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Research Article

A Study on the Analysis of Blood Lipid Profile in Non-Obese Type 2 Diabetes Patients

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ABSTRACT

Background: Diabetes is one of the major burdens of non- communicable disease causing widely morbidity and mortality. Glycated hemoglobin (HbA1c) has been used as an important tool to monitor glycemic control in patients with type 2 diabetes mellitus and elevated HbA1c value is considered as an independent risk factor for dyslipidemia.

Objective: To investigate the association between glycated hemoglobin (HbA1c) and the lipid profile in non-obese patients with type 2 diabetes mellitus (T2DM) at a tertiary care teaching hospital in B.G. Nagar, Mandya, Karnataka.

Methods: The present prospective cross-sectional study was accomplished at the Adichunchanagiri Hospital and Research Centre, Mandya, Karnataka. There were 209 T2DM patients selected for the study (110 females and 99 males), and the data were collected through a review of the documented profile file system of patients used at the Hospital. Biochemical data such as fasting plasma sugar (FPS), HbA1c and lipid profile, along with the patient's age, BMI and gender, were also taken from the documented file system.

Results: Our results display a significant positive relationship between HbA1c and TG, TC, HDL, LDL and VLDL. Pearson correlation was performed to determine if there is a correlation between variables Total Cholesterol, Triglycerides, HDL, LDL, VLDL and HbA1c. There is a positive correlation between variables Total Cholesterol, Triglycerides, HDL, LDL, VLDL and HbA1c with r= 0.16, r= 0.21, r= -0.22, r= 0.25, r= 0.15 respectively. Our study showed that the Male group has lower values for the dependent variables Total Cholesterol, Triglycerides, LDL, HDL and VLDL than the Female group.

Conclusion: The research concludes that the Glycated hemoglobin was associated with Total cholesterol Triglycerides, HDL LDL, VLDL.

Keywords: Diabetes Mellitus, Glycated Hemoglobin, Lipid profile.

INTRODUCTION

Diabetes mellitus type 2 (Type 2 DM) is a multisystem, chronic, non-communicable disease that has become epidemic in scope [1] and has become a major global public health issue [2] and are both closely related worldwide health problems that are on the rise nowadays. Diabetes is a metabolic disorder associated with hyperglycemia, is a result of a deficiency in insulin action, insulin secretion, or both. The prevalence of diabetes needs to be understood by both developing and developed countries[3]. A number of other illnesses, including dyslipidemia, are also associated with elevated blood glucose [1].

According to a recent study by the Indian Council of Medical Research (ICMR), dyslipidemia is prevalent in the Indian population, and this distinctive lipid distribution is caused by both hereditary and dietary factors [4]. If a person is 35 years of age or older, experts advise both men and women to have more frequent testing for lipid issues [5]. The triad of increased triglycerides (TG), decreased high density lipoprotein (HDL), and an excess of microscopic, dense low density lipoprotein (LDL) particles is referred to as diabetic dyslipidemia. Lipid abnormalities are prevalent in diabetes mellitus because crucial enzymes and metabolic pathways involved in lipid metabolism are affected by insulin resistance or deficiency [6].

Patients with type 2 diabetes who are non-obese have been the subject of less investigation. Obese diabetes patients have been used as the subject of the majority of investigations on diabetes and dyslipidemia. Glycosylated haemoglobin (HbA1C), an absolute marker of long-term blood glucose control (a reflection of blood sugar management in the last three months) (T2DM), is the gold standard of glycemic control in persons with type 2 diabetes mellitus [7].

HbA1c may be employed as a possible biomarker for predicting dyslipidemia and cardiovascular disease (CVD), according to numerous studies [8,9]. The level of circulating HbA1c is the gold standard for glycemic control and must be maintained to prevent complications from T2DM. The HbA1c assay provides an accurate and exact measurement of long-term glucose levels and is associated with a higher risk of developing diabetic complications.

Our study mainly focused on the association between HbA1c and the lipid profile in patients with non- obese Type 2 Diabetes Mellitus in a tertiary care hospital in B. G Nagar, Mandya, Karnataka.

METHODS

Study site: Adichunchanagiri Hospital and Research Centre, Mandya District.

Study design: "It is a hospital based Prospective Cross sectional study."

Study period: The study was carried out over a period of 6 months.

Study criteria:

Inclusion criteria: • Patients of age above 35.

• Patients who are having Type 2 Diabetes Mellitus.

• Patients who are Non-obese.

Exclusion criteria: • Patients who are having Type 1 Diabetes Mellitus.

• Patients suffering from CVD, thyroid disorders, renal problems and those taking Lipid lowering agents.

Source of data: Patient data relevant to the study was obtained from the documented Patient medical records.

Method of data collection: The approval of ethics committee of the institution was obtained prior to the commencement of the study. This prospective and community based study was conducted in Adichunchanagiri Hospital and Research Centre, BG Nagar. The study was carried out for over a period of 6 months. The study was approved by Institutional Committee (IRC) and written consent was obtained from all the patients. After considering the inclusion criteria (patients of age above 35, patients who have Type 2 DM and who are non-obese) and exclusion criteria (patients who have type 1 DM, patients who have CVD, thyroid disorders, renal problems and those who are taking lipid lowering agents), the patients were enrolled in the study.

There were 209 patients Type 2 Diabetes Mellitus patients selected for the study 110 females and 99 males), and the data were collected through a review of the documented medical record system used at the hospital. Biochemical data such as Fasting blood glucose (FPG), HbA1c and lipid profile, along with the patient's age, BMI and gender were also taken from the medical records.

Interpretation of lipid profile value was done as per national cholesterol education program-Adult treatment panel III (NCEP-ATPII). According to these guidelines' recommendation normal, desirable, borderline and high-risk level of total cholesterol (TC) was defined as up to 240mg/dl respectively. Triglyceride (TG) value up to 149 mg/dl, 150-199 mg/dl, 200-499 mg/dl and >500 mg/dl was defined as optimal normal, borderline, high and very highrisk level TG respectively. Low density lipoprotein (LDL) level was defined optimal risk when 190 mg/dl respectively and low risk HDL as >60 mg/dl and high-risk level <40 mg/dl[7].

Interpretation of Glycated Haemoglobin was done as per American Diabetic Association (ASA). According to these guidelines' recommendation Non diabetic adults, pre-diabetic and diabetic was defined as <5.7%, 5.7-6.4% and >/=6.5% respectively. Glycemic status was divided into two groups; Good Glycemic Control (GGC) if HbA1c <7% and Poor Glycemic Control (PGC) if HbA1c ≥ 7% as per ADA criteria.

RESULTS

In our study, there were a total of 209 patients. Age of the patients ranged from 30 to 90 years. Demographic parameters are shown in Table 1. There was no statistically significant difference in age, BMI, FBS and HbA1c between the two genders.

Table 1: Comparison of Age, BMI, FBS and HbA1C in different genders

	Gender	N	Mean	SD	t	P Value
Age	Male	99	55.41	12.74	1.556	0.121
	Female	110	52.65	12.86		
BMI	Male	99	19.11	15.67	0.086	0.932
	Female	110	18.92	15.12		
HbA1c	Male	99	10.37	1.98	0.494	0.622
	Female	110	10.24	2.03		
FBS	Male	99	245.95	65.75	0.778	0.437
	Female	110	239.25	58.76		

*Statistical significance set at 0.05; N: Number of samples; SD: Standard deviation

A total of 200 (95.69%) patients had poor glycemic control (Table 2).

Table 2: Frequency and mean of poor glycemic control patients in different gender.

	N	%	Mean	SD
HbA1c>7%	200	95.69	10.46	1.8
HbA1c>7%(Male)	99	49.50	10.45	1.8
HbA1c>7%(Female)	101	50.50	10.35	1.9

Among 209 patients, 200 patients had poor glycemic control and among them 99 (49.50%) male patients and 101 (50.50%) female patients had poor glycemic control.

Table 3: Lipid profile level in DM patients.

	Cholesterol	TG	LDL	HDL
Optimal			143(68.42%)	3(1.44%)
Desirable	192(91.8%)	20(9.5%)	43(20.5%)	12(5.74%)
Border-line	9(4.3%)	89(42.5%)	14(6.7%)	194(92.8%)
High	8(3.8%)	100(47.8%)	9(4.3%)	
Total	209	209	209	209

Table 4: Correlation of HBA1C and lipid profile

		Lipid Profile				
		Total Cholesterol	Triglycerides	HDL	LDL	VLDL
HbA1c	Pearson Correlation	.159	.206	-.224	.248	.152
	Sig. (2-tailed)	**0.022***	**0.003***	**0.001***	**<.001***	**0.028***
	N	209	209	209	209	209

DISCUSSION

The top three nations with the greatest number of diabetics in 2019 are China (116.4 million), India (77.0 million), and the United States of America (31.0 million), according to the International Diabetes Federation (IDF). China (140.5 and 147.2 million people) and India (101.0 and 134.2 million people) are anticipated to continue to have the largest burden of diabetes in 2030 and 2045, respectively [10]. This is corroborated by the Global Burden of Disease Study, which found that the absolute number of individuals with diabetes is rising due to population expansion and ageing in the world's largest nations, such as China and India [11].

The mean age of type2 DM patients were 55.41±12.74 and 52.65±12.86 years for male and female respectively. A study done by Hussain et al[12] showed mean age of 51.71±11.70 years for male and 50.97±10.23 years for female. Another study by Tilchan et al.[13] had nearly equal number of participants as ours and depicted mean age of male and female patients to be 57.7±16.1 and 61.89±15.46 years respectively thus revealing that more elderly people with type 2 DM visited our hospital. Presence of various risk factors, poor dietary intake, change in life style, low physical exercise may be an explanation for these observed difference[14–16].

Most of our patients had poor glycemic control (n=200, 95.6%). Majority of them were female patients and mean HbA1c among poor glycemic control patients was 10.46±1.8 (Table 2). However, numerous investigations contradicted the gender preponderance [9,12].

Our study also found that more than 90% of the patients had increase in TC and HDL. Meanwhile 68% of the patients had optimal level of LDL. We also found more than 80% of the patients had an increase in the level of TGs. Several studies[13,17] that were done on obese patients had different results than our results. This shows the the association between HbA1c and lipid profile may vary in obese and non-obese patients.

HbA1c levels could be employed as a possible biomarker for recognizing T2DM patients at risk of CVD and could be used as a guide for treating patients(17). Our results display a significant positive relationship between HbA1c and TG, TC, HDL, LDL and VLDL. Pearson correlation was performed to determine if there is a correlation between variables Total Cholesterol, Triglycerides, HDL, LDL, VLDL and HbA1c. There is a low, positive correlation between variables Total Cholesterol, Triglycerides, HDL, LDL, VLDL and HbA1c with r= 0.16, r= 0.21, r= -0.22, r= 0.25, r= 0.15 respectively. The result of the Pearson correlation showed that there was a significant correlation between Total Cholesterol and HbA1c, $r(207) = 0.16$, $p = .022$, Triglycerides and HbA1c, $r(207) = 0.21$, $p = .003$, HDL and HbA1c, $r(207) = -0.22$, $p = .001$, LDL and HbA1c, $r(207) = 0.25$, $p = <.001$, VLDL and HbA1c, $r(207) = 0.15$, $p = .028$.

Our study showed that the Male group has lower values for the dependent variables Total Cholesterol (M = 161.27, SD = 38.12) than the Female group (M = 165.68, SD = 39.04). The descriptive statistics show that males have lower

values for the dependent variable Triglycerides (M = 199.48, SD = 69.92) than females (M = 211.55, SD = 66.88). The results of the descriptive statistics show that the Male group has lower values for the dependent variable HDL (M = 29.11, SD = 7.16) than the Female group (M = 29.66, SD = 8.69). The results of the descriptive statistics show that the Male group has lower values for the dependent variable LDL (M = 91.64, SD = 33.1) than the Female group (M = 92.67, SD = 31.42). The results of the descriptive statistics show that the Male group has lower values for the dependent variable VLDL (M = 37.65, SD = 10.77) than the Female group (M = 39.4, SD = 11.54).

These results are relevant to the metabolic impact of hyperglycemia and insulin insufficiency on different lipid markers. HbA1c with various lipid profile components has yielded conflicting findings in numerous research conducted by numerous authors [9,12,18]. These contradictory results were brought about by variations in lifestyle, genetic, behavioral and environmental factors [19,20]. Therefore, taking steps to alter unhealthy lifestyles, encouraging a healthy diet, shedding pounds, and engaging in regular exercise are necessary to improve or control diabetic dyslipidemia [21].

The strength of the study is that we had the complete biochemical data of the patient. The present study is not without limitations. The sample size was too small. Patient's dietary habits, duration of regular physical activity, lifestyle patterns were undetermined.

CONCLUSION

The use of HbA1c as a sign of dyslipidemia in our population should be undertaken with caution. Further research has to be conducted on non-obese diabetes patients. Our study found out that the Glycated Haemoglobin was associated with TG, TC, LDL-C, HDL-C levels in non- obese patients.

REFERENCES

1. Wang L, Yan N, Zhang M, Pan R, Dang Y, Niu Y. The association between blood glucose levels and lipids or lipid ratios in type 2 diabetes patients: A cross-sectional study. Front Endocrinol (Lausanne). 2022 Sep 6;13.
2. Maffi P, Secchi A. The Burden of Diabetes: Emerging Data. Dev Ophthalmol. 2017;60:1–5.
3. Made Junior Rina Artha I, Bhargah A, Dharmawan NK, Pande UW, Triyana KA, Mahariski PA, et al. High level of individual lipid profile and lipid ratio as a predictive marker of poor glycemic control in type-2 diabetes mellitus. Vasc Health Risk Manag. 2019;15:149–57.
4. Joshi SR, Anjana RM, Deepa M, Pradeepa R, Bhansali A, Dhandania VK, et al. Prevalence of dyslipidemia in urban and rural India: The ICMR-INDIAB study. PLoS One. 2014 May 9;9(5):41-46.
5. Leon AS, Franklin BA, Costa F, Balady GJ, Berra KA, Stewart KJ, et al. Cardiac rehabilitation and secondary prevention of coronary heart disease: An American Heart Assoc. scientific statement from the Council on Clin. Cardiol. (Subcommittee on Exercise, Cardiac Rehabil., and Prevention) and the Council on Nutr., Phys. Activity, and Metab. (Subcommittee on Phys. Activity), in collaboration with the Am. Assoc.10018359710018359 7 of Cardiovasc. and Pulmonary Rehabil. Circulation. 2005;111: 369–76.
6. Khan MN, Khaleel M. International Journal of Biomedical and Advance Research Comparative Study of Serum Lipid Profile of Obese and Non-Obese Students (Male) of Aljouf University. Mohamad Khaleel / International Journal of Biomedical and Advance Research 2016;7(1):7-12.
7. Jaiswal M, Schinske A, Pop-Busui R. Lipids and lipid management in diabetes. Vol. 28, Best Practice and Research: Clinical Endocrinology and Metabolism. Bailliere Tindall Ltd; 2014. p. 325–38.
8. Naeem M, Khattak RM, Rehman MU, Khattak MNK. The role of glycated hemoglobin (HbA1c) and serum lipid profile measurements to detect cardiovascular diseases in type 2 diabetic patients. South East Asia Journal of Public Health. 2016 Jul 25;5(2):30–4.
9. Baranwal JK, Maskey R, Majhi S, Lamsal M, Baral N. Association between level of HbA1c and lipid profile Health Renaissance. 2015;13:80-86.
10. Pradeepa R, Mohan V. Epidemiology of type 2 diabetes in India. Indian journal of ophthalmology. NLM (Medline); 2021;69:2932–8.
11. Finucane M, Paciorek CJ, Lu Y, Singh GM, Lin JK, Farzadfar F, et al. National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2Â·7 million participants. www.thelancet.com [Internet]. 2011;378:31–40. Available from: www.thelancet.com
12. Hussain A, Ali I, Ijaz M, Rahim A. Correlation between hemoglobin A1c and serum lipid profile in Afghani patients with type 2 diabetes: hemoglobin A1c prognosticates dyslipidemia. Ther Adv Endocrinol Metab. 2017 Apr 1;8(4):51–7.
13. Pandey T, Khanal J, Godar K. Study of Association Between Glycated Hemoglobin and Lipid Profile in Type 2 Diabetes Mellitus in Tertiary Care Center. J Lumbini Med Coll [Internet]. 2Dec.2020 [cited 20Sep.2023];8(2):238-43. Available from: https://jlmc.edu.np/index.php/JLMC/article/view/387
14. Lam DW, LeRoith D. The worldwide diabetes epidemic. Vol. 19, Current Opinion in Endocrinology, Diabetes and Obesity. 2012. p. 93–6.
15. Hu FB. Globalization of diabetes: The role of diet, lifestyle, and genes. In: Diabetes Care. 2011. p. 1249–57.
16. Rosiek A, Kornatowski T, Frąckowiak-Maciejewska N, Rosiek-Kryszewska A, Wyżgowski P, Leksowski K. Health behaviors of patients diagnosed with type 2 diabetes mellitus and their influence on the patients' satisfaction with life. Ther Clin Risk Manag. 2016 Nov 25;12:1783–92.
17. Alzahrani SH, Baig M, Aashi MM, Al-shaibi FK, Alqarni DA, Bakhamees WH. Association between glycated hemoglobin (HbA1c) and the lipid profile in patients with type 2 diabetes mellitus at a tertiary care hospital: A retrospective study. Diabetes, Metabolic Syndrome and Obesity. 2019;12:1639–44.

18. Bhowmik B, Siddiquee T, Mujumder A, Afsana F, Ahmed T, Mdala IA, et al. Serum lipid profile and its association with diabetes and prediabetes in a rural Bangladeshi population. Int J Environ Res Public Health. 2018 Sep 6;15(9):55-61.

19. Kautzky-Willer A, Harreiter J, Pacini G. Sex and gender differences in risk, pathophysiology and complications of type 2 diabetes mellitus. Vol. 37, Endocrine Reviews. Endocrine Society; 2016. p. 278–316.

20. Ogurtsova K, da Rocha Fernandes JD, Huang Y, Linnenkamp U, Guariguata L, Cho NH, et al. IDF Diabetes Atlas: Global estimates for the prevalence of diabetes for 2015 and 2040. Diabetes Res Clin Pract. 2017 Jun 1;128:40–50.

21. Wu N, Li J. Clinical considerations of lipid target and goal in dyslipidemia control. Chronic Dis Transl Med. 2016 Mar;2(1):3–6.

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