



Study Of Thyroid Dysfunction In Association With Vitamin D Status In Diabetes Mellitus Patients

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Abstract

Introduction:

Diabetes Mellitus is a group of metabolic diseases characterized by hyperglycemia majorly caused by dysfunction of beta cells in the pancreas. it is of increasing concern, because , body does not produce enough insulin or cells in the body does not respond to the insulin that is produced, majorly the thyroid gland regulates the majority of body's physiological actions . present cross-sectional study investigated whether thyroid parameter, including thyroid-stimulating hormone (TSH), free triiodothyronine (FT3), free thyroxine (FT4), thyroid peroxidase antibody (TPOAb), and thyroglobulin antibody (TgAb) & correlated with electrolytes levels in Diabetic patients.

Vitamin D is a fundamental micronutrient with major implications for human health . it plays a critical role in glucose homeostasis and insulin secretion via its endocrine role in the pancreas and paracrine roles in adipose tissues . Very few studies have reported the impact of vitamin D deficiency on autoimmune thyroid disease and demonstrated its conclusive results

Aim And Objective :

To study the serum electrolytes levels and thyroid dysfunction in association with Vitamin D levels in the DM patients

Materials And Methods:

It is a retrospective – cross sectional study

Sample size 100 (50- DM patients and 50 - Healthy age matched controls)

Inclusion:

Patients with Diabetes Mellitus & Thyroid dysfunction were included

Exclusion:

Subjects with other metabolic syndromes (Were excluded)

Results & Conclusion:

our study shows positive associations between the Vitamin D and TSH level in Type II DM. TSH level were identified as the independent predictors of 25-OH-Vitamin D level

Keywords: Fasting Blood Sugar(FBS), Diabetes Mellitus(DM), Vitamin-D Deficiency (VDD), Hypothyroidism, Hyperthyroidism

Introduction

Diabetes Mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia and metabolic disturbances of various metabolisms of Carbohydrates and majorly caused by the Dysfunction of Beta cells in the pancreas. it is of increasing concern, in which a person will have a hyperglycemia, because of the body does not produce enough insulin or because the cells in the body does not respond to the insulin that is produced, majorly, diabetes have been classified into three types.[1]

Type I diabetes mellitus results from inability or failure of our body to produce insulin, which increase Blood glucose levels rapidly and whereas in type II diabetes mellitus the person requires to inject the insulin or wear an insulin pump has emerged as a pandemic health problem in the world right now, and the prevalence is increasing rapidly and the type II diabetes mellitus which accounts for about 20% to 50% cases of new-onset of diabetes in the young people, it is a common endocrine disorder, which is also associated with several electrolytic disorders and this also leads to the disturbances in the thyroid gland.[2-3]

The thyroid gland is one of the most important organs in the human body. It regulates the majority of the body's physiological actions [4]. Thyroid hormone has an impact on renal tubular function and the renin-angiotensin system and is associated with hemodynamic and cardiovascular alterations that interfere with renal blood flow [5]. Conversely, the kidney is not only an organ for the metabolism and elimination of TH but also a target organ of some of the actions of the iodothyronines. The thyroid hormone is a central regulator of body functions, disorder of thyroid functions are considered to cause electrolytic disorders in diabetes mellitus patients. The present cross-sectional study investigated whether thyroid parameter concentrations, including thyroid-stimulating hormone (TSH), free triiodothyronine (FT3), free thyroxine (FT4), T3, T4, thyroid peroxidase antibody (TPOAb), and thyroglobulin antibody (TgAb). it had been correlated with Vitamin D levels in Diabetic patients [6-8]

Vitamin D is a fundamental micronutrient with major implications for human health. The production of vitamin D in the skin is directly proportional to the

exposure of the sunlight and indirectly proportional to pigmentation of the skin.

Through this mechanism it plays a critical role in glucose homeostasis and insulin secretion via its endocrine role in the pancreas and its paracrine roles in adipose tissues⁹

Few past studies have reported the impact of vitamin D deficiency on autoimmune thyroid disease and demonstrated inconclusive results [9-11]. Besides affecting the thyroid gland through immune-mediated processes, vitamin D has been shown to influence rat thyroid follicular cells by directly inhibiting thyrotropin-stimulated iodide uptake in a dose dependent manner [12]

Recently, a population-based study has reported that high vitamin D status in younger individuals is associated with low circulating thyroid-stimulating hormone (TSH) [13]. However, it remains unknown as to why no relationship between vitamin D status and serum TSH levels in middle-aged and elderly individuals was found in this study. Therefore, in the present study, we examined the relationship between vitamin D status and circulating TSH levels in middle-aged and elderly individuals with thyroid autoimmunity, while taking thyroid function into consideration in addition to the relationship between vitamin D insufficiency and thyroid autoimmunity, the presence of thyroid nodule(s) and thyroid volume in a cross-sectional study.[14]

Study suggest that up to 1 billion people around the world may have vitamin D deficiency ($25(\text{OH})\text{D} \leq 20$ ng/mL) or insufficiency ($25(\text{OH})\text{D} \leq 30$ ng/mL) [3]. 39% of healthy adults have vitamin D deficiency and 64% have Vitamin D insufficiency. Adolescents seem to be at a higher risk of vitamin D deficiency than adults, with reports suggesting that up to 60.5% prevalence which have increased to 84.1% in winter. Among adolescent groups girls are more prone to vitamin D deficiency about 73% have been noted and 17% being severely deficient ($25(\text{OH})\text{D} < 12.5$ nmol/l).[16-18]

Studies suggest that the prevalence of vitamin D deficiency varies due to skin pigmentation, diet, socioeconomic status, sunlight exposure and some of the risk factors such as BMI, age, obesity, hip circumference and diabetes mellitus.

Individuals with lighter skin pigmentation exposed to similar UVB doses have shown twice the increase in serum 25 (OH) D concentrations compared with individuals of the opposite extreme [11].

Materials And Methods:

1. It is a retrospective – cross sectional study
2. Sample size - 100 (50- Diabetes mellitus patients and 50 -Non Diabetic) age matched controls
3. Medical records of and laboratory reports of 50 patients and 50 controls where retrieved and these things where retrospectively viewed for clinical findings

Inclusion Criteria:

Patients with diabetes mellitus where included

Exclusion Criteria:

The subjects with other metabolic syndrome (Were excluded)

Results :

Collection Of Blood Samples:

1. 10 ml of blood samples were collected into a labeled heparinized bottles
2. Centrifuged and plasma was seperated
3. Blood samples where used for the analysis

Anthropometric Clinical And Biochemical Measurements

1. Age
2. BMI
3. Sex were noted
4. Estimation of Blood glucose was done by using (GOD-POD method) using semi-auto analyzer
5. Estimation of thyroid hormones (T3, T4 & TSH) by using (CLIA -method) chemiluminescence immune assay method [19]
6. Estimation of Serum Vitamin D was done by using(ELISA method

Table 1 : Shows the anthropometric and biochemical measurements

PARAMETERS	DIABETES(50)	CONTROLS(50)	P*VALUE
HbA1C	8.8±1.9	4.5± 0.4	<0.05
FBS	186± 12	108±13	<0.05
Sodium	242.6±28.5	138±13.3	<0.05
Potassium	5.40±0.65	4.16±0.82	<0.05
Chloride	116±5.5	99.7±0.04	>0.05
PLASMA GLUCOSE (FPS)	170 ± 10 mg/dl	93 ±13 mg/dl	<0.005
SERUM 25(OH)VITAMIN D (ng/ml)	22.79 ± 2.11	44.53 ± 14.91	<0.005
Serum Calcium (mg/dl)	7.92 ± 1.77	10.37 ± 1.55	>0.005
T3	1.27±0.62 nmol/L	1.62±0.54 nmol/L	<0.005
T4	82.14±16.29 nmol/L	85.9±14.09 nmol/L	<0.005
TSH	4.10±3.27 nmol/L	2.48 ±1.66 nmol/L	>0.005

P * value < 0.05 then it is considered to be statistically significant

Table1:

shows the anthropometric and clinical measurements of diabetic and non-diabetic subjects which includes FPS level in type II diabetes mellitus patient was found to be (170 ± 10 **mg/dl**) which is significantly higher than the control subjects (93±13**mg/dl**).

The T3 and T4 levels(**1.27±0.62 nmol/L**) and(**82.14±16.29 nmol/L**) were significantly lowered in type II diabetes mellitus patients when compared to the non diabetic healthy age matched controls (**1.62±0.54 nmol/L**) and (**85.9±14.09 nmol/L**)

Meanwhile the serum TSH was significantly increased in type II diabetes mellitus subjects(**4.10±3.27 nmol/L**) as compared to the non diabetic healthy age matched controls (**2.48 ±1.66 nmol/L**)

The Serum 25(OH)VITAMIN D level in type II diabetes mellitus patient was found to be 22.79 ± 2.11 (**ng/ml**) which is significantly lower than the control subjects (44.53 ± 14.91)(**ng/ml**)

Meanwhile **the serum Calcium** levels was significantly decreased in type II diabetes mellitus patients (7.92 ± 1.77) **mg/dl** as compared to the non diabetic healthy age matched controls (10.37 ± 1.55) **mg/dl**

Table2 : Shows the correlation of thyroid hormones with the FBS in type II DM patients

Relationship between thyroid hormones and FBS	P* value	r*- values	Significance
FBS vs T3	<0.005	0.43	Significant
FBS vs T4	>0.005	-0.128	In significant
FBS vs TSH	<0.005	0.510	Significant

p* (value) < 0.005 is considered to be statistically significant

Table 2 :

Shows the correlation of thyroid hormones with the fasting blood sugar level in which The FBS in Type II diabetes mellitus patients was correlated positively with the T3 and the **P*** value (<**0.005**)and **r*** value (**0.43**) and it shows the significance.

The FBS in type II diabetes mellitus patients were correlated negatively with T4 and the **P*** value was found to be (>**0.005**) and **r***value (**-0.128**) and it shows negative correlation, which is also insignificant

The FBS in type II diabetes mellitus patients were correlated positively with TSH levels the **p*** value was found to be **P*(<0.005)** and **r***value was found to be (**0.510**).

Discussion:

Our study includes 50 type II diabetes mellitus patients and 50 non diabetic age matched healthy controls .The thyroid hormone act as a insulin antagonists which potentiate the insulin action indirectly. In diabetes mellitus the TRH synthesis decreases and this is responsible for the occurrence of low thyroid hormone levels in diabetes. In our study the TSH level was found to be clinically significant in type II diabetes mellitus patients compared to non diabetic age matched controls .

According to the results obtained in our study, that type II diabetes mellitus patients were more prone to hypothyroidism frequently and the results of our present study was compared in accordance with the report of Gujarat singh et al [13], Suzuki et al [14], demitrost et al [15] valeri witting et al [16] they all are the person who have shown a separate study on thyroid profile in diabetic patients, our study shows a significant correlation with the thyroid hormone and the blood glucose levels in the type II diabetes mellitus patients Uncontrolled DM can also induce hypovolemic-hyponatremia due to osmotic diuresis

furthermore in diabetic ketoacidosis, ketone bodies (beta-hydroxy butyrate and acetoacetate) necessitate urinary electrolyte losses and magnify the renal sodium wasting.

Moreover, VDD has received special attention because of its high incidence, VDD and its implication may lead to multiple chronic illnesses. and T2DM are usually recognized as a complication and risk for thyroid disease [17-19]. We found VDD to be common (47.5%). In addition, high levels of TSH have been associated with lower 25-OHD levels. Moreover, suppressed levels of TSH have been associated with higher 25-OHD levels. In addition, a linear association between TSH and 25-OHD has been noticed among T2DM patients. Though higher levels of 25-OHD with suppressed TSH levels might be due to an increased absorption of 25-OHD in hyperthyroid state. Metabolism of 25-OHD is also reciprocally regulated by thyroid hormones. Histological examination of the skin in hypothyroid patients has shown epidermal thinning and hyperkeratosis.[20-21] Finally, the body may not activate vitamin D properly.

Our study showed that 25-OHD was insufficient in patients with T2DM. Lower levels 25-OHD were associated with a poor glycemic control and leads to increase in the blood glucose levels, These findings are supported by a number of international studies. Some studies showed no association of a low 25-OHD levels with HbA1c levels.[22-23]

But inverse correlation between the level of 25-OHD and HbA1c is well known. In many studies 25-OHD levels were low in subjects having higher HbA1c values in patients with T2DM indicating, they are inversely related. [24-25] We had some limitations. study was done at only one centre and was done at one point of time. The study sample confined to patients with T2DM but without comparable groups

On the other hand, study had been conducted in Netherlands showed that Vitamin D deficiency is not associated with early stages of thyroid autoimmunity. We also observed a significant difference in serum calcium levels between the studied groups with lower level seen in hypothyroid patients were it insignificantly decreased in females than male patients.

A study conducted showed significant changes in ionized Ca, but not total Ca means that the physiologically active form of Ca is affected, while the overall concentration of Ca is still significantly unchanged. [26-27] Calcium has an effect on the hypothyroid patients; there is even no correlation with thyroid hormones parameters.

Conclusion :

Our results show that patients with hypothyroidism has suffered from decreased Vitamin D Levels & with hypocalcaemia. it suggest that deficiency of serum Vitamin D and calcium levels were significantly associated with degree and severity of the hypothyroidism which encourage the Intake of Vitamin D supplementation. Screening for Vitamin D and serum calcium levels recommended for all hypothyroid patients.

The dysregulation of glucose homeostasis may lead to many direct & indirect effects and which may likely lead to renal failure, renal stones, cardiac arrhythmias due to increase in sodium & potassium levels, and this also can lead to hypogonadism. In which patients might not be able to permeate the opposite sex, which is as result of low level of testosterone hormone, the high prevalence of diabetes and familiarity of electrolytes related abnormalities are important, in future the further studies are needed in order to study the underlying mechanism of electrolytes and thyroid dysfunction in DM patients.

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