistics							
	Group	N	Mean	Std. Deviation	Std. Error Mean	t	P
FBG (mg/dL)	Cases	60	113.23	7.127	.920	20.434	0.000
	Control	60	84.63	8.170	1.055		
HbA1C (%)	Cases	60	5.772333	.5532412	.0714231	8.757	0.000
	Control	60	4.865167	.5812625	.0750407		
TG (mg/dL)	Cases	60	158.05	21.819	2.817	9.166	0.000
	Control	60	116.75	27.241	3.517		

Table 2: Correlation table for cases (Prediabetic group)

		Correlations			
		FBG (mg/dL)	HbA1C (%)	TG (mg/dL)	DM Risk (%)
FBG (mg/dL)	Pearson Correlation	1	0.478**	0.379**	0.469**
	Sig. (2-tailed)		.000	.003	.000
	N	60	60	60	60
HbA1C (%)	Pearson Correlation		1	.435**	0.608**
	Sig. (2-tailed)			.001	.000
	N		60	60	60
TG (mg/dL)	Pearson Correlation			1	.656**
	Sig. (2-tailed)				.000
	N			60	60
DM Risk (%)	Pearson Correlation				1
	Sig. (2-tailed)				
	N				60

** . Correlation is significant at the 0.01 level (2-tailed).

Figure 1: Scatter plot: correlation of HbA1c and TG levels

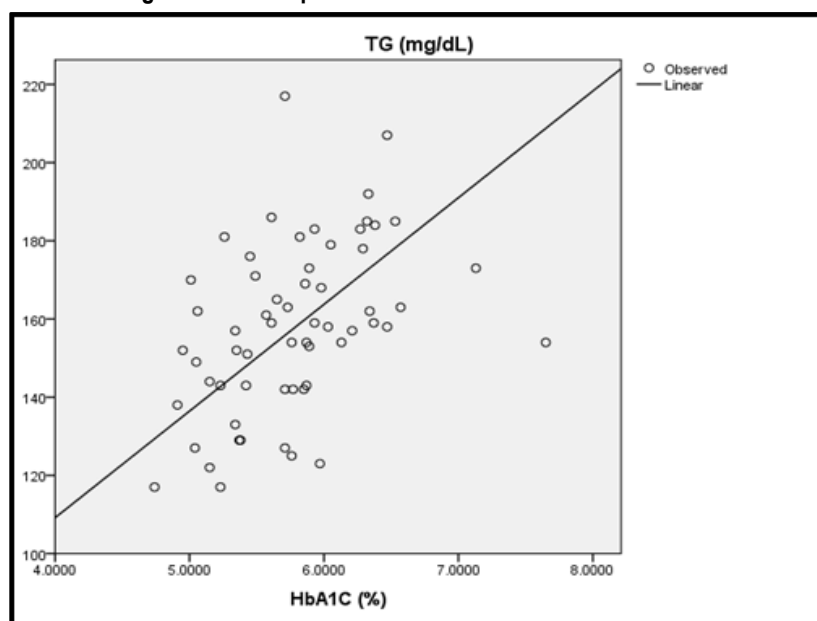


Figure 2: Scatter plot: Correlation of TG levels and 8 yr DM risk

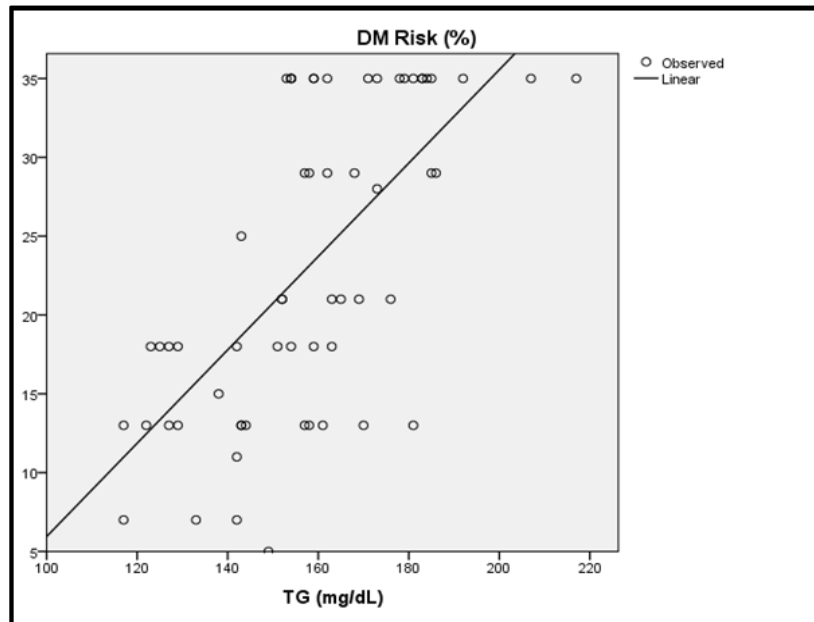


Table 2 indicated moderate positive correlation ($r=0.608^{**}$, $p=0.000$) found between HbA1c and Diabetic Risk. Moderate positive correlation ($r=0.435^{**}$, $p=0.000$) was found between HbA1c and TG, For visual comparison see figure 1. HbA1c showed moderate positive correlation ($r=0.608$, $p=0.000$) with future Diabetic risk.

Triglyceride levels also showed moderate positive correlation ($r=0.656$, $p=0.000$) with future Diabetic risk (Figure 2).

Regression Equations for Cases Were

- $Y = a + b \cdot X$

Y=dependent variable (TG), X= Independent variable (FBG)

$Y = 26.734 + 1.16 \cdot \text{FBS}$, ($R^2=0.379$)

- $Y = a + b \cdot X$

Y = dependent variable (TG), X= Independent variable (HbA1c)

$Y = 59.003 + 17.15 \cdot \text{HbA1c}$, ($R^2=0.435$)

- $Y(\text{DM}) = a + b \cdot (\text{HbA1c})$ ($R^2=0.469$)

Y=dependent variable (8 year DM risk), X= Independent variable (HbA1c)

$Y = -39.42 + 10.838 \cdot \text{HbA1c}$

DISCUSSION

Several studies have suggested that the complications of diabetes begin early in the progression from normal glucose tolerance to frank diabetes.⁵ Prediabetes is a high risk state for development of Diabetes⁶, also referred to as a grey area. Early identification and efforts to improve glycemia in persons with prediabetes can reduce or delay the progression to diabetes and related cardiovascular diseases.⁷

Tenebaum et al (2014) emphasized that hypertriglyceridemia has been a too long unfairly neglected major cardiovascular risk factor.⁸ Parhofer (2015) opined that hypertriglyceridemia and low HDL cannot only be the consequence but also the cause of disturbed glucose metabolism.⁹

Lebovitz et al (2013) suggested that fasting plasma triglycerides predict the glycemic response to type 2 diabetics by a neural mechanism.¹⁰ Several studies have suggested a correlation between glycemic control and dyslipidemia.¹¹ Kushner et al (2016)

assessed the importance of risk factors, consequences and management strategies recommended for patients with hypertriglyceridemia. Statins are associated with a small but significant increase in the risk for new onset diabetes.¹² Hussain et al (2017) suggested a positive correlation between HbA1c and high triglycerides and opined that HbA1c can be used as a potent marker for dyslipidemia and mitigate the macro- and micro-vascular complications of disease.¹³

This study evaluated the correlation between Glycated hemoglobin (HbA1c) and Triglycerides level and the results showed that there is a significant correlation between high HbA1c and high triglyceride levels. This may in turn help in predicting the triglyceride status in Prediabetics from the degree of glycemic control and therefore identifying patients at increased risk from cardiovascular events.¹⁴

CONCLUSION

The study recognized the preponderance of Hypertriglyceridemia in the Prediabetic state and its moderate positive correlation with future Diabetic risk. The study emphasizes the need to lower Triglyceride levels along with control of blood glucose and HbA1c levels in Prediabetic population to prevent future diabetic risk and associated complications.

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