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Original Research Article

Assessment of Plasma Levels of Fasting Blood Glucose, Triglycerides, Total Cholesterol, and HbA1c in patients with Type 2 Diabetes Mellitus

Seif Eldeen Ahmed[1], Elyasaa Mustafa[1], Esam Mohamed AbdulRaheem[2*]

[1]Assistant Professor of Clinical Chemistry, [2]Associate Professor of Pathology,
Department of Medical Laboratories, College of Applied Medical Science,
Al-Quwayiyah, Shaqra University, Saudi Arabia.

[*]Correspondence Email: esamcytomed@yahoo.com

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ABSTRACT

Objective and Study Design: This was a cross-sectional study aimed to evaluate the significance of glycosylated Haemoglobin, triglycerides and total cholesterol in type 2 Saudi diabetic patients.
Material and Methods: This study was conducted at Al- Quwayiyah City during the period between September 2012 and February 2013. The participants were 100 patients with type 2 diabetes and 50 apparently healthy individuals as control group. Venous blood samples were collected from all participants. The whole blood and sera were analyzed for glycosylated hemoglobin, fasting blood glucose and lipid profile. The statistical analysis was done by SPSS statistical package.
Results: Plasma glucose, triglycerides and total cholesterol were significantly increased in diabetic patients compared with control group (P- value 0.000, 0.042 and 0.05 respectively). HbA1c showed positive correlations with fasting blood glucose, triglycerides and total Cholesterol (r = 0.554, P = 0.000, r = 0.288, P = 0.026 and r = 0. 283, P = 0.028 respectively).
Conclusion: It is concluded from the results of this study that HbA1c can be used as a predictor of dyslipidemia in patients with type II diabetes.

Keywords: Diabetes mellitus; Fasting Blood Glucose; Lipid profile; glycosylated Haemoglobin.

INTRODUCTION

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Diabetes causes about 5% of all deaths globally each year. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels. About 50% of people with diabetes die of cardiovascular disease (CVD). [1,2] Diabetes mellitus affects an estimated 5% to 10% of

adult population in industrialized Western countries, Asia, Africa, Central America and South America, and it has a large impact on society. [3-5]

Triglyceridemia is associated with increased risk of coronary heart disease, both in nondiabetic and type 2 diabetic subjects. [6,7] Diabetic patients with dyslipidemia are targets of cardiovascular deaths. Patients with type 2 diabetes often exhibit an atherogenic lipid profile, which greatly increases their risk for cardiovascular disease compared with people without diabetes. [8,9] The combination of hyperglycemia, diabetic dyslipidemia, insulin resistance and hypertension produces an enhanced atherogenic environment within the circulation. [10] Severe hyperlipidemia in diabetes may also lead to lipid infiltration into the retina, causing macular edema and retinal hard exudates and blindness. [11]

Glycated hemoglobin (HbA1c) is a routinely used marker for long-term glycemic control as an indicator for the mean blood glucose level. HbA1c predicts the risk for the development of diabetic complications in diabetes patients. [2] Apart from classical risk factors like dyslipidemia, elevated HbA1c has now been regarded as an independent risk factor for CVD in subjects with or without diabetes. Estimated risk of CVD has shown to be increased by 18% for each 1% increase in absolute HbA1c value in diabetic population. [12] Positive relationship between HbA1c and CVD has been demonstrated in non-diabetic cases even within normal range of HbA1c. [13-16]

The Diabetes Complications and Control Trial (DCCT) established glycosylated hemoglobin (HbA1c) are the gold standard of glycemic control, with levels ≤7% reducing the risk of vascular complications. [17] Elevated HbA1c has been regarded as an independent risk factor for coronary heart disease (CHD) [18] and stroke [19] in subjects with or without diabetes. Ravipati et al. [20] observed a direct correlation between HbA1c and the severity of coronary artery disease (CAD) in diabetic patients. Whereas, improving the glycemic control can substantially reduce the risk of cardiovascular events in diabetics. [21,22] Moreover, attempts to reduce cardiovascular risks resulted in the improvement of HbA1c even in the absence of any specific intervention targeted at improving glycemic control. [23]

MATERIAL and METHODS

A total of 100 type 2 diabetic patients (52 males and 48 females) and 50 apparently healthy age sex- matched individuals from Al- Quwayiyah hospital (western Riyadh) were included in this study. Venous blood samples were collected from all the participants after at least 8 hours fasting. The whole blood and sera were used for analyzing Fasting Blood Glucose (FBG), Total Cholesterol (TC) and Triacylglycerol (TAG) using enzymatic spectrophotometic method. [24-26] HbA1c was estimated by using Ion exchange chromatography. .

The data were evaluated by SPSS statistical package version 13.0. Pearson's correlation test was performed to examine various correlations. Independent samples t-test (2-tailed) was used to compare means of different parameters. Value of HbA1c was given as percentage of total hemoglobin and values of all other parameters were given in mg/dl. All Values were expressed as mean ± standard. The results were considered non-significant when $P > 0.05$.

RESULTS

The results in this study showed significant increase in total cholesterol, fasting blood glucose, triglycerides and HbA1c in type 2 diabetic patients compared

with non diabetic control subjects (P = ≤ 0.05), as shown in table 1.

Table 1: Mean of total cholesterol, triglycerides, fasting blood glucose, and HbA1c in Patients and Controls.

Variable	Patients n=100	Controls n= 50	P- value
Total Cholesterol	188 ± 50.775	168 ± 45.565	0.050
Triglycerides	109 ± 50.663	90 ± 35.905	0.042
Fasting Blood Glucose	165 ± 45.172	106 ± 17.106	0.000
HbA1c	9.507 ± 1.742	6.065 ± 0.349	0.000

There was a significant increase in total cholesterol, triglycerides and fasting blood glucose in diabetic patients compared to controls in reference to HbA1c, as shown in table 2.

Table 2: Comparison of Mean of Total Cholesterol, Triglycerides and Fasting Blood Glucose in type II diabetic patients in reference to Glycemic Control (HbA1c).

Variable	(HbA1c) ≤7.0 (n=100)	(HbA1c) >7.0 (n=50)	P-value
Total Cholesterol	174.89±5.29	181.78±5.19	0.024
Triglycerides	100 ±7.88	110 ±9.07	0.03
Fasting Blood Glucose	123.56±3.03	175.0±6.79	0.000

There was a moderate relationship between total cholesterol and HbA1c (r = 0. 283, P = 0.028), as illustrated in figure 1.

There was a moderate relationship between triglycerides and HbA1c (r = 0.288, P = 0.026), as illustrated in figure 2.

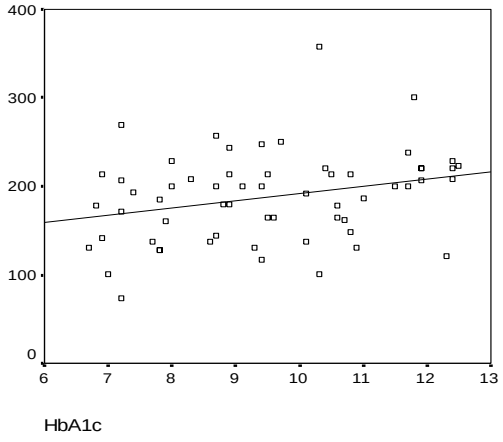

Figure 1: Scatter plot show correlation between Total Cholesterol and HbA1c (r = 0. 283, P = 0.028).

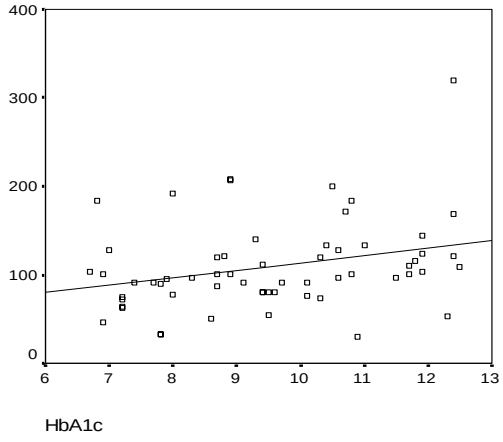

Figure 2: Scatter plot show correlation between Triglycerides and HbA1c(r = 0.288, P = 0.026).

There was a strong relationship between fasting blood glucose (FBG) and HbA1c (r = 0.554, P = 0.000), as illustrated in figure 3.

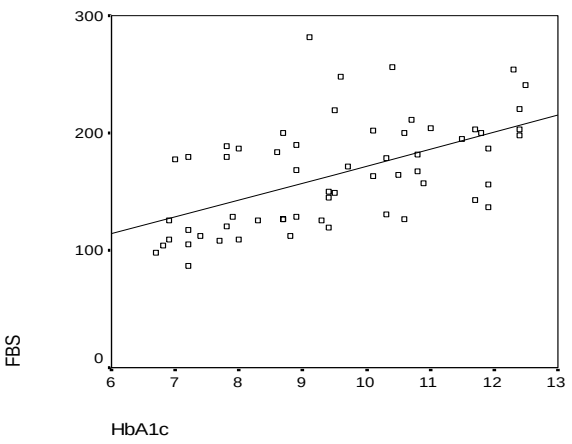

Figure 3: Scatter plot show correlation between fasting blood sugar (FBS) and HbA1c (r = 0.554, P = 0.000)

DISCUSSION

In the present study, triglycerides and total cholesterol were increased in diabetic patients when compared with that of the control group. These findings are in agreement with reports of Abdella NA et al., [27] Hayden JM and Reaven PS, [28] Smaoui M et al., [29] and Wexler, D.J et al. [30]

A significant correlation between HbA1c and FBG found in this study is in agreement with earlier reports by Rosediani M et al., [31] Ito C et al., [32] and Ko GT et al. [33]

In this study, correlating HbA1c with total cholesterol and triglycerides suggested the importance of glycemic control in normalizing dyslipidemia in diabetic patients. This is in agreement with reports of Ladeia AM et al., [34] Faulkner MS et al., [35] and Chan WB et al. [36]

The significant increase in total cholesterol and triglycerides in patients with higher HbA1c value indicates that severity of dyslipidemia increases in patients with increased HbA1c value. This is found in agreement with findings of Khan, H.A et al. [37] and Rohlfing, C.L. et al. [17]

CONCLUSION

It is concluded from the results of this study that HbA1c can be used as a predictor of dyslipidemia in patients with type II diabetes in addition to its importance as glycemic control parameter.

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