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KEY WORDS: Glycemic control, HbA1c, Serum lipid profile, Type 2 diabetes.

''CORRELATION BETWEEN HbA1c CONCENTRATION AND LIPID PROFILES IN TYPE 2 DIABETES MELLITUS"

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ABSTRACT

Patients with type 2 diabetes have increased abnormalities of lipid profile. Early intervention to control the lipid level in blood can reduce the chances of cardiovascular complications. The aim of this study is to evaluate the correlation between HbA1c and lipid profiles levels. The study included 100 cases of type 2 diabetes mellitus that were admitted to Shree Krishna Hospital, Karamsad. Further patient investigations like fasting blood sugar, HbA1c and lipid profile were taken. All tests were performed on Siemens Dimension analyzer. The patients were classified into two groups according to the HbA1cconcentration; Good Control Group (HbA1c < 7.0%) and Poor Control Group (HbA1c ≥7.0%). It was found out that 74 males and 26 females (50 had good glycemic control and 50 had poor glycemic control) from type 2 diabetes. HbA1c showed positive correlations with cholesterol, triglycerides & LDL, and negative correlation with HDL. These results suggest that HbA1c can be used as a good parameter to predict the risk of developing diabetic complications.

INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both(Association, 2010). Recent estimates indicate that there were 171 million people in the world with diabetes in the year 2000 and this is projected to increase to 366 million by 2030(Wild, Roglic, Green, Sicree, & King, 2004). The risk of chronic complications in patients with DM depends on the duration of hyperglycemia, and they usually become manifest in the second decade of the development of DM (Joshi & Parikh, 2007). Studies on migrant Indians have shown that they have a higher predisposition to insulin resistance, type 2 diabetes and coronary artery disease compared to other ethnic groups(Atlas, 2006). There is a higher risk of cardiovascular disease in people with type 2 diabetes, while cardiovascular deaths represent the top killer in this population (Abate & Chandalia, 2001; Sultan, Thuan, & Avignon, 2006).

DM is frequently associated with dyslipidemia and increased percentages of glycated hemoglobin. Patients with type 1 DM are generally not heyperlipidemic if they are under good glycemic control. But patients with type-2 DM are usually dyslipidmic even if under relative good glycemic control. They have several lipid abnormalities including elevated plasma triglycerides, elevated Low- Density Lipoprotein-Cholesterol (LDL-C) and decreased High-Density Lipoprotein-Cholesterol (HDL-C). Dyslipidemia is a risk factor for coronary artery disease, a leading cause of mortality in patients with diabetes mellitus.(Masram, Ghangle, & Biman palli, 2012).

Glycated Hemoglobin (HbA1c) is a routinely used marker for long-term glycemic control.HbA1c predicts the risk of developing diabetic complications in diabetic patients. Nowadays, elevated levels of HbA1c have been regarded as an independent risk factor for cardiovascular disease in subjects with diabetes. Each one percent increase in absolute HbA1c shows eighteen percent increase in the risk of cardiovascular disease (Ramona et al., 2011; Yan, Liu, & Huang, 2012). The positive relationship between HbA1c and cardiovascular disease is shown in nondiabetic cases even within the normal range of HbA1c. (Meenu, Jadeja Jayendrasinh, & Neeta, 2013).

In the previous study by United Kingdom Prospective Diabetes Study (UKPDS) has shown that in patients with type 2 diabetes, the risk of diabetic complications was strongly associated with previous hyperglycemia. Glycemic control with decreased level of HbA1c is likely to reduce the risk of complications (Stratton et al., 2000). A few studies have previously tried to find the correlation between HbA1c levels and lipid profile. Some of these have shown that all the parameters of lipid profile have significant correlation with glycemic control(Deeg & Ziegenhorn, 1983; VinodMahato, Gyawali, Raut, Regmi, Singh, Raj Pandeya, et al., 2011)(Ramona et al., 2011)(Sharma, Sharma, Kumar, & Tripathi, 2015).This study was conducted to examine and reveal the relationship between glycemic control and serum lipid profile.

Methods: A total of 100 patients admitted to the Shree Krishna Hospital, Karamsad, were included in this study. Venous blood samples were collected in two tubes. The whole blood was analyzed for HbA1c and serum for Lipid Profile test. The determination of all tests were performed on Siemens Dimension Clinical Chemistry Analyzer. Estimation of Glycated hemoglobin (HbA1c) was conducted by Turbidimetric Inhibition Immunoassay method (Burtis, Ashwood, & Bruns, 2012; Zurbriggen et al., 2005). Estimation of serum total cholesterol was done by polychromatic endpoint method (Burtis et al., 2012; Meiattini, Prencipe, Bardelli, Giannini, & Tarli, 1978; Wallach, 2007). And for the estimation of serum triglycerides (TG), by the enzymatic dichromatic endpoint was used (Bucolo & David, 1973; Burtis et al., 2012; Sampson, Demers, & Krieg, 1975; Wallach, 2007). Estimation of serum High-density lipoprotein cholesterol (HDL-C) was performed by dichromatic endpoint method (Assmann, Schriewer, Schmitz, & Hägele, 1983). Low-density lipoprotein cholesterol (LDL-C) was calculated by Friedewald formula(Li, Wilcken, & Dudman, 1994).The lipid profiles levels were compared in the patients who have good and poor of glycemic control.

This study was approved by the Institutional Ethics Committee (IEC) in Pramukhswami Medical College (PSMC), Karamsad.

Statistical Analysis:

Descriptive statistics was computed with percentages and proportion. Group comparisons were done by Chi-square test, Pearson correlation and P-value, and the mean plus or minus standard deviation (±SD) by SPSS statistical computerized program. References management was done by Endnote X7 program.

Results: In our study of 100 participants of type Ⅱ DM, we found 74 males out of a total of 100 cases show different percentages regarding glycemic control. It is revealed that 38 of the males cases have good glycemic control and 36 have poor glycemic control. In total 26 females, 12 have good glycemic control, while 14 of them have poor glycemic control from type 2 diabetes. (Table 1)

Patients who have HbA1c value ≥ 7.0% had a higher level of mean in the total cholesterol, Triacylglycerol (TG) and low-density

lipoprotein cholesterol (LDL-C). Compared to the patients whose HbA1c <7.0%, the mean level of high-density lipoprotein cholesterol (HDL-C) was higher in those with good glycemic control (HbA1c <7%) than in patients who had poor glycemic control (HbA1c >7). (Table 2)

HbA1c demonstrated positive correlations with total cholesterol (TC), Triacylglycerol (TG), and low-density lipoprotein cholesterol (LDL-C), but negative correlation with high-density lipoprotein cholesterol (HDL-C).(Table 3)

Table 1 Distribution the males and females according to good and poor glycemic control

		Gender		Total
		M	F	
Good control HbAHBA1C1c < 7	Count	38	12	50
Poor control HbA1c > 7	Count	36	14	50
Total	Count	74	26	100
	% of Total	74.0%	26.0%	100.0%

Table 2. The mean level of lipid profile in good and poor glycemic control

HBA1C		Cholesterol	Triglyceride	High-density lipoprotein	Low-density lipoprotein
Good control **HbA1c** < 7	Mean	148.1	114.1	45.5	72.9
	S. D	35.1	60.3	19.1	32.5
Poor control **HbA1c** > 7	Mean	187.2	156.1	40.1	115.8
	S. D	43.5	60.6	9.0	40.3
Total	Mean	167.6	135.1	42.8	94.4
	S. D	43.9	63.7	15.1	42.3

Table 3-The Correlation between HbA1c and Lipid Profiles.

	Cholesterol	Triglyceride	High-density lipoprotein	Low-density lipoprotein	
HBA1C	**Pearson Correlation**	0.45**	0.33**	-0.17	0.51**
	Sig. (2-tailed)	0.001	.001	.074	0.001
	N	100	100	100	100

Discussion:

Lipid abnormalities are more common in complication of diabetic patients and frequently seen in patients with type-2 diabetic mellitus. The abnormal lipid profile in type 2 Diabetes mellitus is related to insulin resistance as reported in previous studies, which affects the increased release of free fatty acids from fatty tissue . The Diabetes complications and control trial (DCCT) have identified HbA1c as the gold standard of glycemic control. It has been suggested that the level of HbA1c ≤7.0% is appropriate to reduce the risk of cardiovascular complications .

In the present study, we have evaluated the pattern of lipid profile parameters in diabetic patients and its correlation with HbA1c. The levels of HbA1c and FBG were significantly slightly increased in females more than in males. Although there were no significant difference in Lipid profile levels between male and female, the levels of Cholesterol, HDL-C and LDL-C were significantly higher in female as compared to the male of type 2 diabetic patients. This result is consistent with previous studies . Hyperlipidemia in females may be attributed to the effects of sex hormones on body fat distribution, which leads to differences in altered lipoproteins .

The results of the current study also showed that serum lipid levels were significantly higher in poor glycemic control than in good glycemic control. Cholesterol, Triglyceride and LDL-C were higher (187.2±43.5, 156.1± 60.6 and 115.8±40.3) in poor glycemic control compared to good glycemic control (148.1±35.1, 114.1± 60.3 and 72.9±32.5) respectively. Similar conclusions were recorded in studies conducted by R VinodMahatoet al 2011 .Controlling the glycemic levels may decrease the risk of cardiovascular diseases. . This warrants the need for more critical monitoring of lipid profile in diabetic patients so as to prevent cardiovascular complications.

Conclusion:

The results of this study reveal that poor control of blood sugar in patients with type 2 diabetes is more likely to lead to dyslipidemia. HbA1c is significantly correlated with lipid profiles. HbA1c can be used as an indicator of dyslipidemia in type 2 diabetes in addition to glycemic control biomarker.

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