ORIGINAL ARTICLE
HBA1C AS AN INDIRECT MARKER OF HYPERTRIGLYCERIDEMIA IN TYPE 2 DIABETES MELLITUS

Syed Muhammad Hammad Zaidi, Abdul Ghafoor, Fawad Ahmad Randhawa
Department of Endocrinology and Metabolism, Services Hospital, Lahore-Pakistan

Background: Diabetes is usually accompanied by dyslipidaemia, and among these triglyceride levels are related to the insulin resistance in type 2 diabetes. HbA1c which is an indicator of diabetes control can depict the severity of hypertriglyceridemia. The objective of this study was to determine the correlation between HbA1c and Triglyceride levels in type 2 Diabetes mellitus. **Methods:** A sample of 150 diabetic patients fulfilling the inclusion and exclusion criteria were selected for this cross-sectional study .Patient included were type 2 Diabetes Mellitus with HbA1c ≥7. Patients with history of cardiovascular disease, taking lipid lowering medications, smoker and history of cerebral stroke were excluded. HbA1c and triglyceride levels were noted .Study patients were further stratified on the basis of severity of HbA1c and Triglyceride values. The correlation between HbA1c and Triglyceride levels were established with Pearson Correlation. **Results:** Among total number of 150 patients 44% (n=70) were male and 50.3% (n=80) were female. The correlation of HbA1c with Triglyceride as estimated by Pearson Correlation was positive (*p*=0.033, r=0.033) and statistically significant**. Conclusions**: In type 2 diabetes mellitus there is a predictable relationship between Triglycerides and HbA1c.
Keywords: Diabetes Mellitus, HbA1c, Triglyceride levels

INTRODUCTION

Diabetes Mellitus (DM) has become endemic and its prevalence is getting high every day. That phenomenon is present in both developed and developing countries. This is also associated with more risk of developing cardiovascular diseases in these patients.[1]

Various studies conducted in Pakistan have reported 7–11% prevalence of DM. Currently it is 8th in the world according to World Health Organization (WHO) estimation of prevalence and by year 2025 is expected to rise to 4th. Diabetic patients with accompanied dyslipidaemia are risk factor for cardiovascular deaths which is the most common cause of death.[2] Patients with type 2 diabetes often exhibit dyslipidaemia, which increases their cardiovascular risk compared with people without diabetes. Abnormalities in lipids and lipoproteins play an important part in atherogenesis in type 2 diabetics.[3] Dyslipidaemia is a significant factor of the metabolic syndrome and high triglyceride levels along with low HDL levels are important part of the criteria for the diagnosis of metabolic syndrome. Raised Triglyceride levels and insulin resistance are usually correlated.[4,5] In diabetes when there is a high glucose level in the blood it results in the increment of hepatic lipase activity. That increases High density lipoprotein clearance from the blood and also impairs the Very low density lipoprotein metabolism. These two effects decreases HDL levels in these patients.[6] Although elevated glucose levels is the most obvious and frequent feature of diabetes but many patients develop abnormal lipid profile and that can remain unnoticed until blood tests for lipid profile is done. These lipid abnormalities can include increase levels of triglycerides and low density lipoproteins (LDL) and decrease levels of high density lipoprotein (HDL). Metabolic syndrome and its features like obesity, hypertension, hypertriglyceridemia and low HDL levels along with diabetes becomes the highest risk for ischemic heart diseases. If treatment modalities like life style modification and drugs are initiated early for the management then that result in reduction in mortality in type 2 diabetic patients.[7,8]

Hypertriglyceridemia is the most common abnormality of lipoproteins in type 2 diabetes. It is caused by hyperglycaemia and insulin resistance that stimulates overproduction of VLDL (very low density lipoproteins), imperfect clearance of VLDL, and decreased action of lipoprotein lipase and decreased assembly of apo-lipoprotein B. Also the work of VLDL is altered such that the amount of cholesterol increases and this increases the tendency for atherosclerosis.[9]

Various studies have shown the correlation between diabetes and hypertriglyceroidemia but few have worked on Hba1c levels and its correlation with triglycerides levels in type 2 diabetics.

MATERIAL AND METHODS

This cross sectional study was conducted at the Department of Endocrinology and Metabolism (DEM), Services Hospital, Lahore between March-September 2013. A total of 150 patients fulfilling the inclusion and exclusion criteria with Type 2 Diabetes mellitus were included in the study using the purposive sampling

The patients with Type 2 Diabetes Mellitus

of both Gender and between 18–70 years of age having HbA1c ≥7 were included in the study. Patients with history of cardiovascular disease, taking lipid lowering medications, smokers and with a History of cerebral stroke were excluded from the sample. Study patients were further stratified on the basis of severity of HbA1c and Triglyceride values. HbA1c levels stratified in ranges from 7 to 9 and more than 9, whereas Triglycerides in 150 mg/dl to 300 mg/dl, 300 mg/dl to 500 mg/dl and more than 500 mg/dl ranges. The Statistical analysis was done by SPSS version 17.0. Pearson's correlation test was performed to examine correlations between Hba1c and triglyceride levels. Independent samples *t*-test (2-tailed) was used to compare means of different parameters. All Values are expressed as mean±standard error of mean. The results were considered statistically significant when *p*<0.05.

RESULTS

Among total number of 150 patients 44% (n=70) were male and 50.3% (n=80) were female. Triglyceride levels were further divided on the basis of severity, most severe ranges more than 500 mg/dl, moderately severe 300–500 mg/dl and mildly severe less than 300 mg/dl. 33% (50) of patients were found to have less severe, i.e., less than 300 mg/dl Triglyceride levels, 46.6% (70) were having moderately high, i.e., 300–500 mg /dl and 20% (30) were having most severe more than 500 mg/dl triglyceride levels.

In males 50% were less than 300 mg/dl, 35% within 300–500 mg/dl range whereas 14% were in the severest, i.e., more than 500 mg/dl Triglyceride levels. On the other hand in females they were 18%, 56.25% and 25% respectively (Table-1). HbA1c levels was also further stratified in three ranges, i.e., less than 7, 7–9, and more than 9. Among total of 150 patients 33% (50) were having HbA1c of less than 7, 45 %(68) with HbA1c range between 7–9 and 21% (32) with more than 9. In males 30% were having less than 7, 50% from 7 to 9 and 20% with more than 9 HbA1c levels. In contrast female patients were having 36%, 41% and 22% respectively. (Table-2)

The correlation of HbA1c with Triglyceride levels as estimated by Pearson Correlation was positive (*p*=0.033, r=0.033) and statistically significant. (Table-3)

Triglyceride and HbA1c levels trends, distribution and correlation can be seen with the help of scattered plot. (Figure-1)

Table-1: Distribution of triglyceride levels according to severity and gender

Gender	TGs			Total
	<300	300–500	>500	
Male	(50%) 35	(35%) 25	(14%) 10	70
Female	(18.75%) 15	(56.25%) 45	(25%) 20	80
Total	(33.3%) 50	(46.6%) 70	(20%) 30	150

Table-2: Distribution of HbA1c according to severity and gender

Gender	HbA1c			Total
	<7	>7–9	>9	
Male	(30%) 21	(50%) 35	(20%) 14	70
Female	(36.2%) 29	(41.2) 33	(22.5%) 18	80
Total	(33%) 50	(45%) 68	(21%) 32	150

Table-3: Correlation between HBA1c and triglycerides

		HbA1cn	Triglycerides
HbA1c	Pearson Correlation	1	.634**
	Sig. (2-tailed)		.000
	N	150	150
Triglycrides	Pearson Correlation	.634(**)	1
	Sig. (2-tailed)	.000	
	N	150	150

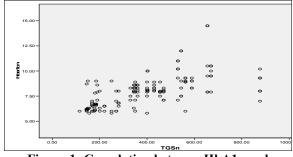**Correlation is significant at the 0.01 level (2-tailed).

Figure-1: Correlation between HbA1c and triglycerides

DISCUSSION

The use of HbA1c for monitoring glycaemic control in diabetic patients has been evolved from the 2 large study trials DCCT and UKPDS. These studies also strongly correlate HbA1c with poor outcome of the patient. The relation between HbA1c and Triglyceride levels is very important for the management of the two conditions in the same patient as they coexist frequently.

In our study number of female patients was more than males which is comparable to other studies which put female at risk as other studies have shown that the effect of diabetes on the risk for Coronary vascular disease is more for women than men. This bigger risk in diabetic women is because of low HDL-cholesterol levels and high triglycerides levels.[10,11] Many other studies have also highlighted the role of increased serum triglyceride levels adding to the risk for Coronary vascular disease.[12,13] As the results of this study revealed that triglycerides levels are significantly correlated with HbA1c these findings are similar to the study by Rashid *et al.*[14] There is some difference in this study and American diabetic Association recommendations. As ADA reported that well controlled type 1 diabetic have lipid abnormalities similar to the rest of the population, where as well controlled type 2 diabetics have a mixed hyperlipidemia.[15] The difference can be because we took triglyceride levels only for comparison with the diabetes control, which was depicted by HbA1c levels.

Whereas ADA has talked about all the components of dyslipidaemia in type 2 diabetics. Aboola-Abu CF, also had same findings. They report that good glycaemic management also effects abnormal lipid profile of patient and actually improves it. It has been described that by managing lipid abnormalities and providing good glycaemic effect decreases atherosclerosis and helps in prevention of coronary heart diseases.[16] Uncontrolled diabetes is invariably related to high triglyceride levels. In a similar study by Amer et al, all lipid components were deranged in patients with uncontrolled type 2 DM.[17] In contrast, poorly controlled type 2 diabetics have a dyslipidaemia of mixed type resulting in both high cholesterol and triglyceride level. These findings have marked resemblance to the results of current study, which also showed elevated triglyceride level in patients with high HbA1c.[18] High HbA1c and abnormal lipid profile are independent causative factors of coronary vascular disease. The diabetic patients with abnormal lipid profile are regarded as at very high risk among the other risks for CVD. So by improving both of these conditions can significantly decrease that risk in diabetics. It has been postulated that dropping HbA1c value by 0.2% could decrease the mortality of patient by almost 10%.[19]

Although we tried to minimize the confounding factors of high triglyceride levels by excluding patients with history of Coronary Vascular disease, cerebral vascular disease, smokers or taking lipid lowering medications. There were some limitations to our study as we used cross sectional model, and also it was a single cantered study. We did not exclude the impact of various treatments which the study patients were taking. In summary, there is an expected correlation between Triglyceride levels and HbA1c. Understanding this correlation will help the physicians to place suitable targets based on HbA1c goals.

AUTHOR'S CONTRIBUTION

SMHZ: study concept, design data collection, manuscript writing, AG, FAR: acquisition of data, analysis and interpretation of data, drafting of manuscript and final proof reading.

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Address for Correspondence:
Syed Muhammad Hammad Zaidi, Department of Endocrinology and Metabolism (DEM), Services Hospital, Lahore-Pakistan
Cell: +92 333 428 3332
Email: zaidi.hammad201@gmail.com