



# Application of Radioimmunoassay Technology for the Detection of Thyroid Disorder Among Diabetic Patients

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## ABSTRACT

Over 200 million people worldwide are affected by type 2 diabetes mellitus (DM), according to research Sub-clinical hypothyroidism in diabetic individuals has been linked to an increased risk of cardiovascular disease and nephropathy. The aim of this study is to assess thyroid dysfunction in hypoglycemic patients with type 2 diabetes through comprehensive evaluation of thyroid hormone profiles using radioimmunoassay technology. This study divided in two groups firstly carried 40 patients with type 2 diabetes mellitus were included in this study age range (40-60) years, a full clinical estimation was applied for all patients including physical examinations, and history of disease. Second group involved 40 healthy volunteers age range (40-60) years included in this present study as control.. All the patients were euthyroid, and there are no clinically significant cases of hypothyroidism or hyperthyroidism. The mean of total and free tri-iodothyroxine levels was significantly lower in patients with type 2 DM ( $1.19 \pm 0.292$ ,  $3.24 \pm 1.13$ , respectively) than in the control group ( $1.58 \pm 0.33$ ,  $4.73 \pm 0.99$ , respectively), and the difference was statistically significant ( $p < 0.003$ ,  $p < 0.001$ , respectively), while total and free thyroxine and thyrotropin showed no statistically significant difference. Thyroid hormone abnormalities are common in DM type 2 patients, euthyroid was more common among patients with hypoglycemia than hyperthyroidism and hypothyroidism, So, regular screening for thyroid hormone abnormalities in DM2 will allow early treatment of subclinical thyroid abnormalities.

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## 1. INTRODUCTION

Well over 200 million persons worldwide suffer from type 2 diabetes mellitus (DM). This disorder is characterized by peripheral insulin resistance (IR) and impaired insulin secretion due to dysfunction of pancreatic beta cells. [1]. Type 2 DM results from interface among genetic, environmental and behavioral risk factors [2]. People living with type 2 DM are more exposed to several complications, typically result in early death. This tendency of rise mortality and morbidity [3]. The first studies were published in 1979, which indicates the relationship between DM and thyroid disorders (TD) [4]. The two most typical endocrinopathies that affect adults are diabetic mellitus and thyroid diseases. Due to their intimate involvement in cellular metabolism, an increase or reduction of any insulin or thyroid hormone can cause functional problems for the other [5]-[6]. Sometime, diabetes is associated with other endocrine problems such as aberrant thyroid hormone levels [7]. The symptoms of hypothyroidism are frequently present in patients with diabetes mellitus type 2 (DM2), whereas signs from hyperthyroidism have been reported in patients with diabetes type 1, suggesting that diabetes and thyroid diseases may frequently occur in patients [8]. Thyroid hormone changes, particularly in patients with uncontrolled DM, have been identified in DM patients, decrease T3 concentration has been found in uncontrolled DM patients [9]-[10]. According to research sub-clinical hypothyroidism in diabetic individuals has been linked to an increased risk of cardiovascular disease and nephropathy [11]-[12].

Micro-angiopathic complications of diabetes such neuropathy and retinopathy can worsen in the presence of co-existing hypothyroidism due to dyslipidemia. Screening for thyroid abnormalities in diabetic patients will allow early treatment of sub-clinical and overt thyroid dysfunction. This study's aim is to identify thyroid dysfunction in patients with hypoglycemia by evaluating thyroid hormones in DM type 2. All these hormones will be evaluated over the sections in the article. In section 1, Subjects and Methods, the patients and healthy individuals and also the methods used to estimate the thyroid hormones and statistical analysis of data occurred. The second section includes results and information on the significant differences of thyroid hormones between the study groups. The third section includes discussing the results of the study and comparing them with the results of previous studies.

## 2. METHOD

This study was conducted over a period of six months, from January 1 to July 1, 2025, and involved participants aged between 40 and 60 years. The study population was divided into two groups. The first group consisted of patients diagnosed with type 2 diabetes mellitus (DM2), while the second group included 40 apparently healthy volunteers who served as the control group and were matched for age and sex with the diabetic patients. All individuals in the DM2 group underwent a comprehensive clinical evaluation prior to inclusion in the study. This evaluation included a detailed medical history, with particular attention to the duration and management of diabetes, as well as any associated complications. In addition, a thorough physical examination was performed for each patient. Only those patients who had no prior history or clinical evidence of thyroid dysfunction were selected for further biochemical analysis, in order to minimize confounding factors and ensure the reliability of the results.

Fasting venous blood samples were collected from all participants after an overnight fasting period of 8–12 hours. Blood samples were obtained by standard venipuncture techniques under aseptic conditions. The collected samples were then centrifuged at 1000 revolutions per minute for 20 minutes to separate the serum. Serum glucose levels were measured using the glucose oxidase (GOD) method shortly after sample collection to ensure accuracy and prevent metabolic changes. Assessment of thyroid function was carried out by measuring serum levels of thyroid hormones using a standard radioimmunoassay technique (MiniVidas system), which is a sensitive and reliable method for hormone quantification. The parameters analyzed included total and free triiodothyronine (T3), total and free thyroxine (T4), and thyroid-stimulating hormone (TSH). All collected data were systematically recorded and subjected to statistical analysis using the Statistical Package for Social Sciences (SPSS), version 20 for Windows. Results were expressed as mean  $\pm$  standard deviation. The Student's t-test was applied to determine the statistical significance of differences between the diabetic and control groups, with a p-value of less than 0.05 considered statistically significant.

## 3. RESULTS

The results presented here are based on analysis of 40 patients with type 2 DM (20 male and 20 female). All the patients were euthyroid, and there are no clinically significant differences in hypothyroidism and hyperthyroidism. The mean of fasting blood sugar was higher in patients with Type 2 DM ( $17.50 \pm 11.37$ ) than in the control group ( $5.23 \pm 0.85$ ), and the difference was statistically significant ( $p < 0.000$ ) (Figure 1). The mean of TT3 and fT3 levels was significantly lower in patients with Type 2 DM ( $1.19 \pm 0.292$ ,  $3.24 \pm 1.13$ , respectively) than in the control group ( $1.58 \pm 0.33$ ,  $4.73 \pm 0.99$ , respectively), and the difference was statistically significant ( $p < 0.003$ ,  $p < 0.001$ , respectively) (Figure 2). TT4, fT4, and TSH showed a difference that was statistically significant, as shown in the table 1 below.

**Table 1 .** Fasting blood sugar, and thyroid hormones of patients with diabetic type 2 and control groups.

Parameters	Control Mean $\pm$ SD	Diabetic type2 Mean $\pm$ SD
Number	40	40
Fasting blood sugar	$5.23 \pm 0.85$	$17.50 \pm 11.37^{***}$
Thyroxine (TT4)	$88.04 \pm 13.52$	$96.87 \pm 34.14$
Free Thyroxine (fT4)	$17.85 \pm 2.31$	$14.02 \pm 3.225$
Tri-iodothyroxine (TT3)	$1.58 \pm 0.33$	$1.19 \pm 0.29^{***}$
Free Tri-iodothyroxine (fT3)	$4.73 \pm 0.99$	$3.24 \pm 1.13^{**}$
Thyrotropin (TSH)	$1.28 \pm 0.60$	$1.84 \pm 0.90$
SD, Standard division, $^{**}P < 0.01$ , $^{***}P < 0.001$		

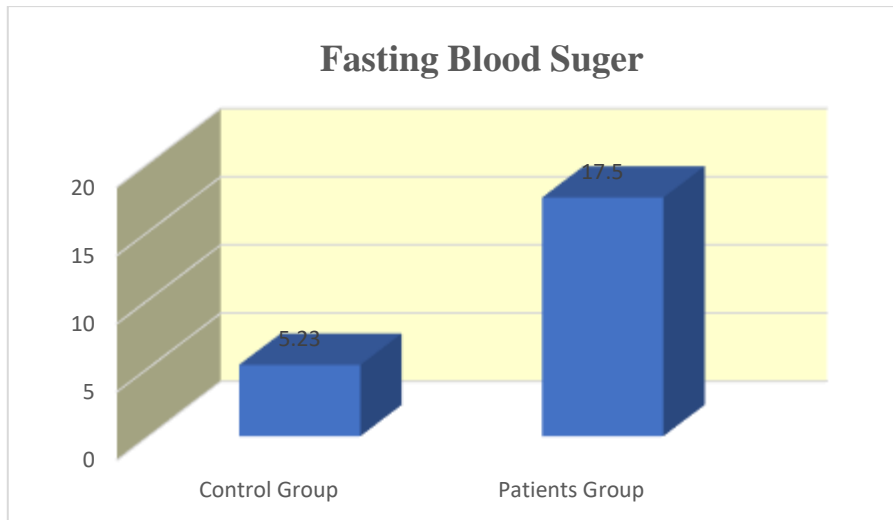


Figure: (1) Fasting Blood Sugar in study groups

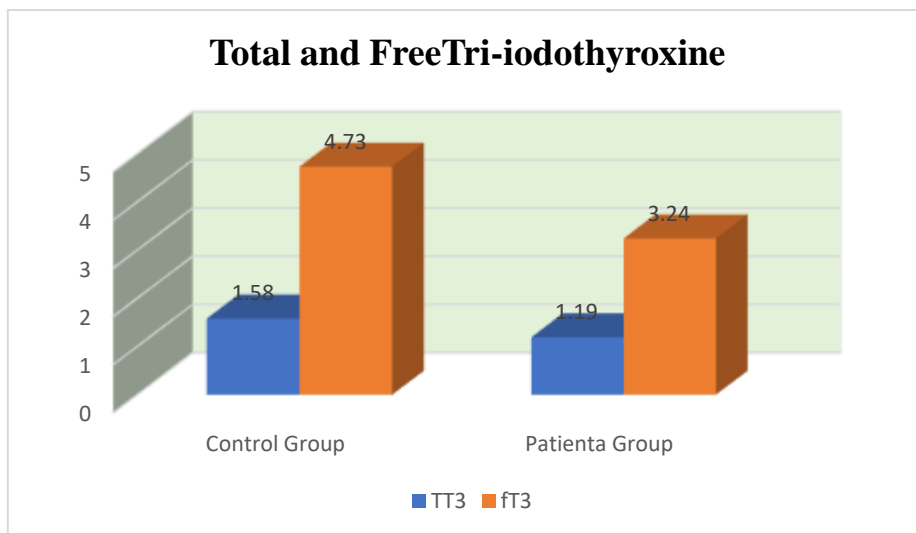


Figure (2) Total and Free Tri-iodothyroxine in study groups

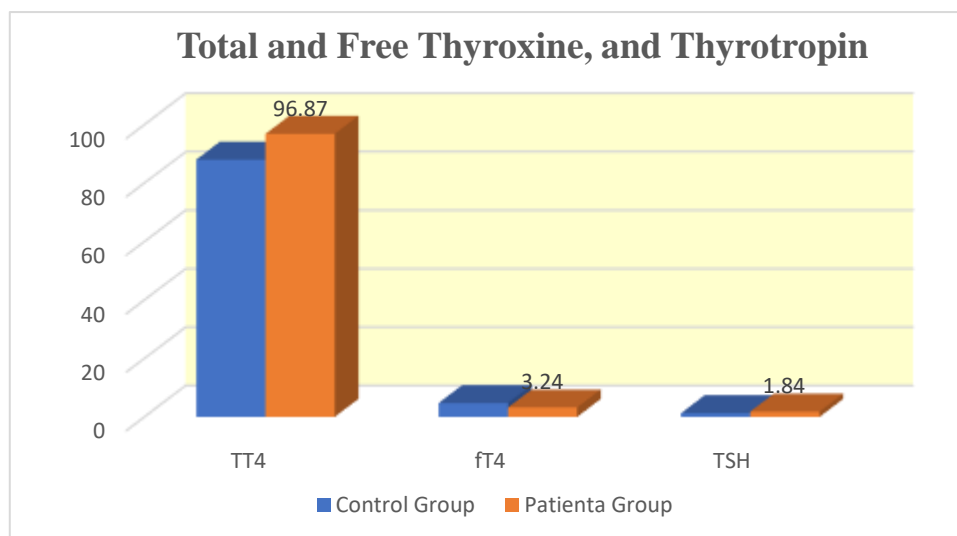


Figure (3) Total and Free thyroxine and Thyrotropin in study groups

#### 4. DISCUSSION

Thyroid conditions are very common in the general population [13]-[14]. Clinically, the two most prevalent endocrine illnesses are thyroid disease and diabetes mellitus. Thyroid issues and diabetes have been found to interact, and there has long been researching linking the two ailments [14]-[16]. In our study, we found all patients were euthyroid and there are no clinically significant in hypothyroidism and hypothyroidism. but the level of fT3 and TT3 decreased significantly in patients with DM type 2 when compared with control groups. Many research have assessed the incidence of TD between DM patients, Singh et al. reported a significant decrease in fT4, TT4, fT3, and TT3 levels, accompanied by an increase in TSH levels, when compared with healthy individuals. Among the 80 patients with diabetes mellitus (DM) included in the study, 30% exhibited thyroid hormone (TH) abnormalities: 6.25% were diagnosed with hyperthyroidism, while 23.75% had hypothyroidism [17]. According to studies of Swamy, et, al 58 patients with type 2 diabetes mellitus, 18 (31.03%) have subclinical hypothyroidism, and 7 (12.004%) have hypothyroidism [18]. In the present study we found significantly lower TT3, and fT3 but TT4, fT4, and TSH with normal in patients compared with control, this low T3 state could be explain by weakness in peripheral transformation of Triiodothyronine 4 to Triiodothyronine3 that normalizes with gets better in glycemic control [19]. Islam et al., investigated TH levels in uncontrolled diabetic patients, In their result, patients with diabetic type-2 had significantly lower serum Free triiodothyronine 3 level, and there were no significantly differences observed in serum Free triiodothyronine 4 and Thyroid Stimulating Hormone levels, compared with control, [19] According to studies Schlienger, et al.,[20]. He examined the impact of DM control on the level of circulating TH, the authors, elevated thyroid hormones in patients 44 diabetic type 1 and 39 diabetic type2 compared with 44 controls, in both the diabetic groups there was a significant decrease in T3 while T4 was normal.

#### 5. CONCLUSION

Thyroid hormone abnormalities are relatively common among patients with type 2 diabetes mellitus, reflecting the complex interaction between metabolic and endocrine functions. Despite this, most patients tend to remain in a euthyroid state rather than developing overt thyroid disorders such as hyperthyroidism or hypothyroidism. This pattern appears to be particularly evident in patients who experience hypoglycemia, where normal thyroid function is more frequently observed compared to clinically significant thyroid dysfunction. Nevertheless, even in the absence of overt disease, subtle changes in thyroid hormone levels—especially alterations in triiodothyronine (T3)—may occur and can have important metabolic implications.

These subclinical variations may influence glycemic control, lipid metabolism, and overall cardiovascular risk, which are already major concerns in patients with type 2 diabetes. Consequently, relying solely on clinical symptoms may not be sufficient to detect early thyroid dysfunction in this population. For this reason, the implementation of routine and periodic screening for thyroid hormone disturbances is strongly recommended in individuals with type 2 diabetes mellitus. Such an approach would enable early detection of subclinical thyroid abnormalities, allowing for timely intervention and appropriate management. Early diagnosis and treatment may help prevent progression to overt thyroid disease and reduce the risk of long-term complications, thereby improving patient outcomes and overall quality of life.

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#### DECLARATION OF COMPETING INTERESTS




The authors declare that there are no known competing financial or personal interests that could have appeared to influence the work reported in this paper.

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