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A Study on Glycated Hemoglobin and Lipid Profile In Type 2 Diabetes Mellitus

Adeeba Anjum,
Post graduate, D.V.H.S Sarma, professor and HOD in Department of Biochemistry, Asiya Naaz professor in Department of Biochemistry, S.V.S Medical College, Mahabubnagar, Telangana.

Abstract:
Diabetes Mellitus is a metabolic disorder and escalating public health issue with noteworthy effects on human health, living standards, the economy and health care systems. Statistics from International Diabetes Federation indicate that 425 million adults worldwide have Diabetes Mellitus and by 2045, the number of DM patients will be 352 million people were at risk of developing Type 2 Diabetes mellitus. These patients are prone to diabetic dyslipidemia, which put them at risk of developing macro vascular (stroke peripheral vascular disease) and microvascular (nephropathy, neuropathy and retinopathy) diseases. Glycated hemoglobin (HbA1c) levels are routinely measured in diabetics to monitor their glycemic control. Levels of HbA1c can be affected by multiple factors. HbA1c potentially be utilized as a possible biomarker for predicting dyslipidemia and cardiovascular disease. It is considered as gold standard of glycemic control and regulating it is imperative for avoiding type 2 Diabetes Mellitus complications. The Aim of present study is to estimate glycated hemoglobin and lipid profile in patients with Type 2 Diabetes mellitus and compare it with healthy subjects.

Key words: *Diabetes Mellitus, Dyslipidemia, Glycated Hemoglobin, macro vascular and microvascular complication*

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I. Introduction

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia , resulting from defects in insulin secretion, insulin action, or both. Type 2 diabetes, the most prevalent form of the disease, is often asymptomatic in its early stages and can remain undiagnosed for many years (American Diabetes Association,2003).(1)

The International Diabetes Federation (IDF)(2) in 2014 reported that 4,50,000 people (3.35% prevalence) have been diagnosed as having diabetes with a further 3,30,000 undiagnosed persons.(International Diabetes Federation, 2014)(108). The prevalence of DM has increased dramatically around the globe, from an estimated 30 million cases in 1985 to 177million in 2000.It is estimated that, more than 360 million individuals may develop diabetes by the year 2030 (Fauci,2008). (3)

Diabetic patients have a greater likelihood of having dyslipidemia, hypertension, and obesity. Because early detection and prompt treatment may reduce the burden of diabetes and its complications, screening for diabetes may be appropriate under certain circumstances (American Diabetes Association, 2003)(1)

Epidemiological studies have demonstrated that type 2 diabetes mellitus (DM) well known risk factor for the development of cardiovascular diseases, cerebrovascular diseases and peripheral vascular diseases. Dyslipidemia is a risk factor for coronary artery disease, a leading cause of mortality in patients with diabetes mellitus. Dyslipidemia is diagnosed and undertreated in high risk populations, such as patient with type- 2 diabetes (Masram*et al*., 2012).(4)

Glycated hemoglobin (HbA1c) is a routinely used marker for long-term glycemic control. In accordance with its function as an indicator for the mean blood glucose level, HbA1c predicts the risk for the development of diabetic complications in diabetes patients. Apart from classical risk factors like dyslipidemia, elevated HbA1c has now been regarded as an independent risk factor for cardiovascular disease in subjects with or without diabetes (Khawet al., 2004).(5)

II. Materials And Methods

The present study is done in department of biochemistry, SVS hospital, Out of 60 subjects 20 people were having high fasting and postprandial blood sugar are grouped as subjects of diabetes mellitus Out of 60 subjects 20 patients were having normal fasting and postprandial blood sugar levels. 20 cases of DM and 20 normal subjects were investigated for HBA1C and lipid profile.:

Inclusion criteria: Both male and female patients above age of 4o years who were obese, previous history of

having hypertension and already diagnosed as type 2 diabetes mellitus were included in study.
Exclusion criteria: Smokers, alcoholics and those on lipid lowering agents and newly diagnosed diabetic patients were excluded from the study.
Biochemical parameters of test group is estimated and compared with those of control group. The following parameters are included in the study.
1. HbA1C
2. Total cholesterol
3. HDL cholesterol
4. Ldl cholesterol
5. Triglycerides
6. VLDL

GLYCATED HAEMOGLOBIN (HbA1C) (NEPHELOMERTY):
PROCEDURE : For Hba1c estimation 5 ml of whole blood is drawn from median cubital vein in Edta vacutainers. Analyser is calibrated before start of analysis.
Method: Nephelometry
Equipment:Nephplus semi autoanalyser
Normal value: 4% -5.6%

Estimation of Total Cholesterol

Procedure : 5 ml of fasting blood sample (overnight fast 8-12hrs)is drawn from median cubital vein into Edta vacutainers. Blood is centrifuged at 2000 rpm to separate the serum.Then serum is used to estimate lipid profile.
Method : (chod –pap); Trinders methodology
Equipment: Erba Mannheim, semi autoanalyser.
Specimen required : Fasting sample.
Normal value:125 to 200 mg/dl.

Estimation of HDL Cholesterol

Method : Enzymatic , Colorimetric method
Equipment : Erba Mannheim,semi autoanalyser
Specimen : Fasting sample
Normal value: 40-60 mg/dl

Estimation of Triglycerides

Method: Enzymatic ,Colorimetric method
Equipment: Erba Mannheim ,semi autoanalyser
Specimen: Fasting Sample
Normal value: <150 mg/dl

Estimation of LDL AND VLD

$$LDL = \text{Total cholesterol} - (HDL + VLDL)$$

$$VLDL = \frac{\text{Triglycerides}}{5}$$

control

S.no	I.P no	Age	Sex	HBA1C	Total cholesterol	HDL	LDL	TG's	VLDL
1	210929522	35 y	F	5.5	171	58	115	145	29
2	210929544	32 y	M	5.4	177	55	78	136	27
3	210929743	23 y	F	5.5	169	59	90	150	30
4	210929816	47 y	M	5.2	198	48	101	128	25
5	210929109	39 y	M	5.1	151	43	119	142	28
6	202109281	62 y	F	5	193	52	101	134	26.8
7	211097641	60 y	F	5.5	146	41	80	103	20.6
8	210924262	22 y	F	4.6	123	45	64	67	13
9	210311477	49 Y	M	5	113	40	108	122	24

10	201918312	46 y	M	5.1	187	44	110	102	20.4

control

S.no	I.P no	Age	Sex	HBA1C	Total Cholesterol	HDL	LDL	TG's	VLDL
11	210911421	36 y	M	4.4	154	52	76	104	20.8
12	21266213	43 y	M	5	150	53	64	96	19.2
13	21267853	70 y	F	5.1	161	49	78	116	23
14	20210906	49 y	F	4.8	148	51	66	78	15.6
15	21262936	43 y	M	5.2	157	42	76	99	19.8
16	21315608	44 y	F	4.6	126	53	68	107	21.4
17	21315546	48 y	F	5.4	174	64	81	145	29
18	213162512	42 y	F	5.5	165	42	90	139	27
19	21317651	51 y	F	5.3	149	51	78	96	19.2
20	213185216	44 y	M	4.5	138	44	77	88	17.6

cases

S.no	I.P no	Age	Sex	HBA1C	Total cholesterol	HDL	LDL	TG's	VLDL
1	210929272	52 y	M	6	253	39	149	197	39.4
2	210929653	65 y	M	6.7	223	28	135	184	36.8
3	210928830	55 y	M	5.9	244	38	67	104	20.8
4	210929544	32 y	M	5.7	277	44	145	194	38.8
5	210929748	46 y	M	6	264	35	131	142	28.4
6	210929318	74 y	M	6.1	206	55	140	151	30.2
7	2109291109	72 y	F	10.8	213	36	142	441	88.2
8	210930911	54 y	M	10.4	239	34	136	182	36.4
9	210719780	38 y	M	6.2	225	27	144	158	31.6
10	210288646	55 y	M	7.8	233	37	177	129	25.3

cases

S.no	I.P no	Age	Sex	HBA1C	Total cholesterol	HDL	LDL	TG's	VLDL
11	21109764	60 y	F	5.9	237	36	158	199	39.8
12	21274735	55 y	M	6.1	253	55	141	159	31.8
13	2013663161	52 y	F	9	221	34	98	356	71.2
14	210924262	43 y	F	7.5	244	32	132	204	40.8
15	211030342	58 y	M	8.2	285	62	153	218	48.8
16	210909181	61 y	M	10.3	358	53	187	439	87.8
17	20210915	48 y	M	12.2	290	55	110	176	35
18	210916103	66 y	M	8.8	276	32	138	111	22.2
19	210916632	62 y	F	6.8	248	31	149	130	26
20	210918234	59 y	M	7.6	269	49	136	164	32.8

Non Diabetic with lipid profile (Controls)

	HBA1C	T.Cholestrol	HDL	LDL	TG	VLDL
Mean	5.08	157	49.3	86.0	114	228
S D	0.35	22.6	6.67	17.3	24.3	4.81

Diabetic with lipid profile (cases)

	HBA1C	T.Cholestrol	HDL	LDL	TG	VLDL
Mean	7.70	252	40.6	138	201.9	40.6
SD	1.95	34.3	10.47	25.5	96.9	19.4

Summary of Result

Investigation		Control	Cases
HBA1C Normal value 4%--5.6%	Mean	5.085	7.700
	S.D	0.351	1.954
	SEM	0.079	0.437
	t- value	5.92	
	P -value	<0.001	
Total cholesterol Normal value 125 to 200 mg/dl	Mean	157	252.9
	S.D	22.6	34.3
	SEM	5.07	7.69
	t-value	9.6051	
	P-value	<0.0001	
HDL cholesterol Normal values 40-60 mg/dl	Mean	40.30	9.60
	S.D	6.67	10.47
	SEM	1.49	2.34
	t-value	3.519	20
	P-value	<0.002	
LDL Normal values <100 mg/dl	Mean	86.0	138.4
	S.D	17.32	25.57
	SEM	3.87	5.72
	t-value	7.69	
	P-value	<0.0001	
Triglyceride TG Normal values <150 mg/dl	Mean	114.85	164
	S.D	24.3	31.07
	SEM	5.44	6.95
	t-value	4.87	
	P-value	<0.0001	
VLDL Normal values 2 to 30 mg/dl	Mean	22.8	40.6
	S.D	4.81	19.4
	SEM	1.07	4.37
	t-value	3.77	
	P-value	<0.0001	

III. Result

- In the present study the biochemical parameters like HBA1C, Total Cholesterol ,HDL, LDL,Triglycerides and VLDL were estimated in 20 controls and 20 cases in non-diabetic and diabetic cases respectively.

- 1.The mean and standard deviation of HBA1C in controls is 5.08 ± 0.35 as compared to 7.7 ±1.95 in cases. The difference is statististically significant as shown in chart.

- 2.The mean and standard deviation of total cholesterol in controls is 157 ± 22.6 as compared to 252 ± 34.3 in cases The difference is statistically significant as shown in chart.

- The mean and standard deviation of HDL in controls is 40.3 ±6.7 as compared to 49.6±10.47 in cases. The difference is statistically significant as shown in the chart.

- 4.The mean and standard deviation of LDL in controls is 86 ±17.3 as compared to 138 ± 25.5 in cases. The difference is statistically significant as shown in the chart.

- The mean and standard deviation of Triglycerides in controls is 114 ± 24.3 as compared to 164 ± 31.07 in cases. The difference is statistically significant as shown in chart.

- The mean and standard deviation of VLDL in controls is 22.8±4.81 as compared to 40.6 ±19.4 in cases. The difference is statistically significant as shown in the chart.

IV. Discussion

Elevated HBA1C in addition to dyslipidemia is regarded as independent risk factor for cardiovascular disease in subject with or without diabetes estimated risk of CVD has shown to be increased by 18% for each one person increase in absolute HBA1C levels in diabetes population.

The results of present study are discussed under two groups:

Control group:

- Total no of 20 subjects were study above the age of 40 years they were normotensive non diabetes with no comorbidities.
- The results of biochemical parameters HBA1C, total cholesterol, HDL, LDL, Triglyceride, VLDL with in normal limit

Case group:

- The total no. of 20 subjects were studied above the age of 40 years.
- They had history of hypertension and we're known diabetes.
- All the subjects showed an increase in HBA1C levels, total cholesterol, LDL, triglyceride and VLDL.
- Mean HBA1C level and mean value of lipid profile were deranged in our study, shows strong correlation with each other.
- Insulin resistance has a major role in pathogenic diabetes of dyslipidemia as there is evidence of increased release of free fatty acid from insulin resistant fat cells.
- The concentration of HBA1C predict diabetes complications such as retinopathy nephropathy.
- Estimated risk of cardiovascular disease has shown to be increased by 18% for each 1% increase in HBA1C value in diabetes population.
- Glycated hemoglobin is a routinely used marker for long term glycemic control.

V. Conclusion

- Thus, HBA1C monitors long term glycemic control in type 2 diabetes mellitus patients.
- Elevated HBA1C and dyslipidemia are independent risk factors of cardiovascular disease.
- There is a need for an education program for diabetes patients regarding blood sugar control and deleterious consequences of dyslipidemia.
- Increased physical activity and lifestyle modification seem to be associated with decreased HBA1C and better glycemic and lipid control.
- Thus, targeting to lower dyslipidemia is likely to reduce HBA1C not only in diabetes subjects but it will have equal effect in non-diabetes subjects.

- Improving glycemic control and timely intervention with stations can substantially reduce of delay the risk of those subjects especially who has higher HBA1C with dyslipidemia.

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