DOI: https://doi.org/10.53350/pjmhs22165492

ORIGINAL ARTICLE

A Comparative Study to Analyze the HBA1C and LIPID Profile in Type 2 Diabetic Patients with and without Diabetic Complications

AAMIR HUSSAIN[1], M SAQIB UR REHMAN[2], ANEEL KAPOOR[3], MUHAMMAD IBRAHIM MENGAL[4], NARINDAR KUMAR[5], HANOZIA HASSAN[6]

[1]*Associate Professor Physiology, Bilawal Medical College for Boys at LUMHS Jamshoro Pakistan*
[2]*Assistant Professor Medicine, Baqai Medical University Karachi Pakistan*
[3]*Associate Professor Biochemistry, Bhitai Dental and Medical College Mirpurkhas Pakistan*
[4]*Consultant Physician Medicine, Bolan Medical Complex Hospital Quetta Pakistan*
[5]*Associate Professor Medicine, Bhitai Dental and Medical College Mirpurkhas Pakistan*
[6]*Assistant Professor Physiology, Bilawal Medical College for Boys at LUMHS Jamshoro Pakistan*
Corresponding author: Aamir Hussain, Email: aamir.hyderabadian@gmail.com

ABSTRACT

Aim: To compare the levels of HbA1c and lipid profile in type 2 diabetic patients with and without diabetic complications.
Study design: A case-control study
Place and Duration: This study was conducted at Bilawal Medical College for Boys at LUMHS Jamshoro Pakistan from September 2020 and September 2021
Methodology: The study sample size was n=140 type 2 diabetic patients. Thirty patients with DM 2 were used as controls, while 110 diabetic patients with problems such as neuropathy, retinopathy, and hypertension were used as cases. Clinicians diagnose based on the patient's history, clinical examinations, and relevant investigations. The HbA1c level and lipid profile of diabetes individuals with problems were compared to diabetic patients without complications.
Results: In this study, n=140 people with DM 2 were included. Males made up 55 % of the total, while females made up 45%. Furthermore, 65.4 % were under the age of 50 years. The average age was 45.544 ± 12.23 years. In this study, HbA1c was higher in DM 2 patients with chronic problems than diabetic patients without complications. Furthermore, the lipid profile of complicated patients was shown to be abnormal compared to the control group.
Conclusion: In diabetic individuals, HbA1c levels should be kept within normal limits to avoid long-term consequences. It can also benefit diabetic patients who have an abnormal lipid profile
Keywords: Complication, Diabetes, HbA1c, Lipid profile

INTRODUCTION

Diabetes Mellitus Type 2 (DM 2) is one of the most common metabolic illnesses, causing micro-and macrovascular problems in people all over the world. (1) Sedentary lifestyle changes, increasing urbanization, and acceptance of an industrialized food culture, which contributes to obesity and insulin resistance, are all key factors in Asians having a higher incidence than Caucasians. (2) The risk of micro and macrovascular diabetes problems increases as blood sugar levels rise. When blood sugar levels are consistently high, the risk of vascular consequences such as heart attack and failure, neuropathy, and blindness increases over time. (3)

DM 2 is a fast-rising public health concern that considerably influences people's health, quality of life, and countries' healthcare systems. According to the International Diabetes Federation (IDF), (4) 415 million adults worldwide have diabetes, with that number anticipated to rise to 642 million by 2040, implying that every 11th person would be diagnosed with DM 2. In most nations, the number of people with DM 2 is rising. The disease affects about 80% of persons in low- and middle-income nations. (5)

Glycated hemoglobin (HbA1c) is a popular blood glucose level biomarker in diabetics. It indicates the average plasma glucose level during the past 8-10 weeks. Along with indicating the mean blood glucose level, the HbA1c serves to predict the likelihood of developing a variety of diabetic problems. (6) A large increase in HbA1c is thought to be an independent risk factor for lipid abnormalities that can contribute to coronary heart disease and stroke in adults with and without diabetes. (7, 8) An international expert committee endorsed in a study issued in 2009 that HbA1c levels of more than 6.5 % can be used to diagnose diabetes. (9)

Diabetes retinopathy (DR) is one of the most frequent microvascular problems, affecting 80 % of diabetic people over 20 years of age. (10) Atherogenic lipoproteins such as cholesterol, LDL, oxidized LDL and triglycerides are linked to the progression of retinopathy, proliferative retinopathy, and the formation of macular oedema. (11)

Diabetic peripheral neuropathies (DPN) affect several regions of the nervous system and have a variety of clinical symptoms. (12) Nearly half of diabetes people are affected. (13) DPN was observed in n=61 DM 2 patients, a research conducted by Yacoub G. Babou, compared to 49 patients with HbA1c <8, indicating a strong involvement of diabetes management in the prevalence of DPN.(14)

People with diabetes are considerably more likely to develop hypertension (HTN), and around 70% of people with diabetes are hypertensive. (15) This study aimed to compare the levels of HbA1c and lipid profile in DM 2 patients with or without diabetic complications.

METHODOLOGY

This case-control study comprised DM 2 patients. The total study sample size was n=140, where n**=**30 patients without problems were used as controls, while 30 diabetic patients had DR, 40 patients had DPN, and 40 patients had HTN. Clinicians diagnose based on the patient's history, clinical examinations, and relevant investigations. The HbA1c level and lipid profile of diabetes individuals with problems were compared to diabetic patients without complications. The permission was taken from the ethical review committee of the institute.

There were total 110 Patients with comorbidities of DM 2, such as retinopathy, neuropathy, and hypertension. There were 30 patients with DM 2 who did not have any problems included in this study. Exclusion criteria are patients suffering from thyroid problems, Diabetic nephropathy, pregnancy and patients with long-term illnesses and diabetic patients with type 1 diabetes. Fasting blood samples were taken to determine the lipid profile and HbA1c level.

SPSS version 21 software was utilized for statistical analysis, and results were represented as mean and SD.

RESULTS

In this study, n=140 people with DM 2 met the conditions for inclusion. Males made up 55 % of the total, while females made up 45%. Furthermore, 65.4 % were under the age of 50 years. The average age was 45.544 ± 12.23 years. In this study, the HbA1c and LP levels in DM 2 patients having complications and healthy

people were compared. The HbA1c level in our study was 5.3 ± 1.0 in controls, 7.1± 0.4 in patients with HTN, 9.2 ± 1.5 in patients with DPN, and 10.3 ± 3.0 in patients with DR. **(As shown in Figure 1).**

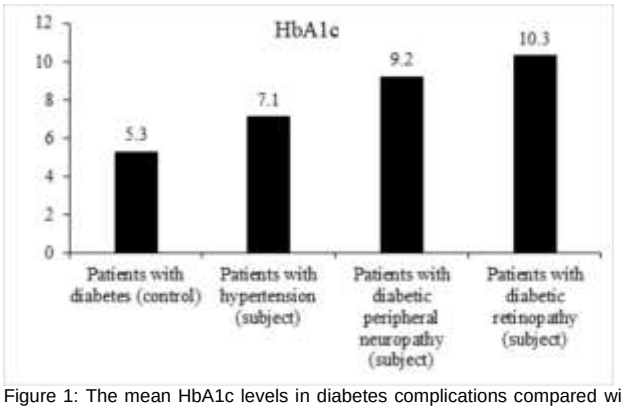

Figure 1: The mean HbA1c levels in diabetes complications compared with the control group.

The level of TC in control was 164.0 ± 5.6, but it was 220.3 ± 23.6 in patients with HTN, 225 ± 24.6 in patients with DPN, and 235.4 ± 45.6 in patients with DR. TGL levels were 125± 11.2 in the control group, 185.5 ± 43.3 in patients with HTN, 172.4± 34 in patients with DPN, and 196.9 ± 65.4 in patients with DR. The level of HDL in the control group was 42.2 ± 34.6, while it was 43.4 ± 5.6 in patients with HTN, 44.2 ± 11.4 in patients with DPN, and 44.6± 7.6 in patients with DR. The level of LDL in the control group was 93.72 ± 22.4, while it was 140± 23.2 in patients with HTN, 140.3 ± 11.5 in patients with DPN, and 153 ± 24.6 in patients with DR. The VLDL level in the control group was 22.3 ± 32.1, while it was 34.5± 12.4 in patients with HTN, 32.34 ± 5.6 in patients with DPN, and 36.89 ± 17.5 in patients with DR. **(As shown in Table 1)**

Table 1: In comparison to control, mean lipid profile levels in diabetes complications.

Parameter	Patients with			
	diabetes (control)	hypertension	diabetic peripheral neuropathy	diabetic retinopathy
TC	164.0 ± 5.6	220.3 ± 23.6	225 ± 24.6	235.4 ± 45.6.
TGL	125 ± 11.2	185.5 ± 43.3	172.4 ± 34	196.9 ± 65.4
HDL	42.2 ± 34.6	43.4 ± 5.6	44.2 ± 11.4	44.6 ± 7.6
LDL	93.72 ± 22.4	140 ± 23.2	140.3 ± 11.5	153 ± 24.6
VLDL	22.3 ± 32.1	34.5 ± 12.4	32.34 ± 5.6	36.89 ± 17.5

DISCUSSION

Diabetes causes retinopathy, neuropathy, cardiovascular disease, nephropathy, and other microvascular consequences. In diabetic complications, we looked at lipid profiles and HbA1c levels. In our study, the HbA1c level was higher in DM2 patients with complications than diabetic patients without complications. Furthermore, the LP of complicated patients was shown to be abnormal when compared to the control group.

Our results are consistent with results from another study conducted in Pakistan. Hussain A, et al., demonstrated that HbA1c can be used as a predictor of dyslipidemia and a valid glycemic index, and its early diagnosis engaged as a deterrent method for the expansion of CVD in patients with DM 2. It was clear that there was a link between high triglycerides and HbA1c and preventing macro-and microvascular problems. (16)

HbA1c is a direct sign of high TG and indirectly beneficial in determining the risk of macro-and microvascular issues, according to the findings of this and other investigations. (16-18) Insulin resistance is thought to be the cause of dyslipidemia in DM 2. Due to increasing substrate levels for TG synthesis, insufficient insulin secretion or function promotes increased hepatic production of very low-density lipoprotein (VLDL) and late clearance of TG-rich lipoproteins in DM 2 patients. (19)

According to Asha Khubchandani et al., HbA1c readings in 60 diabetes patients were originated to be greater than in controls, which is consistent with our findings. It was higher in those with diabetes than in people who didn't have any problems. HbA1c and fasting blood glucose levels had a positive association, according to this study. (20) In diabetics, high levels of HbA1c raise the risk of microangiopathy and macroangiopathy. Ishrat Kareem et al. observed that diabetics with retinopathy had higher mean HbA1c levels than diabetics without retinopathy, which was statistically significant ($p<0.001$). (21) The study by Dornan et al. (1982) found a relation between LDL, cholesterol and retinopathy. (22) In a study conducted by Ucguna et al., cholesterol and LDL levels were found to be higher in individuals with macular oedema and hard exudates. (23) The study's strength is that we had all of the patients' biochemical data. The current investigation had several limitations, including the small sample size and the that patients' food habits and physical activity duration were unknown.

CONCLUSION

This study found that HbA1c levels in individuals with chronic diabetes problems were considerably higher than in patients without complications. In addition, the lipid profile of patients with diabetic problems was considerably altered. To avoid chronic diabetes problems and lipid profile derangement in individuals with diabetic complications, appropriate glycemic control should be maintained by keeping HbA1c below 6.5 %.

Funding source: None

Conflict of interest: None

Permission: Permission was taken from the ethical review committee of the institute

REFERENCES

1. Bhoi SR, Singh K, Kaur M, Sahu RS. A Short Review on Diabetes Mellitus. 2021.
2. Tremblay J, Hamet PJM. Environmental and genetic contributions to diabetes. 2019;100:153952.
3. Sultanpur CM, Deepa K, Kumar SVJIJPSRR. Comprehensive review on HbA1c in diagnosis of diabetes mellitus. 2010;3(2):119-22.
4. Atlas DJERJ. International Diabetes Federation. IDF Diabetes Atlas, 7th edn. Brussels, Belgium: International Diabetes Federation, 2015. 2006;27:188-207.
5. Shkarin V, Anfinogenova O, Kochkonyan T, Al-Harazi G, Kubanov S, Domenyuk S, et al. HEMORHEOLOGIC PROFILE AND MICROCIRCULATORY HEMOSTASIS IN PATIENTS WITH CEREBROVASCULAR DISEASE IN DIABETES MELLITUS. 2021;11(4):68-73.
6. Anjum F, Zaini R, Shami A, Rehaili A, Kufia RJIJWHRS. Glycated hemoglobin and lipid profile association among pregnant women in Saudi Arabian population. 2019;7(2):216-22.
7. Selvin E, Coresh J, Golden SH, Brancati FL, Folsom AR, Steffes MWJAoim. Glycemic control and coronary heart disease risk in persons with and without diabetes: the atherosclerosis risk in communities study. 2005;165(16):1910-6.
8. Fabris C, Heinemann L, Beck R, Cobelli C, Kovatchev BJDT, Therapeutics. Estimation of hemoglobin A1c from continuous glucose

monitoring data in individuals with type 1 diabetes: is time in range all we need? 2020;22(7):501-8.
9. Perlman JE, Gooley TA, McNulty B, Meyers J, Hirsch IBJDT, Therapeutics. HbA1c and glucose management indicator discordance: a real-world analysis. 2021;23(4):253-8.
10. Balasubramanyam M, Rema M, Premanand CJCS. Biochemical and molecular mechanisms of diabetic retinopathy. 2002:1506-14.
11. Malaguarnera G, Gagliano C, Bucolo C, Vacante M, Salomone S, Malaguarnera M, et al. Lipoprotein (a) serum levels in diabetic patients with retinopathy. 2013;2013.
12. Santos DC. Genomic Ancestry as Biomarkers: Links with Diabetic Retinopathy. Biomarkers in Diabetes: Springer; 2022. p. 1-12.
13. Gordois A, Scuffham P, Shearer A, Oglesby A, Tobian JAJDc. The health care costs of diabetic peripheral neuropathy in the US. 2003;26(6):1790-5.
14. Bahou YGJNJ. A clinical and electrodiagnostic study of diabetic neuropathy at Jordan University Hospital. 2007;12(3):215-20.
15. Salman M, Dasgupta S, D'Souza CJ, Xaviour D, Raviprasad B, Rao J, et al. Impact of hypertension on type 2 diabetes in Mysore population of South India. 2013;4(12):561.
16. Hussain A, Ali I, Ijaz M, Rahim AJTaie, metabolism. Correlation between hemoglobin A1c and serum lipid profile in Afghani patients with type 2 diabetes: hemoglobin A1c prognosticates dyslipidemia. 2017;8(4):51-7.
17. Kundu D, Saikia M, Paul TJIJLSSR. Study of the correlation between total lipid profile and glycosylated hemoglobin among the indigenous population of Guwahati. 2017;3(4):1175-80.
18. Naqvi S, Naveed S, Ali Z, Ahmad SM, Khan RA, Raj H, et al. Correlation between glycated hemoglobin and triglyceride level in type 2 diabetes mellitus. 2017;9(6).
19. Goldberg IJJJolr. Lipoprotein lipase and lipolysis: central roles in lipoprotein metabolism and atherogenesis. 1996;37(4):693-707.
20. Khubchandani AS, Sanghani H. Study of Serum Magnesium and HbA1C in Diabetic Patients along with Changes in their Lipid Profiles. 2013.
21. Kareem I, Jaweed S, Bardapurkar J, Patil VJIjoCb. Study of magnesium, glycosylated hemoglobin and lipid profile in diabetic retinopathy. 2004;19(2):124-7.
22. Mathur A, Mathur RJJSR. Study of association of serum lipids with diabetic retinopathy in type 2 diabetes mellitus. 2013;6(1):94-7.
23. Su D, Yeo KJSmj. Diabetic retinopathy and serum lipids. 2000;41(6):295-7.