

ORIGINAL RESEARCH

Estimation of T3 T4 TSH in Type 2 DM along with their Correlation

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Abstract

Background: New addition to complications of Type 2 DM is the thyroid dysfunction. The present study was conducted to evaluate the T3, T4, TSH in Type 2 DM along with their correlation.**Material and methods:** The present cross-sectional study was conducted among 240 subjects separated into two groups: Group I i.e. 120 diagnosed Type 2 Diabetes Mellitus constituting study group, and Group II i.e. 120 healthy age and gender matched individuals constituting control group. The study was conducted over a period of 2 years i.e. 2018 to 2020. The thyroid hormones Levels were analyzed with the ELISA method and HbA1C was analyzed using Ion Exchange Resin Method. The data was analyzed.**Results:** In the present study 240 subjects separated into two groups - 120 subjects of known Type 2 Diabetes Mellitus constituting study group and 120 subjects of healthy, age and gender matched individuals comprising control group. Among 120 cases studied 57.5% have normal level of thyroid hormones, 8.33% have high levels of thyroid hormones (Hyperthyroidism) and 34.16% have low levels of thyroid hormones (Hypothyroidism). FPG was suggestively higher in type 2 diabetes mellitus subjects (210.5 ± 73.5 mg/dl) as contrast with the non-diabetic subjects (96.3 ± 13.4 mg/dl). The serum levels of total T3 and T4 were lower in type 2 diabetes mellitus subjects as compared to the controls while the levels of serum TSH were higher in type 2 diabetes mellitus subjects as compared to the controls. All the results were extremely significant statistically ($p < 0.0001$). TSH showed a positive correlation with FPG while there was a negative correlation between FPG and T3; FPG and T4.**Conclusion:** The present study concluded that TSH showed a positive correlation with FPG while there was a negative correlation between FPG and T3; FPG and T4.**Keywords:** thyroid dysfunction, Type 2 Diabetes Mellitus, endocrine disorders.

Introduction

The two most common endocrine disorders encountered in clinical practice all the time are Diabetes mellitus (DM) and thyroid dysfunction (TD).¹The role of hyperthyroidism in diabetes was investigated in 1927, by Coller and Huggins proving the association of hyperthyroidism and worsening of diabetes. It was shown that surgical removal of parts of thyroid gland had an ameliorative effect on the restoration of glucose tolerance in hyperthyroid patients suffering from coexisting diabetes.² Insulin and thyroid hormones are intimately involved in cellular metabolism and thus excess or deficit of either of these

hormones result in the functional derangement of the other. The physiological and biochemical interrelationship between insulin and the influence of both insulin and iodothyronines on the metabolism of carbohydrates, proteins and lipids are recorded. Such records indicate that iodothyronines are insulin antagonist with high levels being diabetogenic while absence of the hormone inhibits the development of diabetes.³ Diabetes Mellitus plays a vital role in influencing the functioning of thyroid function, firstly at the level of hypothalamus by controlling the release of TSH Hypothalamic control. This leads to variations in the HPT axis. The results show a decreased secretion of pituitary TSH, decreased Hypothalamic TRH, and reduced TSH response to TRH. The second influence of Diabetes is seen at peripheral tissue by converting T4 to T3. A fall in the hepatic concentration of T4–5-deiodinase is seen as a result of hyperglycemia. It is accompanied by low serum concentration of serum T3 and raised level of reverse T3 and low, normal and high level of T4. Therefore it is clear indicator that thyroid hormones control metabolism and diabetes play significant role in altering metabolism.⁴ Therefore, diabetes patients need to be screened for thyroid dysfunction. Therefore, the present study was conducted to evaluate the T3 T4 TSH in Type 2 DM along with their correlation.

Material and methods

The present cross-sectional study was conducted among 240 subjects who were aged above 40 yrs at the time of the research. The study was conducted over a period of 2 years i.e. 2018 to 2020. Before the commencement of the study informed consent was taken from the patient after explaining the study. They were separated into two groups: Group I i.e. 120 diagnosed Type 2 Diabetes Mellitus constituting study group, and Group II i.e. 120 healthy age and gender matched individuals constituting control group. Individuals having Fasting Plasma Glucose (FPG) more than 126 mg/dl at more than two subsequent occasions, Individuals who were confirmed diabetics and were on anti-diabetic treatment such as insulin or oral hypoglycemic agents were included in the study. Individuals who were having complications of diabetes mellitus, Individuals who were having any history of thyroid dysfunction (total / subtotal thyroidectomy, lithium, anti thyroid drugs, or Graves disease, carcinoma patients, radiation exposure, toxic multinodular goiter, toxic adenoma and gestational hyperthyroidism) were excluded from the study. The thyroid hormones Levels were analyzed with the ELISA method. Venous blood sample were withdrawn and assessed for thyroid function (T3, T4, and TSH) and for the glycaemic status (FPG). The following guidelines for detection of thyroid dysfunction were considered – 1) Normal – when T3, T4 and TSH were within the normal range. 2) Primary hypothyroidism – when TSH is more than 5.5 μ IU/L and T3, T4 is less than the normal value. 3) Primary hyperthyroidism - when TSH is less than 0.2 μ IU/L and T3, T4 is more than the normal values. 4) Subclinical hypothyroidism – when TSH is more than 5.5 μ IU/L and T3, T4 is within the normal range. 5) Subclinical hyperthyroidism – when TSH is less than 0.2 μ IU/L and T3, T4 are within the normal range. The data was analyzed using Microsoft Excel Software 2017; SPSS 19.0 version. Chi-Square tests, T- tests and Pearson's Correlation tests were done to analyze the data.

Results

In the present study 240 subjects separated into two groups - 120 subjects of known Type 2 Diabetes Mellitus constituting study group and 120 subjects of healthy, age and gender matched individuals comprising control group. Among 120 cases studied 57.5% have normal level of thyroid hormones, 8.33% have high levels of thyroid hormones (Hyperthyroidism) and 34.16% have low levels of thyroid hormones (Hypothyroidism). FPG was suggestively higher in type 2 diabetes mellitus subjects (210.5 ± 73.5 mg/dl) as contrast with the non-diabetic subjects (96.3 ± 13.4 mg/dl). The serum levels of total T3 and T4 were lower in type 2

diabetes mellitus subjects as compared to the controls while the levels of serum TSH were higher in type 2 diabetes mellitus subjects as compared to the controls. All the results were extremely significant statistically ($p < 0.0001$). TSH showed a positive correlation with FPG while there was a negative correlation between FPG and T3 which is statistically significant. Also there was a negative correlation between FPG and T4.

Table 1: Prevalence of thyroid dysfunction among diabetic patients (n=120)

Thyroid dysfunction	N(%)
Euthyroid	69(57.5%)
Hypothyroid	41(34.16%)
Hyperthyroid	10(8.33%)
Total	120(100%)

Table 2: Comparison of mean of analyzed parameters in diabetic and non diabetic patients

Parameter	Normal Range	Cases(Mean \pm SD)	Controls(Mean \pm SD)	p Value
T3	0.5-1.85 ng/ml	0.73 \pm 0.34	0.96 \pm 0.39	< 0.0001
T4	4.8-11.6 μ g/dl	6.45 \pm 3.76	8.56 \pm 5.23	0.0004
TSH	0.4-4.2 UI μ /ml	5.23 \pm 1.34	3.76 \pm 2.67	< 0.0001
FBG	74-100 mg/dl	210.5 \pm 73.5	96.3 \pm 13.4	< 0.0001

Table 3: Pearson's correlation between FPG and thyroid parameters in diabetic patients

Relationship Between	r value	Diabetic Patients
		p value
FPG Vs T3	-0.221	0.024
FPG Vs T4	-0.192	0.054
FPG Vs TSH	0.250	0.012

Discussion

Diabetes mellitus is a complex and multifaceted disease which depends on many factors. There could be numerous patho-physiological changes in multiple organ systems caused by the metabolic dysregulation associated with diabetes that impose a heavy burden of morbidity and mortality from macrovascular and microvascular complications of diabetes.⁵

In the present study 240 subjects separated into two groups - 120 subjects of known Type 2 Diabetes Mellitus constituting study group and 120 subjects of healthy, age and gender matched individuals comprising control group. Among 120 cases studied 57.5% have normal level of thyroid hormones, 8.33% have high levels of thyroid hormones (Hyperthyroidism) and 34.16% have low levels of thyroid hormones (Hypothyroidism). FPG was suggestively higher in type 2 diabetes mellitus subjects (210.5 \pm 73.5mg/dl) as contrast with the non-diabetic subjects (96.3 \pm 13.4mg/dl). The serum levels of total T3 and T4 were lower in type 2 diabetes mellitus subjects as compared to the controls while the levels of serum TSH were higher in type 2 diabetes mellitus subjects as compared to the controls. All the results were extremely significant statistically ($p < 0.0001$). TSH showed a positive correlation with FPG while there was a negative correlation between FPG and T3 which is statistically significant. Also there was a negative correlation between FPG and T4.

Hypothyroidism was shown to be more prevalent thyroid disorder in type 2 diabetics in the studies of Udiong et al.⁶ The presence of both raised and low levels of thyroid hormones levels in diabetics may be due to modified TRH synthesis and release.⁷

A study by Panneerselvam et al. showed that serum levels of T3, T4, FT3 and FT4 were significantly lower in diabetic subjects as compared to the non-diabetic subjects while serum level of TSH was found to be significantly higher in type 2 diabetes mellitus patients as compared to normal individuals.⁸

Another study by Islam S et al. showed serum level of FT3 was significantly lower in type 2 diabetic patients as compared to the non-diabetic individuals. While FT4 and TSH level did not show any statistical difference between type 2 diabetic patients as compared to normal individuals.⁹

It was found that the diabetics showed the trend towards the hypothyroidism. The pathophysiology of thyroid dysfunction in diabetes is still unclear; however thyroid antibodies have been suggested to be the causative factors.¹⁰

Conclusion

The present study concluded that TSH showed a positive correlation with FPG while there was a negative correlation between FPG and T3; FPG and T4.

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