

## RESEARCH ARTICLE

### Association of hypothyroidism and type 2 diabetes in patients attending tertiary care hospital of Pune City

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#### ABSTRACT

**Background:** Diabetes mellitus (DM) is a group of metabolic disorders which is characterized by hyperglycemia. Hypothyroidism is a pathological state resulting from deficiency of thyroid hormone. Both hypothyroidism and DM affect the cellular metabolism in an adverse way. It is of paramount importance to detect the interplay between these two conditions. **Aims and Objectives:** This study aims to evaluate the serum T3, T4, thyroid-stimulating hormone (TSH), and glycosylated hemoglobin (HbA1c) levels of type 2 DM patients and to correlate the association of hypothyroidism and type 2 DM. **Materials and Methods:** The study is a cross-sectional observational study. The study population consists of 100 patients (50 males and 50 females) diagnosed with type 2 diabetes. Data of HbA1c levels and serum T3, T4, and TSH levels were collected and values were correlated in percentages. **Results:** Hypothyroidism was detected in 11 patients of 100 type 2 diabetic patients. In the age group of <60 years (64%) and >60 years of age, 36% of patients were hypothyroid. Of 50 male diabetics, three were hypothyroid, and in a group of 50 females, eight were hypothyroid. In poorly controlled diabetic patients, eight had subclinical hypothyroidism, and in controlled diabetic patients, one patient had overt hypothyroidism and two had subclinical hypothyroidism. **Conclusion:** Hypothyroidism, particularly subclinical variety, is seen in type 2 diabetic patients. Therefore, routine screening is advised.


**KEY WORDS:** Diabetes Mellitus; Hypothyroidism; Glycosylated Hemoglobin; Thyroid Function Tests

#### INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic disorders which is characterized by hyperglycemia. It may result from either defects in insulin secretion or insulin action or both. The worldwide prevalence of diabetes is estimated to be 366 million people worldwide.<sup>[1]</sup> India often termed as the capital of DM, accounting for 1/6<sup>th</sup> of the cases.<sup>[2]</sup> DM and its complications are a major cause of premature mortality and morbidity due to its complications.

DM and thyroid disorders are common endocrinopathies which influence glucose control. Excess of thyroid hormone is associated with insulin resistance and deterioration of glucose control. Hypothyroidism is a pathological state resulting from deficiency of thyroid hormone. It adversely affects sugar control in a diabetic patient. It is related to decreased rate of the production of liver glucose and reduced insulin requirement. Hypoglycemic episodes are common in hypothyroid diabetic subjects.<sup>[3]</sup>

Hypothyroidism and DM both are common endocrine disorders. On one side, thyroid function contributes to the regulation of carbohydrate metabolism, and on the other side, diabetes affects thyroid functioning to some extents. There has been, however, no uniformity for the same. The prevalence of hypothyroidism in diabetics ranges from 4% to 13% in worldwide studies.<sup>[4,5]</sup> Only few researchers have reported around 31% hypothyroid cases.<sup>[6]</sup> Both hypothyroidism and DM adversely affect the cellular function. It is of paramount importance to detect the

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interplay between these two conditions to find out their effects on each other. The basis of this association will be invaluable for clinicians as they are often challenged by overlapping entities such as obesity in their practice.

Glycosylated hemoglobin (HbA1c) level is the most accurate measure which is associated with glycemic control of 3-month period. T3, T4, and thyroid-stimulating hormone (TSH) levels help to diagnose hypothyroidism and also give a clue about its cause.

Hence, the objectives of the study were to evaluate serum T3, T4, TSH, and HbA1c levels of type 2 DM patients and to correlate association of hypothyroidism and type 2 DM.

## MATERIALS AND METHODS

The study is a cross-sectional observational study. The study population consists of 100 patients (50 males and 50 females) diagnosed with type 2 diabetes who have attended the outpatient department and inpatient department of tertiary care hospital during the study period. All patients aged 30 years and above with the duration of DM >1 year were included in the study. After ethical committee approval, a written consent was obtained. Patients with secondary diabetes, type 1 diabetes, and a known history of thyroid dysfunction were excluded from the study.

HbA1c levels were estimated using high-performance chromatography method (BIORAD D-10) and serum T3, T4, and TSH were estimated using chemiluminescence microparticle immunoassay (Abbott ARCHITECT i1000SR) method.

Diabetic patients were classified into two groups as per their glycemic index: Group 1 - controlled diabetic subjects (HbA1c <7%) and Group-2 poorly controlled diabetic subjects (HbA1c  $\geq$ 7%).<sup>[7]</sup>

The results of serum T3, T4, and TSH were analyzed as:

Normal values:

T3: 0.58–1.59 ng/ml

T4: 4.87–11.27  $\mu$ g/dl

TSH: 0.40–4.00  $\mu$ IU/ml

Patients were labeled as subclinical hypothyroidism if:

T3: 0.58–1.59 ng/ml

T4: 4.87–11.27  $\mu$ g/dl

TSH > 4.00  $\mu$ IU/ml

Patients were labeled as clinical hypothyroidism if:

T3 < 0.58 ng/ml

T4 < 4.87  $\mu$ g/dl

TSH > 4.00  $\mu$ IU/ml

## Statistical Analysis

All parameters were analyzed in percentages.

## RESULTS

A total of 100 patients (50 males and 50 females) diagnosed with type 2 diabetes were assessed. Hypothyroidism was detected in 11 patients.

The age and sex distribution of diabetic patients with clinical hypothyroidism and subclinical hypothyroidism are shown in Table 1. Maximum number of type 2 DM patients with overt or subclinical hypothyroidism belong to the age group of <60 years (64%) and >60 years of age, 36% of patients are hypothyroid. In all 50 male diabetics, three were hypothyroid, and in a group of 50 females, eight were hypothyroid.

Subclinical hypothyroidism patients include three males and seven females, whereas overt hypothyroidism patients include one female and no male.

Patients in the study were divided into two groups based on the glycemic control.

Twenty-five patients had HbA1c levels <7%, of which two had subclinical hypothyroidism and one patient had overt hypothyroidism. Of 75 patients with HbA1c levels >7%, all eight patients had subclinical hypothyroidism.

## DISCUSSION

In this study, of 100 type 2 diabetic patients, hypothyroidism was found in 11 patients. As shown in Table 1, maximum number of type 2 diabetics with hypothyroidism belong to the age group of <60 years (64%) that too more patients were of subclinical hypothyroidism and >60 years of age, 36% of patients were hypothyroid. Of 50 male diabetics, three were hypothyroid, and in a group of 50 female diabetics, eight were hypothyroid. Subclinical hypothyroidism was seen in seven females and three males.

The coexistence of type 2 DM with thyroid disorders is also shown by other researchers. Prasad *et al.* have concluded that the prevalence of thyroid dysfunction in type 2 DM patients was found to be 26.5% whereas 9% in healthy controls.<sup>[8]</sup>

Thyroid function done in 296 type 2 diabetics in which 10.7% suffered from hypothyroidism and out of them >2/3<sup>rd</sup> were of subclinical hypothyroidism.<sup>[9]</sup> It was found that hypothyroidism is more prevalent among females and elderly. Other researchers have reported similar findings.<sup>[10,11]</sup>

In the present study, majority of the patients with overt or subclinical hypothyroidism had HbA1c levels >7% (very poorly controlled DM) as per Table 2. This suggests the increased prevalence of hypothyroidism in poorly managed type 2 DM patients. Ashok khurana *et al.* have concluded that subclinical hypothyroidism was most common (7.5%) and that to more in females, elderly patients, and patients with uncontrolled diabetes, i.e., HbA1C values  $\geq$ 7.<sup>[7]</sup>

**Table 1:** Age and sex distribution of diabetic patients with clinical and subclinical hypothyroidism

Characteristics	Overt hypothyroidism	Subclinical hypothyroidism	Total number of patients (%)
Age <60	1	6	7 (64)
Age >60	0	4	4 (36)
Male (n=50)	0	3	3 (27)
Female (n=50)	1	7	8 (73)

**Table 2:** Comparison of hypothyroidism in controlled and uncontrolled type 2 DM

HbA1c	Total (%)	Overt hypothyroidism	Subclinical hypothyroidism
Poorly controlled DM (n=75)	8 (72)	0	8
Controlled DM (n=25)	3 (27)	1	2

DM: Diabetes mellitus, HbA1c: Glycosylated hemoglobin

In the study was done by Mishra *et al.*,<sup>[11]</sup> hypothyroidism was seen in 8 (16%) patients, five of them having subclinical hypothyroidism and three patients with overt hypothyroidism. The mean HbA1c level in diabetics with thyroid dysfunction was ( $10.33 \pm 2.37$ ) higher than those of euthyroid ones ( $7.16 \pm 1.04$ ). This highlights the need of routine screening of the diabetic patients for thyroid function.

DM appears to influence thyroid function in two ways; either at the level of hypothalamic control of TSH release or the conversion of T4 to T3 in the peripheral tissue.<sup>[5]</sup> Hypothyroidism is also linked to metabolic syndrome. Thus, DM and hypothyroidism both are interdependent. Abnormal thyroid hormone levels may lead to poor management in diabetic patients. Complications such as nephropathy and retinopathy are observed more in diabetic patients with hypothyroidism.<sup>[4,12]</sup> Subclinical hypothyroidism which is more prevalent in diabetics cases is difficult to diagnose clinically, and therefore, periodic evaluation of the patients can avoid further complications.

## CONCLUSION

Routine screening of thyroid function in diabetics or screening of hypothyroid patients for diabetes may help in identifying at-risk patient and to avoid further complications. Limitations of our study were as follows: Sample size was small and the study population was diabetes patients from hospital setting.

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