



## THYROID DISORDER AND HbA1C

### General Medicine

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### ABSTRACT

**Introducton/Background:** Thyroid disorder are commonly associated with Type 2 Diabetes mellitus (T2DM). Since HbA1c is the screening test for Diabetes, so this study was done to find out any co-relation between thyroid disorder and HbA1c and predict the value of it to diagnose a person as diabetic in the back ground of thyroid disorder.

**Objective:** To find out any co-relation between thyroid dysfunction and the value of HbA1C and to predict a co-relation of range of abnormality in diabetic patients.

**Material and Method:** This observational prospective study was conducted on 130 newly diagnosed diabetic patient's of age between 18years to 88years presenting to the OPD and IPD of Rohilkhand Medical College and Hospital Bareilly between November 2015 to October 2016. All patients of both genders underwent investigation of thyroid profile, blood glucose (F&PP) and HbA1C, screening after through clinical history and examination was done. Data was collected, computed and analyzed statistically.

**Results:** More than half of the patients ( 62.2%) with normal thyroid condition (euthyroidism) had HbA1c>8 while 40% patients with hyperthyroidism and 45.5% patients with hypothyroidism had HbA1c >8. Chi square test was applied to check the statistical relation of thyroid abnormality in diabetic patients with level of HbA1c. There was statistically significant relationship (p<0.05).

**Conclusion:** A significant number of diabetics (37.8% ) had thyroid dysfunction. The prevalence of hypothyroidism was more than hyperthyroidism. The value of HbA1c should be interpreted differently in patients having thyroid disorder in newly diagnosed diabetics in comparison with patients having no thyroid disorder. In this study it was found that patients having thyroid dysfunction in diabetes had higher HbA1c (>8) as comparing with the patients having same range of blood glucose without thyroid abnormality.

### KEYWORDS

HbA1c- Glycosylated Haemoglobin, T2DM- Type 2 Diabetes mellitus, OPD and IPD- Out Patient and In Patient, F & PP- Blood glucose Fasting and Post Prandial

### INTRODUCTION:

Diabetes mellitus is one of the modern pandemics and an important health problem worldwide and is on rising trend. Diabetes prevalence has been rising more rapidly in middle and low income countries.<sup>1</sup> The metabolic dysregulation associated with DM causes secondary pathophysiological changes in multiple organ systems that impose a tremendous burden on the individual with diabetes and on the health care system.<sup>2</sup> Glycosylated haemoglobin A1C is used commonly as a screening test for diabetes in clinical practice. It is a form of haemoglobin that is covalently bound to glucose.

Haemoglobin carries oxygen in the blood. When haemoglobin is exposed to glucose in the blood, they are bound together through the glycation process. HbA1c is a measure of the beta-N-1-deoxy fructosyl component of haemoglobin.<sup>3</sup> It is measured primarily to determine the three-month average blood glucose level and can be used as diagnostic test for non diabetics and as an assessment test for glycemic control in people with diabetes.<sup>4</sup> The test is limited to a three month average because the average life span of a red blood cell is around 120 days. Normal level of glucose produce a normal amount of glycated haemoglobin. As the average amount of plasma glucose increases, the fraction of glycated haemoglobin increases in a predictable way.

In diabetes higher amount of glycated haemoglobin, indicating poor control of blood glucose levels, have been associated with cardiovascular disease, nephropathy, neuropathy and retinopathy. Glycosylated haemoglobin can be altered in different conditions. Some observed that non diabetic patient with anemia showed elevated HbA1c so labeling any patient as diabetic (based on elevated HbA1c), first we should check for anemia.

Diabetic patients had a higher prevalence of thyroid disorders as compared with a normal population. Higher prevalence of thyroid disorders in patients of type2 diabetes mellitus were found more in females, elderly and patients with uncontrolled diabetes.<sup>5,9</sup> The rate of postpartum thyroiditis in diabetic patients were three times more than that of normal women.<sup>10</sup>

Thyroid hormone regulates the method by which the body uses energy.

It works by attaching to specific proteins termed as receptors that are present in cells throughout the human body. Therefore, thyroid hormone exerts wide range of changes in regulating the function of virtually every organ of the body, accordingly any changes in the blood level of thyroid hormone and can affect many body systems and cause a wide range of symptoms.<sup>11</sup>

The association between thyroid disorder and diabetes is of importance as thyroid disorder may have been having somewhere hidden & ignored abnormality of raised blood glucose. As ADA endorsed on HbA1C>6.5% is a diagnostic parameter for diabetes hence, this study was conducted to find out correlation between HbA1C and thyroid disorder.

### MATERIAL AND METHODS:

The study was conducted in 130 diabetic patients (newly discovered) age between 18-88years from OPD and IPD of Rohilkhand Medical College and Hospital, Bareilly between November 2015 to October 2016 after taken approval from institutional research and ethical committee. Through clinical history taken including any previous thyroid dysfunction, any other type of illness or any treatment taken in the form of drug along with general physical examination and through systemic examination was carried out. Acutely ill and already taking oral hypoglycemic medications were excluded from the study. All patients of both genders with informed consent enrolled in the study underwent biochemical investigations for thyroid profile, blood glucose (F&PP) and HbA1C. Screenings were carried out using proper aseptic precaution for collecting blood samples.

Determination of thyroid profile was done by Bene Sphere Avantor Elisa test kit for quantitative TSH (Thyroid stimulating hormone), T3(Tri-Iodothyronine) and T4(Thyroxin) by Erba Lisascan II. Determination of fasting plasma glucose and postprandial plasma glucose was estimated by Chem5 semiautoanalyzing commercially available based on GOD-POD (Glucose oxidase peroxidase method). Determination (Estimation) of HbA1C was done by Automated Analyser ERBA EM360 using commercially available kit particle enhanced immunoturbidimetric method.

The correlation of prevalence of thyroid disorder with gender and age

distribution, HbA1c was done. The observations, interpretation and results were statistically analyzed.

**RESULTS:**

Out of 130 patients, Hyperthyroidism was present in 12.8% male and 11% female. Where as hypothyroidism was present in 20.5% male and 27.5% female patients.(Table1)

**Table 1: Distribution of patients based on Thyroid condition and Gender**

Sr. no	Thyroid condition	Gender		
		Male (%)	Female (%)	Total (%)
1	No Deformity	26 (66.7)	56 (61.5)	82 (63.1)
2	Hyperthyroidism	5 (12.8)	10 (11.0)	15 (11.5)
3	Hypothyroidism	8 (20.5)	25 (27.5)	33 (25.4)
	Total	39(100)	91 (100)	130 (100)

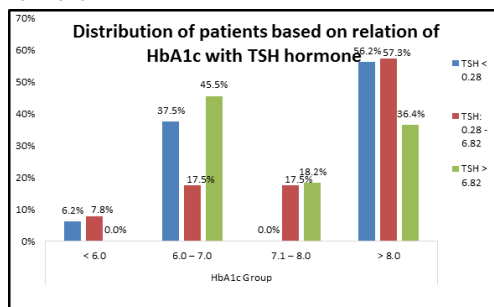
Chi square test = 0.714; df = 2; p value = 0.700

Around two third(66.6%) of hyperthyroid patients were belonging to 51-70 years of age and only 20% were in 41 -50 years of age with more than one fourth (30.3%) of Hypothyroidism condition between 41- 50 years of age followed by 31-40 years(21.2%), 51-60 years(21,2%) and 61-70 years(21.2%).( table 2)

**Table 2: Age wise distribution of patients based on Thyroid gland Condition**

Sr. no	Age groups (Years)	Thyroid Condition			Total (%)
		No deformity (%)	Hyperthyroidism (%)	Hypothyroidism (%)	
1	< 30	10 (12.2)	1 (6.7)	1 (3.0)	12 (9.2)
2	31 – 40	18 (22.0)	1 (6.7)	7 (21.2)	26 (20.0)
3	41 – 50	25 (30.5)	3 (20.0)	10 (30.3)	38 (29.2)
4	51 – 60	20 (24.4)	5 (33.3)	7 (21.2)	32 (24.6)
5	61 – 70	8 (9.8)	5 (33.3)	7 (21.2)	20 (15.4)
6	71 – 80	0	0	1 (3.0)	1 (0.8)
7	> 80	1 (1.2)	0	0	1 (0.8)
	Total	82(100)	15 (100)	33 (100)	130 (100)

**Fig. no 1: Distribution of patients based on relation of HbA1c with TSH hormone**



62.2% of euthyroid patients, 40% of hyperthyroid and 45.5% of hypothyroid patients were having HbA1c >8%. (Table 3)

**Table 3 : Distribution of patients based on relation of Thyroid gland Condition with HbA1c level**

Sr. no	HbA1c level	Thyroid Condition			Total (%)
		No deformity (%)	Hyperthyroidism (%)	Hypothyroidism (%)	
1	< 6.0	4 (04.9)	1 (06.7)	4 (12.1)	9 (06.9)
2	6.0 – 7.0	12 (14.6)	8 (53.3)	9 (27.3)	29 (22.3)
3	7.1 – 8.0	15 (18.3)	0	5 (15.2)	20 (15.4)
4	> 8.0	51 (62.2)	6 (40.0)	15 (45.5)	72 (55.4)
	Total	82 (100)	15 (100)	33 (100)	130 (100)

Chi square test = 15.461; do = 6; p value = 0.017

HbA1c level and Co-relation with Fasting and Post-Prandial blood glucose (number of patients having poor and good glycaemic control) (Table 4)

**Table 4. Co-relation of Glycemic Control with HbA1c**

Sr. HbA1c level	Fasting Blood glucose		Post Prandial Blood glucose	
	Poor Glycemic Control	Good Glycemic Control	Poor Glycemic Control	Good Glycemic Control
8				

1	< 6.0	7	2	8	1
2	6.0 – 7.0	26	3	26	3
3	7.1 – 8.0	20	0	20	0
4	> 8.0	72	0	72	0

**DISCUSSION:**

In the present study of 130 patients, 48 patients (37.8%) had thyroid dysfunction and 82 patients (62.2%) i.e. more than half were found to be Euthyroid. While Palma et al<sup>15</sup> found lower prevalence of thyroid dysfunction in all diabetic patients. A recent study done in Manipur had found higher prevalence of thyroid dysfunction (31.2%) in T2DM.<sup>12</sup>

Shanmugham et al<sup>13</sup> had found 21.5% prevalence of thyroid dysfunction in all diabetic patients (40 out of 186 diabetic patients) in Coimbatore. Out of 120 diabetic subjects recruited in the study of Uppal et al<sup>14</sup>, 17% (n=17) had hypothyroidism and 7.5% (n=9) had hyperthyroidism. Thus total 24.5% patients showed thyroid disorder.

In the present study the prevalence of hypothyroidism was present more in females than males (27.5% in females and 20.5% in males) while hyperthyroidism was present more in males (12.8%) than females (11%). Chi square test was applied to check the relationship of thyroid condition with gender but there was no statically significant relation (p>0.05) at par with Shanmugam et al.<sup>13</sup>

Around two third i.e. 66.6% of hyperthyroid condition belong to 51-70 years of age and only 20% were in 41-50 years age group, while in hypothyroid one fourth (30.3%) of patients were in 41-50 years age group followed by 31-40 years(21.2%),51-60 years (21.2%) and 61-70 years (21.2%).

Hypothyroidism patients (55.4%) and hyperthyroidism patients (40%) which had good glycaemic control but HbA1c >8 while more than half (62.2%) patients were with normal thyroid condition had poor glycaemic control (HbA1c >8). Chi square test was applied and was found that there is statistically significant relationship ( P<0.05). Khurana et al<sup>8</sup> had seen thyroid disorders were more common in patients with HbA1c values>7 in uncontrolled diabetes.

Limitation of the study was that the sample size was small and more studies are required with the large sample. Study was selection biased as it was conducted in a hospital, due to limited resources and time constrains a general population based study was not possible. The study cannot be extrapolated on the general population.

**CONCLUSION:**

A significant number of diabetics (37.8%) had thyroid dysfunction. The prevalence of hypothyroidism was more than hyperthyroidism. This study found that patients having good blood glucose control with thyroid dysfunction had HbA1c > 8% , so one cannot depend only on HbA1c as a marker to label patient as uncontrolled diabetes in patients having associated thyroid disorder. The value of HbA1c should be interpreted differently in patients having thyroid disorder in newly diagnosed diabetics in comparison with patients having no thyroid disorder. So the conclusion is that the patients having thyroid dysfunction along with diabetes had higher HbA1c>8 as comparing with the patients having same range of blood glucose without thyroid abnormality.

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