Study of HbA1c and lipid profile in Type II diabetes mellitus

S A Patel[1*], H N Khan[2], A M Siddiqui[3], W A Shaikh[4]

[1]Assistant Professor, [2,3]Associate Professor, Department of Biochemistry, Dr. S.C. Government Medical College, Nanded, Maharashtra, INDIA.
[4]Sr. Lecturer, Department of Oral and Maxillofacial Surgery, SDDC, Parbhani, Maharashtra, INDIA.
Email: shabeenapatel86@gmail.com

Abstract   **Background:** Dyslipidaemia and poorly controlled blood glucose levels as indicated by HbA1c, is commonly seen in Type II diabetes mellitus. Therefore study of HbA1c and lipid profile in these patients could be helpful in therapeutic and prognostic aspects. **Aim:** To study HbA1c and lipid profile in type II Diabetes mellitus patients. **Material and Methods**: 50 already diagnosed type II diabetes mellitus patients and 50 controls were selected. We estimated and compared HbA1c and lipid profile in them. **Statistical Analysis:** We used student t-test and Pearson's correlation coefficient to find the statistical significance. **Result:** HbA1c and all the parameters of lipid profile except HDL-C were increased while HDL-C concentration decreased in type II diabetes meliitus as compared to that of control. **Conclusion:** Type II diabetes mellitus is associated with poor glycaemic control and dyslipidaemia.
Key Words: HbA1c and lipid profile.

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 30 August 2017

INTRODUCTION

Diabetes mellitus is the most common endocrinal disease in the world today.[1] The prevalence of disease has significantly increased worldwide and projected to increase in future. Amongst the various ethnic groups, Asian Indians seems to be at a particularly greater risk of developing diabetes.[1] DM is frequently associated with dyslipidemia and increased percentages of glycated hemoglobin.[2] They have several lipid abnormalities including elevated plasma triglycerides, elevated Low Density Lipoprotein-Cholesterol (LDL-C) and decreased High Density Lipoprotein-Cholesterol (HDL-C).[2] Epidemiological studies have demonstrated that type 2 diabetes mellitus (DM) is a well-known risk factor for the development of cardiovascular disease, cerebrovascular disease, and peripheral vascular diseases. Alterations in lipid and lipoprotein profile contribute to artherosclerosis in type 2 diabetes.[3] Dyslipidemia is a risk factor for coronary artery disease, a leading cause of mortality in patients with diabetes mellitus. The amount of glycated hemoglobin (HbA1c) reflects the glycemic control of a patient during the 6 – 8 week period before the blood sample was obtained. At present HbA1c is the best surrogate marker we have for setting goals of treatment.[4] The Diabetes complications and control trial (DCCT) established HbA1c as the gold standard of glycemic control. The level of HbA1c value 7.0% was said to be appropriate for reducing the risk of cardiovascular complications.[5] So this study was done to estimate HbA1c and lipid profile in type II diabetes mellitus and compare it with controls.

MATERIAL AND METHODS

The present study was conducted in Department of Biochemistry, Government medical college with the help of Medicine Department during period of May 2013 to July 2014.The study was approved by Institutional Ethics

Committee for research work. A total of 100 subjects were included in the study. They were divided into two groups as follows:

- Group I- Type II Diabetes mellitus. (50 cases)
- Group II- Controls. (50 subjects)

Already diagnosed: Type II DM patients visiting the medicine O.P.D. were selected .These cases were compared with apparently healthy controls. 5 ml of fasting venous blood sample was collected from the ante-cubital vein. Out of this 1ml was collected in F- bulb for estimation of fasting plasma glucose. 1 ml was collected in EDTA bulb for estimation of HbA1c. Rest 3 ml was collected in plain bulb for estimation of lipid profile. The sample in the plain bulb was kept undisturbed for one and a half hour so that it clots. Then the clotted blood is subjected to centrifugation and the serum thus separated is used for investigations. They were studied for the following parameters

1. Fasting plasma glucose by GOD-POD method
2. HbA1c in plasma by cation- exchange resin method.
3. Lipid profile

i. Total Cholesterol by enzymatic end point CHOD POD method.
ii. Triglyceride by enzymatic glycerolphosphate oxidase / peroxidase method.
iii. HDL-C (High density lipoprotein Cholesterol) by direct enzymatic end Point method.
iv. LDL-C (Low density lipoprotein Cholesterol) by Friedewald's formula.[6]
v. VLDL-C(Very low density lipoprotein Cholesterol) by Friedewald's formula.[6]

STATISTICS

Student t-test and Pearson's correlation coefficient was used to find the statistical significance. A p value <0.05 was to be considered statistically significant. The statistical software Graph pad prism 5 was used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc. Continuous data is presented as mean $\pm$ SD.

RESULTS AND DISCUSSION

Lipid profile and HbA1c was studied in 50 type II diabetes mellitus patients and compared with the apparently healthy controls.

Table 1: Pair wise comparison of Parameters in type II diabetes mellitus and controls

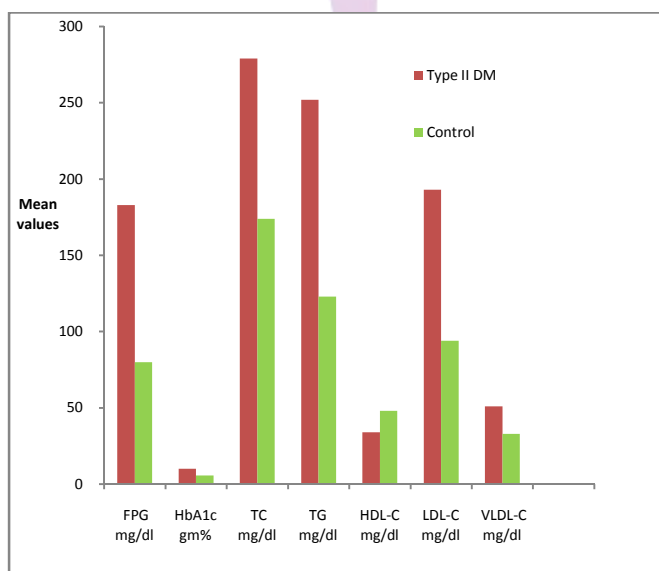| Sr. No.	Investigation	Type II DM	Controls	p value
1	Fasting Plasma Glucose mg/dl	182.96 ± 59.49	80 ± 11.93	< 0.05
2	HbA1c gm%	10.3 ± 2.18	5.58 ± 0.84	< 0.05
3	Serum Total Cholesterol mg/dl	278.52 ± 70.3	173.94 ± 9.62	< 0.05
4	Serum Triglyceride mg/dl	251.7 ± 42.24	122.8 ± 29.80	< 0.05
5	Serum HDL-C mg/dl	34.24 ± 5.07	48.04 ± 9.20	< 0.05
6	Serum LDL-C mg/dl	192.94 ± 68.7	94 ± 27.97	< 0.05
7	Serum VLDL-C mg/dl	50.5 ± 8.75	32 ± 6.23	< 0.05

Figure 1: Bar diagram showing comparison of parameters between Type II DM and Controls

In our study the mean FPG values of Type II DM patients was 182.96 ± 59.49 mg/dl. The mean FPG value of the controls was 80 ± 11.93 mg/dl [table 1]. Our findings coincided with Alejandra [7] et al and Masram et al [2] who found that the mean FPG levels were significantly higher in diabetics compared to the controls. The reason for increased blood glucose levels in Type II DM insulin resistance is seen which increases with the duration of disease. Some Type II DM patients may have progressive beta cell failure also.[8] The mean levels of HbA1c in Type II DM and controls were 10.3 ± 2.18 and 5.58 ± 0.84 gm % respectively [table 1]. We found that the values were significantly higher in Type II diabetes mellitus as compared to the controls (p value <0.05) [table 1]. Our findings correlated with Masram et al [2], Palmer AJ et al [9], V.A. Fonseca et al [10], R Paul Wadwa et al [11] and Moussa et al [12] who also found significantly higher HbA1c levels in diabetics compared to the controls. Persistent hyperglycemia results in glycation of Hb and that leads to the formation of HbA1c.[13] In uncontrolled or poorly controlled diabetes, there is an increased glycation of a number of proteins including hemoglobin.[14] We found that the mean values of TC, TG, LDL-C and VLDL-C were significantly higher (p value <0.05) in Type II DM as compared to controls [table 1]. While HDL-C was significantly lower in diabetics compared to the controls (p value < 0.05) [table 1]. Our findings correlated with Masram et al [2], G et al [15], Al Muhtaseb N et al [16] and D M Joven J et al [17] who showed similar comparative results in controls and Type II DM. Many reasons have been put forth for dyslipidaemia as

1. Genetic predisposition to obesity and to insulin resistance[18],
2. Increased mobilization of fatty acids from adipose tissue since insulin inhibits the hormone sensitive lipase.[19,20]
3. On the other hand, glucagon, catecholamines and other hormones enhance lipolysis.[21]This leads to secondary elevation of free fatty acid level in the blood.[22]They enter the liver and are esterified to form triglycerides.[23]
4. Diabetes is also known to be associated with an increase in the synthesis of cholesterol, which may be due to the increased activity of HMG CoA reductase.[24]

Hyperlipidemia is a relatively common problem in patients with poorly controlled diabetes mellitus. Diabetics as a group tends to have higher lipid levels than non-diabetics and this abnormality is exaggerated in patients with poor diabetic control.[25]

CONCLUSION

Diabetics have elevated HbA1c representing poor long-term glycemic control. Thus diabetics have a high risk of development of microvascular and macrovascular complications leading to an increased morbidity and mortality. The FPG levels indicate the blood glucose level at a single point of time that is at the time of blood investigation. Therefore there is a need of long term glycemic indicators like HbA1c which give idea about last few weeks of glycemic control. The diabetic patients had a higher prevalence of high serum cholesterol, high triacylglycerol, high LDL-C and high VLDL-C than the controls, indicating that diabetic patients were more prone to macrovascular diseases like cardiovascular diseases. All the diabetics should therefore be regularly screened for glycemic control and lipid profile along with routine measuring of the blood glucose level. This will help in maintaining a required glycemic control, preventing the development of complications and early detection of complications thereby decreasing the mortality and morbidity.

LIMITATIONS

- We compared HbA1c and lipid variables, and did not take into account the current use of medication in the patients.
- Study group was small

REFERENCES

1. Enas. A. "Prevalence of coronary artery disease in Asian Indians". American journal of cardiology, 1992; 70:945-950.
2. Study of Lipid Profile and GlycatedHemoglobin in Diabetes Mellitus S.W. Masram, M.V. Bimanpalli.Suresh Ghangle – Indian medical gazette July 2012
3. A. Bener and M. Zirie, "Lipids, lipoprotein (a) profile and HbA1c among Arabian Type 2 diabetic patients," Biomedical Research., 2007, pp. 97-102.
4. Joslin"s Diabetes Mellitus 14th Ed Lippincott Williams and Wilkins Chapter 33: Genearl approach to the treatment of diabetes mellitus.
5. Ram VinodMahato, "Association between glycaemic control and serum lipid profile in type 2 diabetic patients: Glycated haemoglobin as a dual biomarker," Biomedical Research., 2011, pp. 375-380.
6. Friedewald W.T., Levy R.I., Fredrickson D.S., ClinChem. 18: 499, 1972.
7. Oxidative Damage and Antioxidant Status in Diabetes Mellitus and Rheumatoid Arthritis: A Comparative Study Alejandra N. Cimato1.*, Graciela B. Facorro1, Lidia L. Piehl1, María M. Martínez Sarrasague1,Diana Grinspon2, Horacio A. Farach3 and Emilio Rubin de Celis1The Open Clinical Chemistry Journal, 2008, 1, 92-98
8. UPKDS group Intensive blood glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type II DM : Lancet 1998 : 352: 837-54

9. Palmer A.J., Rozes et al. — Impact of changes in HbA1C, lipids and blood pressure on long term outcomes in type-2 diabetes patients: an analysis using the CORE diabetes Model. Curr Med Res Opin. 20 Suppl.1: S, 53-58, Aug 2004.
10. Vivian A. Fonseca, Thomas R. Valiquet, Saling A. Huang, Mahmoud N. Ghazzi, Randall W. — Whitcomb and the Troglitazone study group. Journal of the Clinical Endocrinology and Metabolism. Vol. 83, 9: 3169- 3176, 1998.
11. R. Paul Wadwa, Grengory L. Kinney et al. — Awareness and Treatment of Dyslipidemia in Young adults with type-1 diabetes. Diabetes care. 28: 1051-1056, 2005.
12. Oxidative stress in diabetes mellitus, S.A. Moussa Received: May 2008; in final form June 2008. ROMANIAN J. BIOPHYS., Vol. 18, No. 3, P. 225–236, BUCHAREST, 2008
13. Yabe-Nishimura C. Aldose reductase in glucose toxicity: A potential target for the prevention of diabetic complications", Pharmacological Reviews, vol, 50, pp, 21–33, 1998.
14. Pasupathi P, Bhakthavathasalam G, Saravanan G, Sundaramoorthi R. 2008. Screening for Thyroid Dysfunction in the Diabetic/Non-Diabetic Population.Thyroid Science 3(8):CLS1-6.
15. Imperatore g. Et al. — serum lipids and glucose control the search for diabetes in youth study. Arch pediatr adolesc. 161(2): 159-165, feb med. 2007.
16. Al-Muhtaseb N., Al Yusuf A.R., Bajaj J.S. —Lipoprotein lipids and apolipoproteins (A1, AII, B, CII, CIII) in type 1 and type 2 diabetes mellitus in young Kuwaiti women. Diabet Med. 8(8): 732-737, Oct 1991.
17. Joven J. Viella E., Costa B., Turner P.R., Richart C.,Masana L. — Concentration of lipids and apolipoproteins in patients with clinically well controlled insulin dependent and non insulin dependent diabetes. Clinical Chemistry. 35(5): 813-816, 1989.
18. Camerron Ne, Eaton SE, Cotter MA, Tesfay S Vascular factors and metabolic interactions in the pathogenesis of diabetic neuropathy.
19. Al-Shamaony L, Al-Khazraji SM and Twaij HAA (1994). Hypoglycemic effect of Artemisia herbaalba. II. Effect of a valuable extract on some blood parameters in diabetic animals. J. Ethnopharma-col., 43:167-171.
20. Braun JE, Severson DL. Tissue-specific regulation of lipoprotein lipase.CMAJ.1992 Oct 15; 147(8):1192.
21. Marcus C, Ehrén H, Bolme P, Arner P. Regulation of lipolysis during the neonatal period. Importance of thyrotropin. J Clin Invest. 1988 November; 82(5): 1793–1797.
22. Shanmugam KR, Ramakrishna CH, Mallikarjuna K, Reddy KS. Perturbation in kidney lipid metabolic profiles in diabetic rats with reference to alcoholic oxidative stress. Indian J Nephrol. 2009 July; 19(3): 101–106.
23. Suri, R.K., Guptha, M.M. and Chakkravarthi, A.K. Hyper-lipidaemias and vascular populations of diabetes mellitus. J. Ass. Phys. India., 27: 505 (1979).
24. Jingming Li, Joshua J. Wang, Danyang Chen, Robert Mott, Qiang Yu, Jian-xing Ma, Sarah X. Zhang. Systemic Administration of HMG CoA Reductase Inhibitor Protects the Blood-retinal Barrier and Ameliorates Retinal Inflammation in Type 2 diabetes. Exp Eye Res. 2009 June 15; 89(1): 71–78.
25. Shivanand K G, Manjunath M, P S Jeganathan. lipid profile and its complications in diabetes mellitus. International journal of biomedical and advance research IJBAR (2012) 03(10) 775-780.

Source of Support: None Declared
Conflict of Interest: None Declared