

# Correlation between Hypothyroidism and Type 2 Diabetes Mellitus

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## ABSTRACT

### Introduction

Hypothyroidism is the most common thyroid disorder in India with prevalence of 10.95%. Type 2 Diabetes (T2DM) is the most common endocrine disorder with prevalence of 8.9%<sup>2</sup> in India. Studies showed that there is a prevalence of T2DM in hypothyroidism. We considered FBS (Fasting blood sugar) and HbA1c (Glycated hemoglobin) to diagnose diabetes in our study as per to American diabetes association. The aim is to assess the incidence of T2DM in biochemically proven hypothyroidism.

### Materials and Methods

50 patients of either sex between the ages 18-60 years, who are biochemically proven newly diagnosed case of hypothyroidism, are taken for the study. A detailed clinical history of the patient including history of presenting complaints, past history and other relevant history is taken. A detailed general examination, systemic examination and ENT examination is done. Patients underwent screening for T2DM using FBS and HbA1c as per American diabetes association. This is used to calculate the incidence of T2DM in biochemically proven hypothyroidism.

### Results

The number of cases diagnosed as diabetic is, 13 (26.0%) cases with high FBS (fasting blood sugar) and 16 (32.0%) cases with uncontrolled HbA1c values. Showing a total of 16 cases among the 50 cases of hypothyroidism found as newly diagnosed diabetes, showing a prevalence of 32% among the study group.

### Conclusion

Our study agrees with the various studies showing a similar relationship between hypothyroidism and T2DM. As such we would also like to propose that in cases of hypothyroidism, T2DM to be evaluated for as well for early detection and management.

### Keywords

Diabetes Mellitus; Hypothyroidism; Thyroid Dysfunction

Hypothyroidism is the most common form of thyroid disorder in India with prevalence of 10.95% that present in ENT OPD.<sup>1</sup> Diabetes is the most common endocrine disorder with prevalence of 8.9% in India.<sup>2</sup> In India around 7 million individuals were found to be having diabetes and constitute second greatest number of individuals with diabetes worldwide. The role of hyperthyroidism in diabetes was investigated in 1927, by Collier and Huggins proving the association of hyperthyroidism and worsening of diabetes.<sup>3</sup>

Thyroid hormones have been proven to have a significant role in the carbohydrate metabolism as well as pancreatic function. And similarly diabetes has also shown to effect thyroid function to varying degrees.<sup>4</sup>

Hypothyroidism and subclinical hypothyroidism are more prevalent in patients with T2DM, and it is possible that hypothyroidism is a risk factor for the development of T2DM reduction of glucose-stimulated insulin secretion after the restoration of thyroid function has been shown in patients with hypothyroidism as well as in those with subclinical hypothyroidism.<sup>5</sup>

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Various studies have pointed to a complex intertwining biochemical, genetic, and hormonal malfunctions mirroring this pathophysiological association.<sup>3</sup> 5' adenosine monophosphate activated protein kinase (AMPK) is a central target for modulation of insulin sensitivity and feedback of thyroid hormones associated with appetite and energy expenditure.<sup>3</sup>

A meta-analysis reported a frequency of 11% in thyroid dysfunction in the patients of T2DM. Autoimmunity has been implicated to be the major cause of thyroid-dysfunction associated T2DM. And the prevalence of T2DM among hypothyroid patients is also found to be 7.01%.<sup>4</sup>

All of this shows a probable inter-relationship between hypothyroidism and T2DM. With most of the studies done in a non Indian population, there is a need to find any such correlations in the Indian population where both these diseases are quite prevalent, hence this study assumes significance.

## Materials and methods

50 patients of either sex in age group of 18 to 60 years attending ENT OPD are selected at a teaching hospital in Davanagere, Karnataka. 50 Patients who presented in ENT OPD that fulfilled all inclusion criteria and exclusion

criteria, diagnosed as new cases of hypothyroidism were selected and tested for T2DM.

Diagnosis of hypothyroidism was done by conducting a thyroid function test, of which we had considered TSH > 4.5mIU/ml as the main indicator.<sup>6</sup> Free T3 and Free T4 were not used in this study as per most of review of literature and studies done on thyroid and its functions; there is no final consensus on if Free T3 and FreeT4 are superior to TFT as both are found to be accurate. According to some studies Free T3 and Free T4 may vary in asymptomatic liver diseases. By comparing free T3, Free T4 and TSH, TSH is more reliable and sensitive marker.<sup>6,7</sup> Taking this also into consideration instead of FreeT3 and Free T4 we have thus used TSH as a slightly more reliable marker to thyroid function tests in this study.

All patients who are suffering from biochemically proven hypothyroidism are taken for the study. A detailed clinical history of the patient including history of presenting complaints, past history of same illness and other relevant history is taken. A detailed general examination, systemic examination and ENT examination is done. Patients underwent screening for T2DM. FBS and HbA1C are currently used diagnostic criteria to diagnose T2DM as per American diabetes association for the study of diabetes (Fig. 1).<sup>8</sup> This data was then used to find the incidence of T2DM in biochemically proven hypothyroidism.

Test <sup>a</sup>	Threshold	Qualifier
Hemoglobin A <sub>1c</sub> or	≥ 6.5%	Lab NGSP-certified, standardized DCCT assay
Fasting glucose or	≥ 126 mg/dL (7.0 mmol/L)	No caloric intake for at least 8 hours
2-hour glucose or	≥ 200 mg/dL (11.1 mmol/L)	After 75 g of anhydrous glucose
Random glucose	≥ 200 mg/dL (11.1 mmol/L)	Plus classic hyperglycemia symptoms or crisis
NGSP, National Glycohemoglobin Standardization Program; DCCT, Diabetes Control and Complications Trial. <sup>a</sup> Results must be confirmed by repeated testing.		

Fig. 1. American diabetes association criteria for diagnosis of T2DM<sup>8</sup>

The study is a cross sectional descriptive study conducted between June 2022 and November 2022. Both sexes are considered. Patient with other co-morbid conditions, previously diagnosed case of T2DM or hypothyroidism and/or family history of other co morbidities were excluded from the study.

## Results

Of the selected 50 patients, 44 (88.0%) were females and 6 (12%) were males which corresponds with the normal female preponderance for hypothyroidism. The ages ranged from 18 years being the youngest and 68 years being the oldest with a mean age of  $39.24 \pm 12.86$

years. The most common age group was found to lie within the age group 31-40 years (Figure 2).

The number of cases that are diagnosed as diabetic as per the criteria put forward by the American diabetes association is as follows, 13 (26.0%) cases with high FBS (fasting blood sugar) and 16 (32.0%) cases with uncontrolled HbA1C values as shown in table I and table II respectively.

This shows a total of 16 cases among the 50 cases of hypothyroidism selected as newly diagnosed cases of diabetes, showing a prevalence of 32% among the study group. This result might be higher than compared to other studies due to the smaller study group and the focused nature of the study.

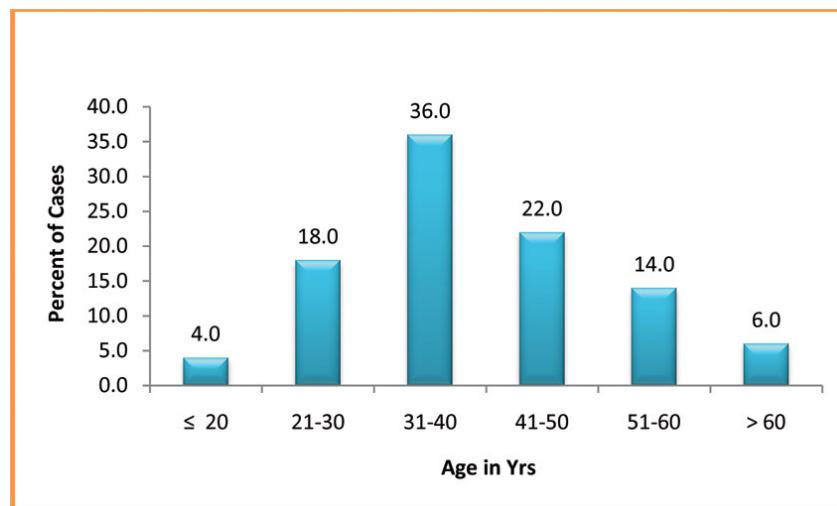


Fig. 2. Age distribution

Table I : Hypothyroidism cases with altered FBS Values

TFT	DM	N	MEAN	STD. DEVIATION	MANN-WHITNEY U P VALUE
T3	Present	13	49.20	52.20	0.972
	Absent	37	35.59	51.40	
T4	Present	13	10.46	2.34	0.181
	Absent	37	9.61	3.46	
TSH	Present	13	7.95	12.79	0.842
	Absent	37	11.30	22.75	

**Table II: Hypothyroidism cases with altered HbA1C Values**

TFT	HbA1C	N	MEAN	STD. DEVIATION	MANN-WHITNEY U P VALUE
T3	Poor Control	16	46.75	51.67	0.957
	Normal	34	35.47	51.66	
T4	Poor Control	16	9.40	2.69	0.625
	Normal	34	10.00	3.45	
TSH	Poor Control	16	8.14	11.63	0.448
	Normal	16	11.51	23.71	

## Discussion

Hypothyroidism is the most common form of thyroid disorder in India with prevalence of 10.95% that present in ENT OPD.<sup>1</sup> Diabetes is the most common endocrine disorder with prevalence of 8.9% in India.<sup>2</sup> In India around 7 million individuals were found to be having diabetes and constitute second greatest number of individuals with diabetes worldwide. The role of hyperthyroidism in diabetes was investigated in 1927, by Collier and Huggins proving the association of hyperthyroidism and worsening of diabetes.<sup>3</sup>

Thyroid hormones have been proven to have a significant role in the carbohydrate metabolism as well as pancreatic function. And similarly diabetes has also shown to effect thyroid function to varying degrees.<sup>4</sup>

Hypothyroidism and subclinical hypothyroidism are more prevalent in patients with T2DM, and it is possible that hypothyroidism is a risk factor for the development of T2DM, as reduction of glucose-stimulated insulin secretion after the restoration of thyroid function has been shown in patients with hypothyroidism as well as in those with subclinical hypothyroidism.<sup>5</sup>

J. J. Díez et al<sup>9</sup> conducted a study by screening of all patients with T2DM for thyroid disorders. Which shows new cases of thyroid dysfunction in patients suffering

from T2DM, indicating there is correlation between thyroid dysfunction and T2DM.

Ali Fatourechi et al<sup>10</sup> studied children with T2DM and hypothyroidism had significantly higher rates of anti TPO antibodies. Autoimmune hypothyroidism is prevalent among children with T2DM and is associated with more aggressive disease at initial presentation poorly controlled T2DM.

Dr Chandrashekhar H R et al<sup>4</sup> showed that thyroid hormone disorders both hypothyroidism and hyperthyroidism is associated with T2DM in a study done on OPD basis by evaluating GRBS and thyroid function test, which shows prevalence of T2DM is more in hyperthyroidism patient compared to hypothyroidism.

Chaoxun Wang<sup>3</sup> shows the contribution of abnormalities of thyroid hormone in type 2 DM, the mechanism behind this lead to perturbed genetic expression of a constellation of genes leads to impaired glucose utilization and disposal in muscles, overproduction of hepatic glucose output, and increased absorption of splanchnic glucose, and also insulin resistance.

Guillermo E et al<sup>11</sup> confirm the association between autoimmune thyroid dysfunction and type 1 diabetes, and proposed that all subject with type 1 diabetes undergo annual screening of serum TSH particularly those with positive TPO antibodies.

## Conclusion

In our study the incidence of diabetes among the cases of hypothyroidism selected, 16 (32.0%) cases were found to be newly diagnosed cases of T2DM as per the diagnostic criteria by American diabetes association. This is in agreement to the various studies showing a similar relationship between hypothyroidism and T2DM. The higher incidence in our study as compared to other studies could be due to the smaller sample size and the focused nature of the participants considered. Regardless, there seems to be a definite strong relationship between the two with one affecting the status of the other.

As such we would also like to propose that in cases of hypothyroidism, the patients need to be evaluated for T2DM as well for early detection and management to reduce the burden of the disease on the individual.

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