Original Research Paper

Volume-8 | Issue-9 | September-2018 | PRINT ISSN No 2249-555X

Biochemistry

EVALUATION OF GLYCEMIC INDEX AND LIPID PARAMETERS IN TYPE 2 DIABETIC PATIENTS: A CASE CONTROL STUDY

Gunjan Kumar Lecturer, Department Of Biochemistry, Rajeev Gandhi College, Bhopal, Madhya Pradesh

ABSTRACT

BACKGROUND: Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both.

METHODS: 35 type 2 diabetic patients (age range of 30-65 years) with an age & sex matched along with 35 healthy controls were selected as per the inclusion and exclusion criteria. Venous blood samples were collected from all known cases of diabetes and controls to analyze FBS, HbA1c, TC, TG, HDL-c & LDL-c.

RESULTS: The Mean±SD of cases and controls were FBS(168±25.2), HbA1c(8.5±2.42), TC(257.6±32.7), TG(204.9±21.04), HDL-C(39.02±8.07) and LDL-C(187.02±36.8) and FBS(102±12.06), HbA1c(5.2±1.4), TC(146.6±2.5), TG(110.5±20.3), HDL-C(50.6±10.5) and LDL-C(124.06±18.15) respectively.

CONCLUSION: The HbA1c showed positive correlation with TC, TG, & LDL-c and negative correlations were observed between HbA1C and HDL-c.

KEYWORDS : Type-2 DM, FBS, HbA1c and Lipid parameters.

INTRODUCTION:

Diabetes mellitus is a heterogeneous group of disease, characterized by a state of chronic hyperglycemia, resulting from a diversity of etiologies, genetic and environmental factors acting jointly. The underlying cause of diabetes is the impaired production or action of insulin, a hormone that controls glucose, fat and amino acids metabolism. The metabolic dysregulations associated with diabetes mellitus (DM) causes secondary pathophysiological changes in multiple organ systems that impose a tremendous burden on the individual with diabetes and on health care system. Two broad categories of diabetes are designated as type 1 and type 2 diabetes mellitus (DM). Type 2 DM is more common than type 1 DM. India is called the diabetic capital of the world. Type 2 diabetes mellitus in Indians is being increasingly seen in younger and less obese persons than in western countries.[1]

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).[2,3] In Indian population, 61.3 million people had diabetes in 2011, which is expected to reach 101.2 million by 2030 (International Diabetes Federation) now placing India at second position in world diabetic prevalence.[4] Changes in lipid-profile are a consequential event in DM. Due to these changes distribution and function of various fractions of lipids are affected. Many Studies have evaluated the risk factors for CHD in DM patients and observed high fasting blood sugar (FBS) and post prandial blood sugar (PPBS), total cholesterol (Chol), low density lipoproteins (LDL), triglycerides (TG) levels and low high density lipoproteins (HDL) levels when compared to controls.[5] Glycated heamoglobin (HbA1c) is considered a gold-standard measure of chronic glycemia in diabeticpatients. It was studied that HbA1c was a better CHD predictor than fasting or 2-h glucose.[6] HbA1c was strongly associated with atherosclerosis as measured by carotid IMT (intima-media thickness).[7,8] The ADA recommends measurement of HbA1c in patients with both type 1 and 2 diabetes, first to document the degree of glycemic control, then as part of continuing care.[9] Changes in lipid profile is also well related with severity of DM as adjudged by HbA1c. Dyslipidemia (raised triglycerides, raised cholesterol, raised LDL, raised VLDL and low HDL) were common in type 2 diabetes mellitus, which is further associated with insulin resistance like hyperinsulinemia, hypertension with obesity collectively known as metabolic syndrome or Reaves's syndrome; strongly correlated with atherosclerosis. Atherogenic indices i.e. TC/HDL-C ratio (<5) and LDL-C/HDL-C (<3.5) is the main indicator of cardiovascular disease (CVD). TG/HDL-C which is considered as reliable as fasting serum insulin levels and is determined to assess insulin resistance status in type 2 diabetes[10] Dyslipidemia , especially high LDL, is common in diabetes mellitus and strongly associated with poor glycemic control. Glycated hemoglobin (HbA1c) is main routinely used tool for measuring long term glycemiccontrol .[11] HbA1c is a main indicator for mean blood glucose level; HbA1c predicts the risk of diabetic complications in diabetic patients. Thus, in the present study an attempt has been made to find any correlation of HbA1c with lipid profile in patients with type 2 diabetes mellitus. Thus, the aim of this study was to observe the Glycemic index and lipid parameters in type 2 diabetes mellitus patients and it's correlation between Lipid parameters and HbA1c.

MATERIALS AND METHODS:

This present study was a cross sectional, case control carried out in the Department of Biochemistry, Rajeev Gandhi College, Bhopal, Madhya Pradesh during the period from March 2009 to April 2011. Randomly selected, 35 type 2 diabetic patients (age range of 30-65 years) with an age & sex matched along with 35 healthy controls were selected as per the inclusion and exclusion criteria. Venous blood samples were collected for following Biochemical[4] parameters:

1. Blood Glucose by GOD-POD methods.
2. Glycated Haemoglobin (HbA1c) by cation exchange resin methods.
3. Total Cholesterol(TC) by enzymatic end point CHOD-POD methods.
4. Triglyceride (TG) by enzymatic glycerol phosphate oxidase/peroxidase methods.
5. HDL-Cholesterol by direct enzymatic end point method.
6. LDL-Cholesterol by Friedewald's formula.
7. VLDL-Cholesterol by Friedewald's eqution.

[LDL-c = Tc-HDL-c(TG/5)]

All the parameters under investigation were determined in the serum of the subjects using commercially available reagent kits. The glycated hemoglobin (HbA1c) was estimated by appropriate standard kits. The data were evaluated by SPSS statistical package version 18.0. Pearson's correlation test was performed to examine various correlations. Value of HbA1c were given as % of total hemoglobin and values of all other parameters were given in mg/dl. All values were expressed as mean±SD. We used student t-test and pearson's correlation coefficient to find the statistical significance. A P-value <0.05 was to be considered statistically significant.

RESULTS AND DISCUSSION:

A total of 35 Type 2 Diabetic patients as cases and 35 Healthy subjects controls were included in this study. The mean age (Mean±SD) of cases and controls were 42.6 and 36.9±10.23 years respectively. Table 1 shows the Mean±SD of cases and controls were FBS(168±25.2), HbA1c(8.5±2.42), TC(257.6±32.7), TG(204.9±21.04), HDL-C(39.02±8.07) and LDL-C(187.02±36.8) and FBS(102±12.06), HbA1c(5.2±1.4), TC(146.6±2.5), TG(110.5±20.3), HDL-C(50.6±10.5) and LDL-C(124.06±18.15) respectively. In this study, the level of FBS, HbA1c, TC, TG, LDL-c, were significantly increased

(P<0.001) while HDL-c level was significantly decreased (P<0.001) as compare to controls.

Table 1: Comparison of Biochemical parameters between cases and Controls:

Biochemical Parameters	Cases (35)	Controls (35)
	Mean ± SD	Mean ± SD
FBS(mg/dl)	168 ± 25.2	102 ± 12.06
HbA1c (%)	8.1 ± 2.42	5.2 ± 1.4
TC (mg/dl)	257.6±32.7	146.6±2.5
TG (mg/dl)	204.9±21.04	110.5±20.3
HDL-c(mg/dl)	39.02 ± 8.07	50.6 ± 10.5
LDL-c(mg/dl)	187.02 ± 36.8	124.06 ± 18.15

Statistically Significant at p value <0.05

Table 2: Correlation between HbA1c and Lipid parameters type 2 diabetics patients:

Parameters	Correlation Coefficient(r)	P- value
TC	+0.072	<0.001
TG	+0.134	<0.001
HDL-c	-0.036	*NS
LDL-c	+0.084	<0.001

*NS: Statistically not Significant

There was a significant positive correlation between HbA1c and TC (r = +0.072, p =0.001). HbA1c also demonstrated a significant correlation with TG (r = +0.134, p =0.001). The correlation between HbA1c and HDL-C was negative and was found to be statistically not significant (r = -0.036, p =0.65). Furthermore, it was found that HbA1c was positively and significantly related to LDL-C (r = +0.084, p =0.001). High prevalence of hypercholesterolemia, hypertriglyceridemia and high LDL-c & low HDL-c was found in type-2 diabetes which is well known risk factors for cardiovascular disease.[12] The cause of dyslipidemia in type 2 diabetes mellitus may be that, insulin is not working properly and which affects the liver apo lipoprotein production.[13] The apo lipoprotein regulates the enzymatic activity of lipoprotein lipase and cholesterol ester transport protein.[13] A highly positive significant relationship of HbA1c with dyslipidemia was observed in the present study. Erciyas et al[14] also reported positive correlation of HbA1c level with TC and TG in diabetic patients. The diabetes complication and control trail established HbA1c as Value ≤7.0% was said to be appropriate for reducing the risk of cardiovascular complications. The diabetic patients with higher HbA1c value can exhibit a significant increase in TC, TG, LDL-c and HDL-c in comparison to patients with HbA1c value ≤7.0%[15] khan et al[16] reported the severity of dyslipidemia increases in patients with higher HbA1c value. As elevated HbA1c and dyslipidemia are independent risk factors of CVD, diabetic patients with elevated HbA1c and dyslipidemia can be considered as a very high risk group for CVD. Improving glycemic control can substantially reduce the risk of cardiovascular events in diabetes[17] and also reported that reducing the HbA1c level by 0.2% could lower the mortality by 10%.[18] Thus present study suggests the importance of glycemic control in prevention of cardiovascular disease in type-2 diabetics.

CONCLUSION:

In conclusion, the HbA1c showed positive correlation with TC, TG, & LDL-c and negative correlations were observed between HbA1C and HDL-c. These findings suggest that HbA1c level can be used as good parameter for predictor of dyslipidemia in type 2 diabetics in addition to as glycemic control. Thus, early diagnosis of dyslipidemia can be used as a preventive measure for the development of cardiovascular disease in type-2 diabetics. So, HbA1c may be utilized for screening diabetic patient for risk of cardiovascular events and also for timely intervention with lipid lowering drugs.

REFERENCES

1. Lt Gen SR Mehta, VSM, Col AS Kashyap, Lt Col S Das. Diabetes Mellitus in India: The Modern Scourge. MJAFI 2009;65:50-4.
2. WHO. Diabetes. http://www.who.int/ nmh/publications/factsheet_diabetes_en. pdf (accessed 30/5/2013).
3. Glycosylated Haemoglobin, HbA1C. hptt:// clinlabnavi-gator.com/ test-interpretations/haemoglobin-a1c. html? Letter=h (Updated on 18 June 2010).
4. Manoj Kr Yadav, Tapan Kr Mohapatra, Rabindra Kr Mohapatra et. al. Study on Glycated Hemoglobin & lipid profile in Type-2 Diabetes Mellitus. International Journal of Science & Research (IJSR) 2015;4(6): 1917-19.
5. Surekha Rani. H, Madhavi G, RamachandraRaoV,Sahay B.K, Jyothy A. Risk Factors for Coronary Heart Disease in Type II DM. Indian Journal of Clinical Biochemistry 2005;20(2):75-80.
6. Zachary T,Bloomgarden. Cardiovascular Disease, Neuropathy and Retinopathy.Diabetes care 2009;32: e64- e 68.
7. Chambless LE, Heiss G, Folsom AR, Rosamond W,Szklo M, Sharrett AR, Clegg LX. Association of coronary heart disease incidence with carotid arterial wall thickness and major risk factors: the Atherosclerosis MahanteshPatilet. al. Int J Cur Res Rev, March 2014/ Vol 06 (06) Page 24 Risk in Communities (ARIC) Study, 1987– 1993. Am J Epidemiol 1997;146:483–94.
8. Burtis Carl A, Ashwood Edward R, Bruns David E.Tietz Textbook of clinical chemistry and molecular diagnostics. 4th Ed. New dehli: Elsevier publishers; 2008. Chapter 26,Lipids, lipopropteins, apolipoproteins and other cardiovascular risk factors: p. 903-83.
9. American Diabetes Association. Standards of medical care for patients with diabetes mellitus. Diabetes Care 2000;23(Suppl 1):S32–42. 10
10. Rath M, Ncendorf A, Reblin T, Dietel M, Knebber HJ. Detection and quantification of lipoprotein(a) in the arterial wall of 107 coronary bypass patients. Atherosclerosis 1989; 9:579-92.
11. KhareKC, Raman PG, Bhatnagar AD, ReemaBhavsar. Serum Lp(a) levels in patients of diabetes mellitus. Int. J. Diab. Dev. Countries 2000;20:79 – 83.
12. American Diabetes association. Dyslipidemia management in adult with diabetes. Diabetes care 2004; 24: s68-s71.
13. Goldberg IJ. Lipoprotein lipase and lipolysis: central roles in lipoprotein metabolism and atherogenesis. J. lipid Res 1996; 37: 693-707. Pmid: 8732771.
14. Erciyas F, taneli F, Arslan B and Uslu Y. glycemic control, oxidative stress and lipid profile in children with type I diabetes mellitus, Arch. Med. Res 2004; 35: 134- 140.
15. Rohlfing CL, Wiedmeyer HM, Little RR, England JD, Tennill A and Goldstein DE. Definging the relationship between plasma glucose and HbA1c: analysis of glucose profiles and HbA1c in the Diabetes Control and Complications trail. Diabetes care 2002;25:275-278.
16. Khan HA, Sobki SH and Khan SA. Association between glycemic control and serum lipids profile in type 2 diabetic patients: HbA1c predicts dyslipidemia. Clin. Exp. Med 2007;7:24- 29.
17. Rosediani M, Azidah AK, Mafauzy M. correlation between fasting plasma glucose, post prandial glucose and gycated hemoglobin and fructosamine. Med J Malaysia 2006;61:67-71.pmid:16708736.
18. Smith SC. Multiple risk factors for cardiovascular disease and diabetes mellitus. Am J med 2007;120:s3- s11.