ASSOCIATION BETWEEN GLYCATED HEMOGLOBIN AND LIPID PROFILE IN TYPE 2 DIABETES MELLITUS PATIENTS ATTENDING TERTIARY CARE HOSPITAL: A CROSS SECTIONAL STUDY

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ABSTRACT

INTRODUCTION

Glycated haemoglobin levels are routinely measured in type 2 diabetes mellitus to monitor their glycaemic control. Lipid disorder in diabetes is common issues either independently or in association with type 2 Diabetes mellitus. We aim to establish the association between Glycated haemoglobin and lipid profile in type 2 diabetes mellitus patients attending our centre.

MATERIAL AND METHODS

This is hospital based cross-sectional study conducted on 161 patients conducted in out-patient department of internal medicine and from 10/02/2079 to 20/04/079 at Devdaha Medical College and Research Institute (DMCRI). Patients were enrolled after taking informed consent fulfilling inclusion and exclusion criterias. Data were entered on Microsoft Excel 2010 and analyzed using SPSS v25.

RESULTS

Among 161 Participants, male to female ratio was almost 1:1, with mean age of diabetes of male and female was 58.1 ± 11.2 standard deviation (SD) and 56.7 ± 10.4 SD, with 13.04% were alcohol consumer; 1.86% were smokers; 57.76% of them had high blood pressure; (29.19%) had known dyslipidaemia and 11.18% had hypothyroidism. While comparing controlled (HBA1c<7%) with uncontrolled (HBA1c ≥7%) glycated hemoglobin and level of different components of lipid profile like total cholesterol, triglyceride, LDL- cholesterol and HDL-cholesterol, there is statistical correlation [χ^2=4.67; df=1; p=0.031] between only high triglyceride level and uncontrolled type 2 diabetes.

CONCLUSION

High value of glycated hemoglobin not only measures uncontrolled type 2 diabetes but can also be considered for high lipid disorder biomarker. Early detection of high glycated hemoglobin could prevent complications related with diabetes independently or in combine with dyslipidemia.

KEYWORDS

Diabetes mellitus, Dyslipidemia, Glycated hemoglobin

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INTRODUCTION

Dyslipidaemia is one of the complications of diabetes mellitus (T2DM) leading to atherosclerosis related disorder like peripheral arterial disease, coronary artery disease, stroke, diabetic retinopathy,nephropathy and neuropathy . Diabetic dyslipidaemia is often characterized by high TG, low HDL cholesterol, and increased level of LDL and postprandial lipidaemia.[1] Glycated haemoglobin (HbA1c) levels are routinely measured in diabetics to monitor their glycaemic control (less than 7%).[2,3] The level of HBA1c predicts the complication of diabetes independently.[3]

As the T2DM is related to unhealthy lifestyle so the dyslipidaemia is.[3] A lipid profile assessment in T2DM may be useful to reduce the risk of disease progression and for early intervention.[3]

International studies have already proved high association between these two conditions but very few national studies were conducted.[3–5] So, this study will help to further established the relationship between the glycated haemoglobin level and lipid profile in the patients of type 2 diabetes mellitus patients. The objective of our study is to establish the association between Glycated haemoglobin and lipid profile in type 2 diabetes mellitus patients attending our centre.

MATERIAL AND METHODS

This is hospital based cross-sectional, observational, descriptive study conducted in tertiary centre at Devdaha Medical College and Research Institute, Bhaluhi, Rupandehi, Lumbini province, Nepal from 10/02/2079 to 20/04/2079. Ethical clearance was taken from Devdaha Medical College and Research Institute- Institutional Review Committee (DMCRI-IRC). Patient consent was taken both verbally and in written form. A total of 161 patients recruited in daily basis at Out- Patient Department (OPD) of Internal medicine fulfilling the inclusion criteria, as cases should be already diagnosed of type 2 diabetes mellitus with both male and female of age more than 18 years. Exclusion criteria was known case of type 1 diabetes. Non- probability, purposive sampling technique was opted with sample size calculated using Cochrane formula, taking prevalence of dyslipidemia in type 2 diabetes mellitus as 88.1%.[6] So, using this formula sample size was calculated as 161.099 and we considered total sample of 161.Lipid was analyzed by Agappe Mispa CCXL, Auto chemistry analyzer machine using Friedewald formula.

Statistical analysis was done by SPSS (Statistical package for social science) version 25. Descriptive statistics was represented as Mean ± Standard deviation (S.D) with 95% confidence intervals for continuous data (age, level of HBA1c, duration of diabetes, total cholesterol, triglyceride, low density lipoprotein, high density lipoprotein and very low-density lipoprotein) and categorical data (gender, alcohol use, smoking, presence of hypertension, dyslipidemia, hypothyroidism,) was depicted as frequency number. For measuring the association between variables, we use correlation test and if correlation test shows significant, we use t- test for quantitative data and chi- square for qualitative data. Statistical significance was assumed at p- value < 0.05. Glycated hemoglobin is categorized as less than 7 for control sugar level and 7 and more is considered as uncontrol sugar level as per American Diabetes Association guidelines. Also, for lipids: Total cholesterol less than 200 is considered as normal and 200 and above considered as high; Triglyceride level less than 150 was considered as normal and 200 and above considered as high; LDL cholesterol less than 70 considered as normal and 70 and above considered as high level; HDL less than 40 for male and less than 50 for female was considered low-HDL and for male LDL equal and more than 40 and for female if level 50 or more is considered normal.

RESULTS

In our study, the mean age for male and female was 58.1 ± 11.2 standard Deviation (SD) with minimum of 33 years and maximum of 86 years and 56.7 ± 10.4 SD with minimum of 31years and maximum of 82 years. The mean duration of diabetes was 8.47 ± 6.57 for male and 7.68 ± 4.88 years for female. The ratio of male to female was almost 1:1. Almost 13% were alcohol consumer and 2 % were smokers. More than half, (57.76%) had high blood pressure; around one quarter (29.19%) had dyslipidaemia and almost one tenth (11.18%) had hypothyroidism as shown in Table 1.

Table 1. Clinico-demographic profile of Diabetes patient

S.N.	Variables		Total (n=6)		
			Male (N=79)	Female (N=82)	Total Percentage
1	Gender		79	82	100
2	Alcohol	Yes	15	6	13.04
		No	64	76	86.95
3	Smoker	Yes	2	1	1.86
		No	77	81	98.13
4	Hypertension	Present	47	46	57.76
		Absent	32	36	42.3
5	Known dyslipidemia	Present	26	21	29.19
		Absent	53	61	70.81
6	Hypothyroidism	Present	5	13	11.18
		Absent	74	69	88.81

The mean ± SD of TC, TG, HDL-C and LDL-C were 181 ± 39, 183 ± 104, 102 ± 33.2 and 42.7 ± 10.9 respectively. The frequency of high total cholesterol, high triglyceride, high LDL-cholesterol and low-HDL were 21%, 50%, 91.9% and 64% respectively. The mean level of total cholesterol, triglyceride, LDL-cholesterol and HDL-cholesterol in case of HBA1c less than 7% and HBA1c equal and above 7% is shown in Table 2 where, there is only significant difference between mean level of triglyceride in controlled and uncontrolled HBA1c groups.

Table 2. Description on lipid profile according to controlled (<7%) and uncontrolled (≥7%) HBA1c.

Lipid Parameter	HBA1cCat	N	Mean	SD
TOTALCHOLESTEROL	<7%	92	180.3	36.40
	7% or More	69	182.1	42.44
TG*	<7%	92	163.2	72.29
	7% or More	69	208.8	130.92
LDL	<7%	92	106.3	33.07
	7% or More	69	97.0	32.81
HDL	<7%	92	42.4	6.05
	7% or More	69	43.1	15.13

*Significant mean difference present.

The mean level of glycated haemoglobin (HBA1c) was 7.25 ± 1.78% SD with minimum of 3.87% and maximum of 14.9%. Comparison between association of glycated hemoglobin and level of different components of lipid profile, total cholesterol, triglyceride, LDL- cholesterol and HDL-cholesterol was shown by Table 2. While performing analytical test {chi-square (χ)}, we found that there was no association between HBA1c level and lipid profile except for triglyceride cholesterol as shown in Table 3. Triglyceride level would be high with increasing HBA1c which is statistically significant [χ^2=4.67; df=1; p=0.031] as shown in figure 1.

Table 3. Contingency Table of HBA1c and Total cholesterol; Triglyceride; LDL; HDL

Lipid profile		HBA1c <7%	HBA1c ≥7%	χ^2-value	χ^2 continuity correction value	df	p-value
Total Cholesterol	Normal	71	56	0.376	0.175	1	0.540
	High	21	13				
Triglyceride	Normal	53	27	5.39	4.67	1	0.031*
	High	39	42				
LDL-Cholesterol	Normal	5	8	2.02	1.27	1	0.260
	High	87	61				
HDL-Cholesterol	Normal	33	25	0.00225	0.000	1	1.000
	Low-HDL	59	44				

*TG and HBA1c has positive association as P<0.05

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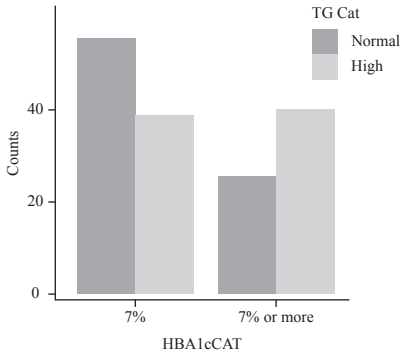
Figure 1. Bar-plot diagram of HBA1c and triglyceride



DISCUSSION

Our study aims at to establish whether there is any association between lipid disorder like high total cholesterol, high triglyceride, high LDL-cholesterol and low-HDL with HBA1c level in type 2 diabetic patients. In our study, the mean age for male and female was 58.1 ± 11.2 SD and 56.7 ± 10.4 SD which is comparable with study by Hussain A et al. where mean age for male and female was 51.71 ± 11.70 and 50.97 ± 10.23 years respectively.[5] Also, mean duration of diabetes was of 8.47 ± 6.57 for male and for female mean of 7.68 ± 4.88 years.

Regarding lipid profile, the frequency of occurrence of high total cholesterol, high triglyceride, high LDL-cholesterol and low-HDL were 21%, 50%, 91.9% and 64% respectively. These frequencies are quite high comparing nondiabetic individuals which were also shown by different studies.[4,5,7–11] Many studies have clearly mentioned that dyslipidemia independently or in combination with diabetes were responsible for atherogenesis.[12,13] Comparing diabetes with nondiabetic individual, diabetes were found to have dyslipidemia and so does related complications like cardiovascular disease, cerebrovascular disease, retinopathy, nephropathy, neuropathy.[4,12,13] This relation is because of interrelation between carbohydrate and lipid metabolism. Several studies showed that insulin affects the liver apolipoprotein production and regulates the enzymatic activity of lipoprotein lipase and cholesterol ester transport protein, which causes dyslipidemia in diabetes mellitus. Moreover, insulin deficiency reduces the activity of hepatic lipase and several steps in the production of biologically active lipoprotein lipase.[14–16]

Present study showed that those individuals with uncontrolled HBA1c (7% and above) had higher triglyceride level comparing with low HBA1c (<7%) which is statistically significant p-value equal to 0.031. But other parameters of lipids like total cholesterol, LDL-cholesterol and HDL-cholesterol which are in higher level in diabetes patients comparing with nondiabetic patients but comparing with uncontrolled with controlled HBA1c, there is no association. Similar findings were present in other studies like Hussain et al. (2017) and Alzahrani S et al. (2019).[5,10]

But, if we consider other studies like Vinodmahato R et al (2011) and Pokharel D et al (2017) which were done in Nepal showed that there were association between all the parameter of lipid like total cholesterol, triglyceridemia, LDL cholester-

ol and HDL- cholesterol with uncontrolled diabetes which was statistically significant.[3,8] These differences between studies might be due to sample population, hospital-based sample, food habits of different society, education level, knowledge about disease and infrequent use of statins and other anti- lipid drugs.

The limitation of this study is that it is hospital based, single centered, small, sample size study. There are other confounding factors that contribute dyslipidemia like age, smoking, alcohol, hypothyroidism, hypertension and use of different anti diabetic drugs. So, we overlooked these factors. Also, we did not analyze the types and effect of lipid lowering effect in patients with dyslipidemia that was used in past and present. So, the findings may not be generalized.

CONCLUSION

Our study concludes that there is high prevalence of lipid disorder in diabetes patients comparing with nondiabetics and this association is directly correlated with higher level of triglyceride cholesterol and glycated hemoglobin level. So, we can use level of HBA1c as potential biomarker of dyslipidemia in type 2 diabetes patients in addition to glycemic control. Nevertheless, other parameters of lipids individually or in combination are also responsible for complications in diabetes patients.

We recommend control of dyslipidemia in patients with high HBA1c level by using medicine or change of lifestyle. Also, we recommend longitudinal and case-controlled studies to be conducted in this region to explore more link between dyslipidemia and HBA1c. Awareness of this link among patients and clinicians helps to prevent complications related with diabetes and dyslipidemia.

CONFLICT OF INTEREST

None

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