Original Research Article

A Study of Thyroid Profile and Vitamin D Levels In Type 2 Diabetes Mellitus Patients

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Received: 07-11-2021 / Revised: 28-12-2021 / Accepted: 11-01-2022

Abstract

Introduction: Non-communicable disease continues to be an imperative public health problem in India, leading to substantial increase in mortality and morbidity. Among these, Type-2 diabetes mellitus (T2DM) and hypertension are increasing at an alarming rate. T2DM increases the risk of thyroid dysfunction in the long-term. T2DM and hypothyroidism is the primary reasons for mortality and morbidity in most high income and developing countries. **Materials and Methods:** A cross-sectional single centre study was conducted among 100 patients with T2DM attending a tertiary care centre between January 2019 to June 2019. Eligible patients were 20 years or older. Exclusion criteria were known hepatic or renal disease, metabolic bone disease, malabsorption, hypercortisolism, pregnancy and medications influencing bone metabolism. The serum concentration of 25-OHD was measured by competitive protein binding assay using kits (Immunodiagnostic, Bensheim, Germany). Vitamin D Deficiency (VDD) was defined as serum 25-OHD concentration <50 nmol/L.Glycosylated hemoglobin (HbA1c) was measured by the high performance liquid chromatography method (Bio-Rad Laboratories, Waters, MA, USA). TSH levels between 0.22-4.2 mIU/L were regarded normal. Participants were divided to three subgroups according to their TSH level (below <0.22 mIU/L, 0.22-4.2 mIU/L and >4.2 mIU/L). Study was approved by the Institutional Ethical Review Board. Data are presented as means±standard deviation (SD) and numbers. **Results:** A total of 100 participants were included in this study. Average age of the study population was 50.1±17.3 years and females predominated males. Vitamin D Deficiency was found in 49% of the participants. In 5% of the cases, TSH was lower than 0.22 mIU/L and in 75%, TSH was within normal reference range. Abnormally high levels of TSH (>4.2 mIU/L) were reported in 20% of participants. **Conclusion:** The present study shows high prevalence of Vitamin D Deficiency levels among diabetic patients and there was a positive association between the VDD and TSH level among T2DM patients.

Keywords: Thyroid Profile, Vitamin D, In Type 2 Diabetes Mellitus.

Introduction

Non-communicable disease continues to be an imperative public health problem in India, leading to substantial increase in mortality and morbidity. Among these, Type-2 diabetes mellitus (T2DM) and hypertension are increasing at an alarming rate[1].

Incidence and prevalence of Type 2 diabetes mellitus (T2DM) is increasing rapidly; there were greater than 285 million patients worldwide with diabetes in 2010, increasing to approximately 438 million by 2030[2]. Asian Indians are at a high risk for developing insulin resistance, the metabolic syndrome, T2DM and coronary heart disease[3]. The prevalence of diabetes between the age groups of 20–79 years was around 7.1% in India in 2010 (50.7 million) and these figures were estimated to rise to 8.6% by 2030 (87.0 million)[2,4].

Defects in pancreatic β-cell function, insulin sensitivity, and systemic inflammation are few of the contributing factors towards the development of T2DM. Type 2 Diabetes Mellitus and hypothyroidism are the main threats in developed and developing countries[5]. T2DM increases the risk of thyroid dysfunction in the long-term[6-8]. T2DM and hypothyroidism are the primary reasons for mortality and morbidity in most high income and developing countries[6,7].

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However, several studies have shown a higher prevalence of hypothyroidism occurring among T2DM patients[8-10]. Moreover, positive correlations between VDD and hypothyroidism among T2DM patients have been reported[9-11]. 25-OHD was shown to affect the thyroid gland through immune-mediated processes by directly inhibiting thyrotropin-stimulated iodide uptake[12]. Moreover, high 25-OHD status is associated with low thyroid-stimulating hormone (TSH)[13].

Objectives

1. To assess the Thyroid profile and Vitamin D levels among type 2 Diabetes Mellitus patients attending a Tertiary care center.
2. To determine the relationship between serum TSH levels and vitamin D status among these patients with T2DM.

Materials and Methods

A cross-sectional single centre study was conducted among 100 patients with T2DM attending a tertiary care centre between January 2019 to June 2019. Eligible patients were 20 years or older. Exclusion criteria were known hepatic or renal disease, metabolic bone disease, malabsorption, hypercortisolism, pregnancy and medications influencing bone metabolism. The serum concentration of 25-OHD was measured by competitive protein binding assay using kits (Immunodiagnostic, Bensheim, Germany). Vitamin D Deficiency (VDD) was defined as serum 25-OHD concentration <50 nmol/L.Glycosylated hemoglobin (HbA1c) was measured by the high performance liquid chromatography method (Bio-Rad Laboratories, Waters, MA, USA). TSH levels between 0.22-4.2 mIU/L were regarded normal[14]. Participants were divided to three subgroups according to their TSH level (below <0.22 mIU/L, 0.22-4.2 mIU/L and >4.2 mIU/L)[15]. Study was approved by the Institutional Ethical Review Board. Data are presented as means±standard deviation (SD) and numbers. Quantitative variables were compared between two groups by using the Student's test. Differences in categorical variables were analysed using the chi-square test. Differences in mean serum 25- OHD levels were tested with ANOVA.Linear regression analyses were performed to examine the factors that predicted serum concentrations of 25(OH)D. P value <0.05 indicates significance. The statistical analysis was conducted with SPSS version 20.0 for Windows.

Results

A total of 100 participants were included in this study. Average age of the study population was 50.1±17.3 years (Table 1) and females predominated males (Figure 1). Vitamin D Deficiency was found in 49% of the participants. In 5% of the cases, TSH was lower than 0.22 mIU/L and in 75%, TSH was within normal reference range. Abnormally high levels of TSH (>4.2 mIU/L) were reported in 20% of participants. Table 1 shows the characteristics of three subgroups of study population according to their serum TSH level. Serum 25-OHD level was significantly different among the study subgroups (P <0.0001). In post hoc analysis, it was determined that subjects with TSH levels <0.22 mIU/L had significantly higher 25- OHD concentrations (70.2±37.3 nmol/L) compared to subjects with normal TSH levels and those with elevated TSH concentrations. However the difference in serum 25-OHD concentrations was not significant between subject with normal and those with elevated TSH levels (P = 0.4). In order to identify the independent factors affecting 25-OHD levels, a multivariate linear regression model was constructed using the serum 25-OHD concentrations as the dependent factor (Table 2). Age, gender, HbA1c and TSH were the independent predictors of 25-OHD levels. The second linear regression analysis using serum TSH concentrations as the dependent variable was performed with Age, gender, HbA1c and 25-OHD levels as independent variables. In the constructed model, age, gender and HbA1c and 25-OHD were found not to be independent predictors of serum TSH level (Table 3).

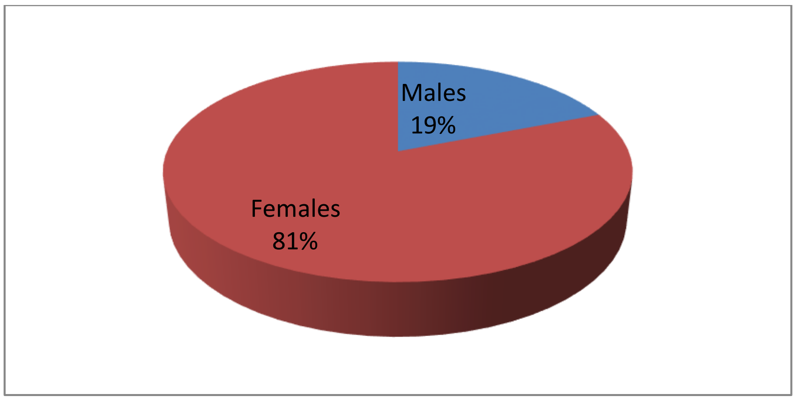

Fig 1: Gender distribution of study participants

Table 1: Distribution of patients based on TSH categories of suppressed TSH, normal TSH and elevated TSH (mean±SD or number)

Variable		TSH (mIU/L)			Total	P value
		<0.22	0.22-4.2	>4.2		
Numbers		5	75	20		
Age (yrs)		49.5±12.6	50.3±15.4	49.8±16.4	50.1±17.3	0.7
Gender	Males	1	13	5	19	<0.0001
	Females	4	62	15	81	
HbA1c (%)		6.5±1.7	7.6±2.4	7.9±2.3	7.6±2.1	0.005
25-OHD (nmol/L)		70.2±37.3	59.0±28.3	53.3±30.4	59.1±29.9	<0.0001
Vit D Deficiency		7	15	27	49	<0.0001
TSH (mIU/L)		0.15±0.08	2.2±1.1	11.3±17.3	3.6±8.4	<0.0001
FT4 (pmol/L)		18.2±4.4	14.7±4.6	14.3±3.2	14.8±3.4	<0.0001

Table 2: Linear regression analysis using serum 25-hydroxyvitamin D concentrations as the dependent variable

Parameters	Coefficients	SE	95% Confidence interval	P value
Gender	5.67	2.06	1.62-9.24	0.01
Age (yrs)	0.51	0.05	0.34-0.59	<0.0001
HbA1c (%)	-1.89	0.52	-1.76	<0.0001
TSH	0.37	0.18	0.02-0.68	0.05
FT4	2.45	0.40	1.78-2.98	<0.0001

Table 3: Linear regression analysis using serum concentrations of thyroid stimulating hormone as the dependent variable

Parameters	Coefficients	SE	95% Confidence interval	P value
Gender	-0.40	0.42	-1.32	0.4
Age (yrs)	0	0.02	-0.04	1.0
HbA1c (%)	0.06	0.72	-0.41	0.6
25-OHD	0.003	0.004	-0.03	0.4

Discussion

Diabetes mellitus is a worldwide epidemic and currently the most prevalent chronic illness in the world having a prevalence of around 9% in the adult population[2,4,16]. Moreover, VDD has received special attention lately because of its high incidence and its implication in the genesis of multiple chronic illnesses. VDD and T2DM are usually recognized as a complication and risk for thyroid disease[17]. Present study found VDD to be common among diabetics

(49%). 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[18,19], and so the body may not activate vitamin D properly[20].

It was found that age, gender, HbA1c and TSH were the independent predictors of 25-OHD level. Thyroid disorders were more common in females by 5–10 times[17, 22]. It has been shown that serum levels of 25-OHD decrease with age[23]. The present study also found that age has a positive correlation with 25-OHD level. As the study population grew older, 25-OHD concentrations increase. We hypothesize that such finding were due to the fact our subjects in the sixth decade of their lives (mean 50.1±17.3 years). Higher levels of 25-OHD have been reported in older patients compared to younger counterparts[24]. This could be due to the higher consumption of Vitamin D supplements in this age group.

The high prevalence of VDD in our study population underlines the fact that VDD is more common in chronic diseases like diabetes mellitus. Present study showed that 25-OHD was inadequate in a half of our population of patients with T2DM. Lower 25-OHD levels were associated with a poor glycemic control. These findings are supported by a number of international studies. Some studies showed no association of a low 25-OHD levels with HbA1c levels[25]. But inverse correlation between the level of 25-OHD and HbA1c is well known[26,27]. There were some limitations in the present study like small sample size, it was done at only one centre and was done at one point of time.

Conclusion

The present study shows high prevalence of Vitamin D Deficiency levels among diabetic patients and there was a positive association between the VDD and TSH level among T2DM patients. Age, gender, HbA1c and TSH level were identified as the independent predictors of 25-OHD level.

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Conflict of Interest: Nil Source of support: Nil