HBA1C AND LIPID PROFILE LEVELS IN THE KNOWN TYPE 2 DIABETIC GROUP IN THE RURAL REGION OF VIDARBHA, MAHARASHTRA, INDIA

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ABSTRACT

BACKGROUND

Diabetes Mellitus (DM) is a group of metabolic diseases in which there is high blood sugar levels over a prolonged period of time, and if early interventions are not taken, then it can cause many life-threatening complications like heart disease, stroke, kidney failure, damage to eyes, etc. Our aim is to determine HbA1c and Lipid profile level in the known type 2 diabetic group in the rural region of Vidarbha, Maharashtra, India, to see that as our study is a rural-based study and there is less pollution and stress factor compared to the cities whether it effects out study result or not.

MATERIALS AND METHODS

FBS, HbA1c, TC, HDL, LDL, VLDL, TG levels were evaluated. Total sample size 60 in between 30-40 years including males and females divided into two groups. 30 patients study group with known history of type 2 DM who attended the Medicine OPD and 30 age, sex matched healthy controls. Statistical analysis was done by using SPSS 17.0 version.

RESULTS

Results of serum lipid profile showed that mean values for TC, TG, HDL, LDL and VLDL in study group were 227.76±30.72, 152.23 ± 40.94, 40.5 ± 6.43, 153.30 ± 27.70 and 33.00 ± 9.94 mg/dL. FBS showed significant positive correlation with HbA1c ($p<0.002$). HDL has significant negative correlation with HbA1c ($p<0.008$).

CONCLUSION

Early detection in the abnormalities of serum lipid profile and HbA1c can minimise the risk for micro and macroangiopathies in the known type 2 diabetic patients.

KEYWORDS

Diabetes Mellitus, Glycated Haemoglobin, Lipid Profile Panel.

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BACKGROUND

Diabetes Mellitus (DM) is a group of metabolic diseases characterised by hyperglycaemia resulting from defects in insulin secretion, insulin action or both.[1] Type 2 DM is caused by a combination of resistance to insulin action and an inadequate compensatory insulin secretary response. This form of DM accounts for approximately 90-95%. According to the International Diabetic Foundation, currently, the disease affects >62 million Indians, which is >7.1% of India's adult population. As per World Health Organization (WHO), at least 171 million people suffering worldwide in diabetes. Its incidence is increasing rapidly and estimated that by the year 2030, this number will be double. India leads the world with largest number of diabetic subjects, so WHO termed India as "the diabetes capital of the world." Diabetes is associated with a greater risk of morbidity and mortality from Cardiovascular Disease (CVD). Serum lipids are frequently abnormal and are likely to contribute to the risk of coronary artery disease.[2] Worsening of glycaemic control deteriorates lipid abnormalities in diabetes mellitus.[3]In diabetes, glucose is underutilised and develops clinical hyperglycaemic episodes, such as ketoacidosis or hyperosmolar coma. As the disease progresses, individuals are at risk for the development of specific complications including retinopathy leading to blindness, nephropathy causes renal failure and atherosclerotic heart disease.

Glycated Haemoglobin (HbA1c) is routinely used as a diagnostic tool for screening and measuring long-term blood glucose control in diabetic patients. Glycated haemoglobin (HbA1c) is routinely measured to check the glycaemic control over a preceding 8-12 weeks of time. It is an indicator for the mean blood glucose level in diabetic patients. HbA1c predicts the risk for the development of severe diabetic complications in diabetic patients. The

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UKPDS study has shown that in patients with type 2 diabetes mellitus, the risk of diabetic complications were strongly associated with uncontrolled hyperglycaemia. Regardless of dyslipidaemia, high HbA1c is now considering as an independent risk factor for CVD. According to the American Diabetes Association (ADA), HbA1c level of <7% as a goal of optimal blood glucose control[4] and the American Association of Clinical Endocrinologist has further recommended HbA1c level of <6.5% is the target goal.[5]One of the major risk factors of CVD in type 2 diabetic mellitus is dyslipidaemia. The indicators of diabetic dyslipidaemia include elevated level of triglycerides and LDL-C and low HDL-C. The changes in lipid parameters in diabetes mellitus are due to increased free fatty acid level secondary to insulin resistance. Criteria for abnormal lipid profiles were based on the ADA criteria, hypercholesterolaemia refers to a total cholesterol level ≥200 mg/dL, hypertriglyceridaemia refers to a level is ≥150 mg/dL, HDL was considered low when the level is <40mg/dL in males and <50mg/dL in females and LDL was considered high when the level is ≥100mg/dL. HbA1c is formed by the condensation of glucose with the N-terminal valine residue of each β-chain of HbA to form an unstable Schiff-base, which is the most widely used as the long-term glycaemic control as well as an independent risk factor for cardiovascular diseases (stroke).[6] Atherosclerosis is characterised by the deposition of cholesterol into the artery wall. Atherosclerosis accounts for around 80% of all deaths among diabetic patients. Prolonged exposure to hyperglycaemia is now recognised a major factor in the pathogenesis of atherosclerosis in diabetes. Hyperglycaemia induces a large number of alterations at the cellular level of vascular tissue that potentially accelerate the atherosclerotic process. There are three major mechanisms that encompass most of the pathological alterations observed in the diabetic vasculature- 1) Nonenzymatic glycosylation of proteins and lipids, which can interfere with their normal function by disrupting molecular conformation, alter enzymatic activity, reduce degradative capacity and interfere with receptor recognition; 2) Oxidative stress; and 3) Protein Kinase C (PKC) activation with subsequent alteration in growth factor expression.

The aim of the study is to study the HbA1c and lipid profile level in the known type 2diabetic group in the rural region of Vidarbha, Maharashtra, India. The study was carried out in the Department of Biochemistry in association with Department of Medicine, Jawaharlal Nehru Medical College and Acharya Vinoba Bhave Rural Hospital, Sawangi (Meghe), Wardha, Maharashtra, India.

MATERIALS AND METHODS

A comparative and cross-sectional study was conducted. Institutional Ethical Committee approved the study and informed consent was obtained from the patients. The study was done from July 2016 to December 2016 among total sample size 60 patients including males and females and divided into two groups. Informed written consent were taken for the study purpose. 30 study group with type 2 DM who attended the outpatient clinic of the Medicine Department of AVBRH Hospital, Sawangi (Meghe), Wardha, and 30 age, sex matched healthy controls. All patients with known history of type 2 DM within the age group of 30-40 years included in the study. Information about subject's age, sex, lifestyle, family history of diabetes and other chronic diseases/disorders were written in predesign format. HbA1cassay was done by immunoassay method, fasting blood glucose by GOD/POD method,[7] total cholesterol by enzymatic endpoint method,[8] triglycerides liquid stable GPO-POD method,[9] HDL direct enzyme method, LDL using Friedewald formula and VLDL by appropriate formula - all measured by Randox auto-analyser on the same day of collection.

Sample Collection

3mL blood sample was collected from each subject. Fasting blood sample in sterile fluoride bulb for FBS, plain bulb for lipid profile and in EDTA bulb for HbA1c under all the aseptic conditions with consent of the patient. Sample was allowed to stand for clotting for 25 to 30 minutes. Serum was separated by centrifuging blood at 3000rpm for 10 mins.

Inclusion Criteria

All patient with known history of type 2 DM, age group between 30-40 years and diabetic patients, those who gave the consent for the study were included in the study.

Exclusion Criteria

Patient with major illness like liver disease, renal failure, cardiovascular disease, which can directly or indirectly affect the result, previous or current treatment with drugs known to interfere with glucose and lipid metabolism were excluded from the study.

Statistical Analysis

Statistical analysis was done by using Student's unpaired t-test and Pearson's correlation coefficient and software used in the analysis was SPSS 17.0 version and $p<0.05$ is considered as level of significance ($p<0.05$).

RESULTS

Table 1 shows results of serum lipid profile showed that the mean values for TC, TG, HDL, LDL and VLDL in study group were 227.76 ± 30.72, 152.23 ± 40.94, 40.5 ± 6.43, 153.30 ± 27.70 and 33.00 ± 9.94 mg/dL, respectively. TC, TG and LDL level is significantly higher in the cases as compared to controls ($p<0.0001$). Table 2 shows HbA1c has significant negative correlation with HDL ($p<0.008$). FBG showed positive correlation with TG ($p<0.13$) and VLDL ($p<0.33$). Positive correlations were observed between serum levels of TC, TG, LDL, VLDL with HbA1c. Table 3 shows FBS has significant positive correlation with HbA1c ($p<0.002$) and FBS has negative correlation with TC, HDL and LDL.

	Group	N	Mean	Std. Deviation	Std. Error Mean	t-value	p-value
Total cholesterol	Study	30	227.76	30.72	5.61	16.01	0.0001***, S
	Control	30	136.10	6.24	1.14		
TG	Study	30	152.23	40.94	7.47	10.74	0.0001***, S
	Control	30	71.30	5.17	0.94		
HDL	Study	30	40.50	6.43	1.17	1.22	0.226, NS
	Control	30	38.73	4.58	0.83		
LDL	Study	30	153.30	27.70	5.05	15.07	0.0001***, S
	Control	30	75.50	5.65	1.03		
VLDL	Study	30	33.00	9.94	1.81	0.71	0.47, NS
	Control	30	34.73	8.69	1.58		
HbA1c	Study	30	6.93	0.47	0.08	16.28	0.0001***, S
	Control	30	5.37	0.23	0.04		
FBS	Study	30	146.90	31.51	5.75	10.77	0.0001***, S
	Control	30	84.56	3.12	0.57		

Table 1. Comparison of Biochemical Parameters in Two Groups

S= Significant; *** highly significant, NS= Nonsignificant.

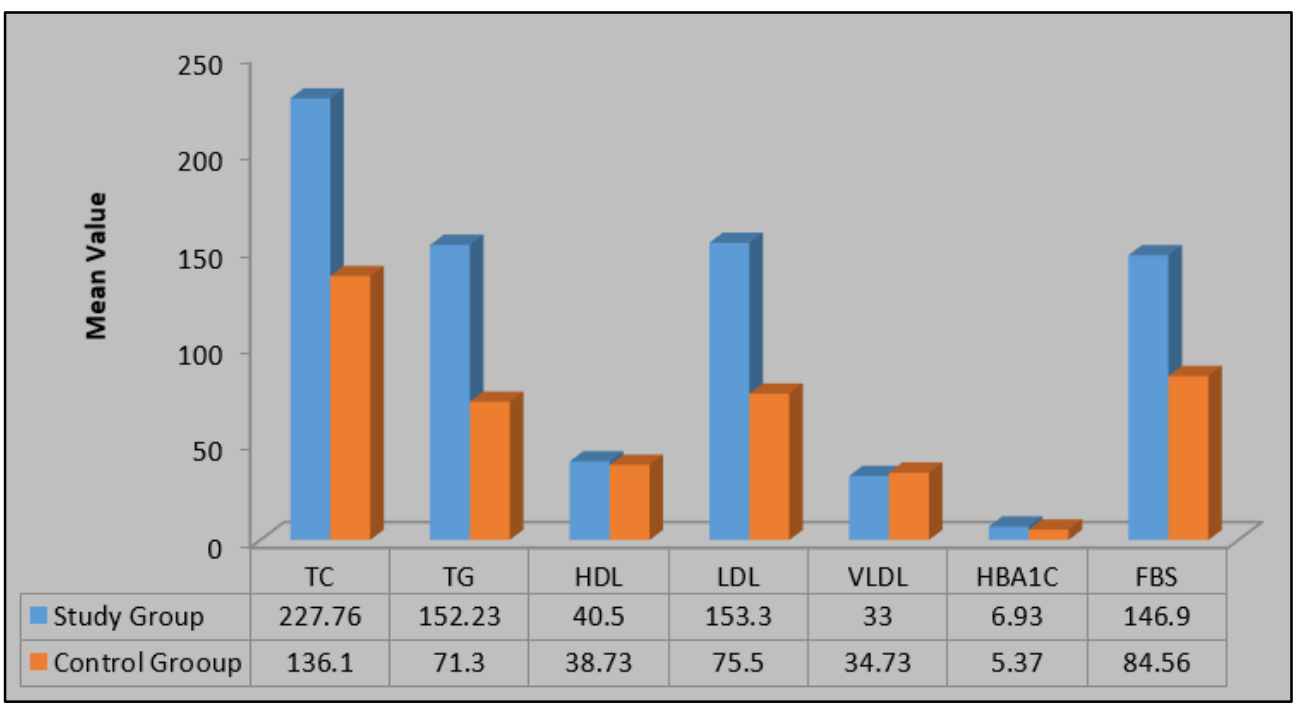

Figure 1. FBS, HbA1c and Lipid Profile is Raised in Cases as Compared to Controls

	Mean	Std. Deviation	N	r-value	p-value
HbA1c	6.93	0.47	30	-	-
TC	227.76	30.72	30	0.08	0.66, NS
TG	152.23	40.94	30	0.16	0.37, NS
HDL	40.50	6.43	30	-0.47	0.008**, S
LDL	153.30	27.70	30	0.15	0.42, NS
VLDL	33.00	9.94	30	0.10	0.59, NS

Table 2. Correlation of HbA1c with Lipid Profiles

r = Pearson's Correlation, (-) = negative correlation

	Mean	Std. Deviation	N	r- value	p-value
FBS	146.90	31.51	30	-	-
TC	227.76	30.72	30	-0.25	0.16, NS
TG	152.23	40.94	30	0.28	0.13, NS
HDL	40.50	6.43	30	-0.34	0.05, NS
LDL	153.30	27.70	30	-0.26	0.16, NS
VLDL	33.00	9.94	30	0.18	0.33, NS
HbA1c	6.93	0.87	30	0.534	0.002**, S

Table 3. Correlation of FBS, HbA1c with Lipid Profiles

r = Pearson's Correlation, (-) = negative correlation.

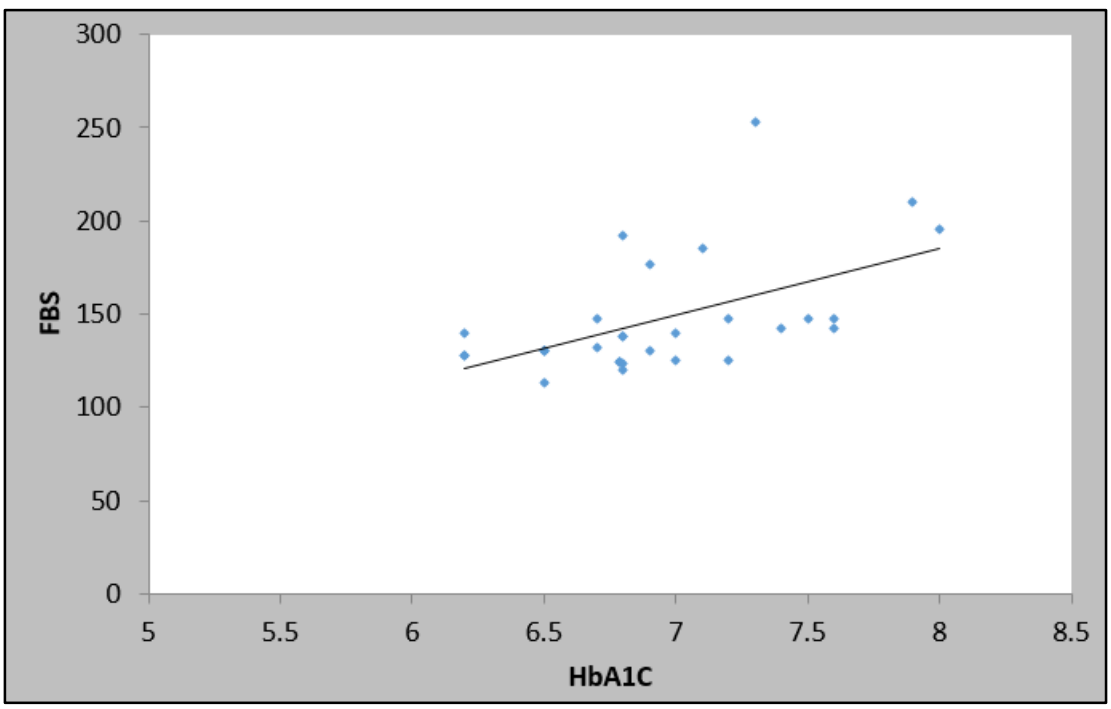

Figure2. Significant Positive Correlation between HbA1c and FBS

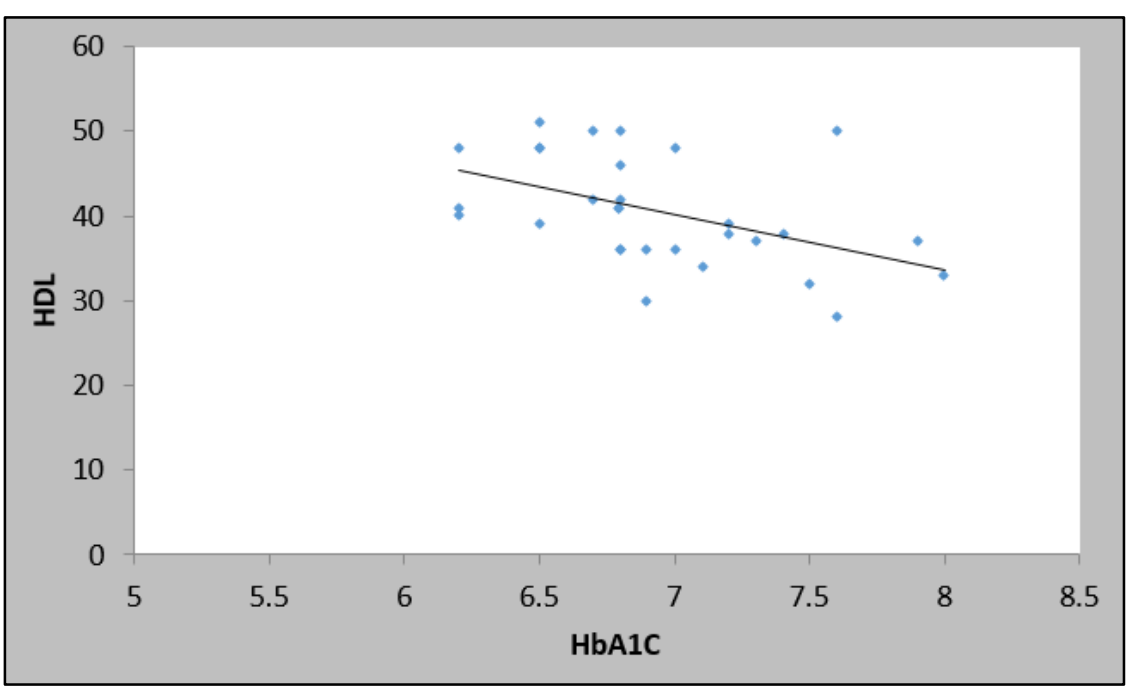

Figure 3. Significant Negative Correlation between HbA1c and HDL

DISCUSSION

In the present study, we have evaluated the pattern of lipid profile in type 2 diabetic patients and its correlation with HbA1c level. The present study was carried out at AVBRH and JNMC, Sawangi (Meghe), Wardha in the Vidarbha region. The findings are as follows-

FBS, HbA1c, TC, TG, HDL and LDL levels were found higher in the cases as compared to controls, which is in accordance with the study of Wexler et al.[10]

Our study results also showed significant positive correlation of FBS with HbA1c level, which in accordance with the study of Davis and Nicolet al.[11]

In our study, positive correlations were observed between serum levels of TC, TG, LDL,VLDL with HbA1c, which is in accordance with the study of Erciyas et al, (2004).[12]

HbA1c shows significant negative correlation with HDL ($p<0.008$).

Diabetic patients with elevated HbA1c and altered lipid profile considered as a very high risk group for severe complications. Improving glycaemic control can reduce the risk of various complications in diabetic subjects.[13] According to the Diabetes Complications and Control Trial (DCCT) HbA1c is the gold standard of glycaemic control and the level of HbA1c value ≤7.0% was said to be appropriate for reducing the risk of cardiovascular complications.[14]

It has also been showed in previous study conducted by Khaw et al that by reducing the level of glycated haemoglobin (HbA1c) by 0.2% could lower the mortality rate by 10%.[15] Goldberg in their study showed that the cause of altered lipid profile in type 2 diabetes maybe due to the insulin is not working properly or secreted in a proper manner, which can affect the production of liver apolipoprotein.[16]

In our study, altered lipid profile level has been seen, which is commonly seen among type 2 diabetic subjects. Our study reveals high prevalence of hypercholesterolaemia, hypertriglyceridaemia and high LDL cholesterol levels. These are the well-known risk factors for cardiovascular diseases. In diabetes mellitus, the peripheral utilisation of sugar is impaired following low plasma and tissue concentration of insulin,[17] which results in increased lipolysis and decreased re-esterification; as a result, there is increase in plasma-free fatty acids. As the lipoprotein lipase activity is low in diabetic subjects, the plasma level of LDL cholesterol, triglycerides are increased.[18]These are all the factors for development of dyslipidaemia in diabetes mellitus.

Thus, the results of our study suggest the importance of controlling hyperglycaemia in order to manage altered lipid profile levels. Thus, it can reduce the risk for cardiovascular diseases in type 2 diabetic subjects.

CONCLUSION

Our study demonstrates that altered lipid profile has been associated with elevated level of blood sugar levels in the diabetic group. Thus, the adverse effect of hyperglycaemia and associated dyslipidaemia should not be overlooked in diabetics. HbA1c can be used as a marker of glycaemic control and as well as an indicator of lipid profile status in the type 2 diabetic patients in the rural populations.

The age group between 30-40 years is the vulnerable age group for developing diabetes, because at this early age, they are generally not aware of this situation. So, they should be screened for blood sugar, HbA1c and lipid profile levels, which are very inexpensive blood testing for early detection of diabetes and its related complications as it will be beneficial for the rural populations.

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