DOI: https://doi.org/10.53350/pjmhs22164360

ORIGINAL ARTICLE

The Effect of Blood Sugar Fasting Levels on Diabetic Dyslipidemia

RAHEELA YASMIN[1], AASHI AHMED[2], AMBREEN JAVED[3], MALEHA ASIM[4], RABBIA SHABBIR[5], SHAHIDA MUSHTAQ[6], FAIZA IRSHAD[7]
[1]Assistant Professor, [3]Associate Professor, Department of Biochemistry, HITEC-IMS Taxila
[2]Professor of Community Medicine, HITEC-IMS Taxila
[4]Assistant Professor of Biochemistry, Islamic International Dental College, Islamabad
[5]Assistant Professor of Biochemistry, Dental College HITEC Taxila
[6]Assistant Professor of Pathology, HITEC-IMS Taxila
[7]MS Biochemistry & Molecular Biology, HITEC-IMS Taxila
Correspondence to: Raheela Yasmin, Email: raheelaadil1@gmail.com, Cell: 0334-5202456

ABSTRACT

Background: Diabetic dyslipidemia is a group of lipoprotein defects described by raised triglycerides, elevated low density lipoprotein and reduced levels of high density lipoprotein.
Objective: To assess the effect of blood sugar fasting levels on individual lipoproteins.
Study design: Cross-sectional study
Place and duration of study: Fauji Foundation Hospital Rawalpindi & POF Hospital Wah Cantt from 1st February 2014 to 31st July 2014.
Methodology: Fifty patients with age from 30 to 70 years were enrolled. Patients' body mass index was calculated. Serum cholesterol, high density lipoprotein and triglyceride levels were estimated by enzymatic colorimetric kit. Low density lipoprotein was calculated by Friedewald equation.
Results: The mean blood sugar fasting level was 204.050±87.0755. The P-value of low density lipoproteins to blood sugar fasting and cholesterol to high density lipoprotein ratio blood sugar fasting were significant i.e. 0.03 and<0.001 respectively.
Conclusion: Dyslipidemia worsened with uncontrolled blood sugar fasting. Elevated low density lipoprotein and cholesterol to high density lipoprotein ratio was observed.
Keywords: Blood sugar fasting, Type 2 diabetes mellitus (T2DM), Cardiovascular system (CVS), Dyslipidemia, high density lipoprotein (HDL)

INTRODUCTION

Cardiovascular risk (CVR) for individuals with type 2 diabetes mellitus (T2DM) is 2–3 folds greater than individuals without diabetes. The main reason of morbidity and mortality in T2DM is atherosclerotic cardiovascular disease (ASCVD).[1,2] In diabetic patients, there is 1.5 times higher risk of death than individuals who are non-diabetic.[3] It is observed that the risk of having complications of diabetes increases with poor blood sugar control.[4]

International Diabetes Federation (IDF) reported 415 million diabetic patients, 91% of them are T2DM and by 2040 this figure will reach 642 million.[5,6] International Diabetes Federation atlas estimates, 19.4 million diabetic individuals in Pakistan.[7]

Diabetic dyslipidemia is a group of lipoprotein defects described by raised triglycerides, reduced high-density lipoprotein-cholesterol and raised small dense low-density lipoprotein (LDL) particles.[8,9] Dyslipidemia is a continuing indicator that decides the risk of cardiovascular problems.[10] This project was planned to evaluate the effect of BSF levels on individual lipoproteins.

MATERIALS AND METHODS

This is a cross-sectional study was done at Fauji Foundation Hospital Rawalpindi & POF Hospital Wah Cantt from 1st February 2014 to 31st July 2014. This project comprised of 50 patients of T2DM. Real-time polymerase chain reaction (RT-PCR) and deoxyribonucleic acid (DNA) sequencing were used for genetic mutations and single nucleotide polymorphism detection. For a customary cross-sectional study, the sample size standard was required but was not carried out, seeing the scope of molecular studies, specifically in the less developed nations. So, this study data is of value for more independent studies specially planned for the reason of additional research.[11] Ethical committee of institution (02/CREAM-A/Raheela Yasmin) recommended this study.T1DM, GDM, T2DM with cardiovascular disease, patients on statins were not taken into account. Patients' BMI was done.BSF and lipid profile was completed. Serum cholesterol, HDL and TG levels were estimated by enzymatic colorimetric kit was used for the estimation of cholesterol, HDL and triglycerides. Friedewald equation calculated LDL. SPSS 20 was used for data analysis was done on SPSS 20.Pearson correlation was done and P-value <0.05 was taken significant.

RESULTS

Seventeen (42.5%) were males and 23 (57.5%) were females. Twenty one (52.5%) participants had dyslipidemia while 19 (47.5%) did not have the condition. The mean serum BSF, cholesterol, HDL, triglycerides, cholesterol to HDL ratio was 204.05±87.07, 174.38±59.77, 35.20±10.91, 166.58±85.64 and 5.261±2.01 (Table 1). The P-value of low density lipoproteins to blood sugar fasting and cholesterol to HDL ratio and BSF was significant i.e. 0.03 and <0.001 respectively (Table 2). Coefficient value of -.223 which shows both variables move in opposite direction if BSF is increasing HDL decreases. Coefficient value of cholesterol to HDL ratio and BSF is 0.52 which shows strong correlation.

Table 1: Descriptive statistics of BSF and individual lipoproteins of patients

Variable	Mean±SD
Blood sugar fasting	204.05±87.07
Serum cholesterol	174.38±59.77
Serum triglycerides	166.58±85.64
High density lipoproteins	35.20±10.91
Low density lipoproteins	113.20±51.44
Cholesterol to HDL ratio	5.26±2.01

Table 2: The Pearson Correlation and P-value among BSF and individual lipoproteins

Variable	Pearson Correlation	P value
Serum cholesterol Blood sugar fasting	.269	.093
Serum triglycerides Blood sugar fasting	.292	.068
High density lipoproteins Blood sugar Fasting	-.223	.167
Low densitylipoproteins Blood sugar Fasting	.334	.035
Cholesterol to HDL ratio Blood sugar Fasting	.529	<0.001

DISCUSSION

Dyslipidemia triggered by Insulin resistance and T2DM is main cause of cardiovascular disease.[12,13] There is manifold effects of insulin resistance on fat metabolism. Increase in free fatty acid flux because of insulin resistance is responsible for changes in lipid levels in diabetes mellitus.[14,15] In previous studies, there is documented association between HbA1c levels and the total cholesterol in patients with uncontrolled T2DM.[10]

In our study TC/HDL-C ratio was significantly affected by uncontrolled blood sugar level. Quebec Cardiovascular Study backs the concept that the occurrence of atherogenic dyslipidemia and risk of ischemic heart disease in insulin resistance can be detected by a simpler and effective marker that is TC/HDL-C ratio. Total-to-HDL cholesterol ratio is a valid forecaster of CHD risk.[16-18] It was observed that glycation of HDL reduces the stability and functioning of HDL in T2DM[19] by decreasing the cholesterol efflux capacity.[20]

In this study LDL cholesterol is most affected by increasing blood sugar. It is LDL-c that has to be lowered in order to minimize fatal CVS events.[21] There are many reasons for this raise in level. Increase in blood sugar levels raises the extent of LDL glycosylation, this may slow LDL catabolism and hence increase plasma LDL levels. Slowest development of coronary atherosclerosis is linked to low LDL levels as LDL is more liable to oxidation.[22]

The patients should change their life style by monitoring their intake, regular exercise and compliance to prescribed medication.[10]

CONCLUSION

Dyslipidemia worsens with uncontrolled diabetes. Increase in LDL and cholesterol to HDL ratio was observed. Further studies should be done to explore the molecular basis of these findings so that better treatments can be developed.

REFERENCES

1. Roman G, Stoian AP. Cardiovascular risk/disease in type 2 diabetes mellitus. In: Stoian AP, ed. Type 2 diabtes. 2021.
2. Di Pino A, DeFronzo RA. Insulin resistance and atherosclerosis: implications for insulin-sensitizing agents. Endocr Rev 2019;40(6):1447-67.
3. Siu AL, US Preventive Services Task Force. Screening for abnormal blood glucose and type 2 diabetes mellitus: US Preventive Services Task Force recommendation statement. Ann Intern Med 2015;163(11):861-8.
4. Haghighatpanah M, Nejad ASM, Haghighatpanah M, Thunga G, Mallayasamy S. Factors that correlate with poor glycemic control in type 2 diabetes mellitus patients with complications. Osong Public Health Res Perspect 2018;9(4):167-74.
5. Einarson TR, Acs A, Ludwig C, Panton UH. Prevalence of cardiovascular disease in type 2 diabetes: a systematic literature review of scientific evidence from across the world in 2007–2017. Cardiovasc Diabetol 2018;17(1):1-19.
6. Chatterjee S, Khunti K, Davies MJ. Type 2 diabetes. Lancet 2017;389(10085):2239-51.
7. Basit A. The foot in diabetes. 5th ed. Pakistan: 2020:47-9.
8. Jialal I, Singh G. Management of diabetic dyslipidemia: an update. World J Diabetes 2019;10(5):280.
9. Mooradian AD. Dyslipidemia in type 2 diabetes mellitus. Nat Rev Endocrinol 2009;5:150-9.
10. Amelia R, Damanik HA, Lindarto D, Mutiara E. The correlation between the level of HbA1c with total serum cholesterol of uncontrolled Type 2 diabetes mellitus patients in Binjai, Sumatera Utara. Advan Sci Letters 2017;23(4):3610-3.
11. Yasmin R, Majeed A, Rashid A, Razak S. The association of age with glycaemic and cholesterol control in patients with type 2 diabetes mellitus. JPMA 2017;67(1):33-6.
12. Ormazabal V, Nair S, Elfeky O, Aguayo C, Salomon C, Zuñiga FA. Association between insulin resistance and the development of cardiovascular disease. Cardiovasc Diabetol 2018;17(1):1-14.
13. Gutiérrez-Rodelo C, Roura-Guiberna A, Olivares-Reyes JA. Molecular mechanisms of insulin resistance: an update. Gac Med Mex 2017;153(2):214-28.
14. Hirano T Pathophysiology of diabetic dyslipidemia. J Ahterocler Thromb 2018: 25(9): 771-82.
15. Yasmin R, Majeed A, Rashid A, Razak S. The association of age with glycaemic and cholesterol control in patients with type 2 diabetes mellitus. J Pak Med Assoc 2017;67(1):33-6.
16. Després J-P, Lemieux I, Dagenais G-R, Cantin B, Lamarche B. HDL-cholesterol as a marker of coronary heart disease risk: the Quebec cardiovascular study. Atherosclerosis 2000; 153(2):263-72.
17. Lemieux I, Lamarche B, Couillard C, Pascot A, Cantin B, Bergeron J, et al. Total cholesterol/HDL cholesterol ratio vs LDL cholesterol/HDL cholesterol ratio as indices of ischemic heart disease risk in men: the Quebec Cardiovascular Study. Arch Intern Med 2001;161(22):2685-92.
18. Holman RR, Coleman RL, Shine BS, Stevens RJ. Non-HDL cholesterol is less informative than the total-to-HDL cholesterol ratio in predicting cardiovascular risk in type 2 diabetes. Diabetes Care 2005;28(7):1796-7.
19. Kashyap SR, Osme A, Ilchenko S, Golizeh M, Lee K, Wang S, et al. Glycation reduces the stability of ApoAI and increases HDL dysfunction in diet-controlled type 2 diabetes. J Clin Endocrinol Metab 2018;103(2):388-96.
20. Srivastava RAK. Dysfunctional HDL in diabetes mellitus and its role in the pathogenesis of cardiovascular disease. Mol Cell Biochem 2018;440(1-2):167-87.
21. Younis N, Sharma R, Soran H, Charlton-Menys V, Elseweidy M, Durrington PNJ. Glycation as an atherogenic modification of LDL. Curr Opin Lipidol 2008;19(4):378-84.
22. Lopes-Virella MF, Virella G. Modified LDL immune complexes and cardiovascular disease. Curr Med Chem 2019;26(9):1680-92.