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Research Article

A CLINICAL STUDY ON VITAMIN D DEFICIENCY IN HYPOTHYROIDISM

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ABSTRACT

Objectives: The aim of the study was to determine the relationship between hypothyroidism and Vitamin D deficiency.

Methods: It was an observational study, a study conducted in the Department of Biochemistry at MGM Medical College and LSK Hospital Kishanganj, Bihar. In the present study, 50 patients and 50 healthy age and sex-matched controls were included during the study period from June 2021 to March 2022. Serum Vitamin D (25-OH) levels were measured in all the patients. Vitamin D deficiency was designated at levels lower than 20 ng/ml. Thyroid hormones (Thyroid stimulating hormone [TSH], T3, and T4) were also evaluated in all participants.

Results: Incidence of Vitamin D deficiency is significantly high among hypothyroid patients compared to normal controls (p=0.036). The mean level of Vitamin D was significantly low level among patients with hypothyroidism compared to controls (23.57±9.77 vs. 31.20±10.23 ng/ml, p=0.02). Pearson's correlation between Vitamin D level and thyroid profile among hypothyroid cases revealed that there was a significant negative correlation between serum Vitamin D and TSH level (p≤0.0001).

Conclusion: Deficiency of Vitamin D is significantly associated with hypothyroidism, and therefore, screening of Vitamin D is essential for all hypothyroid patients.

Keywords: Hypothyroidism, Subclinical hypothyroidism, Vitamin-D, Thyroid stimulating hormone.

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INTRODUCTION

Vitamin D is a fat soluble vitamin that has hormone-like function [1]. Vitamin D is a steroid molecule that is mostly generated in the skin and affects the expression of several genes [2]. Vitamin D receptors can be found in a variety of human organs. Vitamin D operates through these receptors in a variety of ways, including the regulation of ion homeostasis, cell proliferation, cell differentiation, and cellular immunity [3]. Vitamin D is essential in avoiding the onset of many inflammatory, infectious, and autoimmune illnesses [4]. New data suggest that Vitamin D insufficiency, which is ubiquitous throughout the world, may also play a role in autoimmune illnesses, malignancies, metabolic syndromes, cardiovascular disease, and infection, as well as all-cause mortality [5].

Different as studies have found a link between Vitamin D insufficiency and a wide range of ailments, including musculoskeletal, cardiovascular, kidney disease, diabetes, and infections [6]. Vitamin D receptors can also be found in the thyroid gland, which is one of the body's most important organs. The thyroid Vitamin D receptor is a part of a wide group of receptors known as nuclear receptors, which also include the thyroid hormone receptor [7]. According to another research, Vitamin D insufficiency is linked to a variety of autoimmune illnesses [8].

Hypothyroidism is an endocrine condition defined by low serum thyroxin levels, with a clinical range ranging from no signs and symptoms to life-threatening problems [9].

Thyroxine (Total T4), triiodothyronine (Total T3), and their free variants, free T4 (fT4) and free T3 (fT3), are the most common circulating thyroid hormones (fT3). The hypothalamus-pituitary-thyroid axis tightly regulates blood levels through a negative feedback mechanism [10]. In most cases, primary overt hypothyroidism is characterized by low blood fT4 levels and reciprocally increased thyroid stimulating hormone levels (TSH) [9]. The illness spectrum also includes an undiscovered state known as subclinical hypothyroidism, which is distinguished by normal total T4 levels but slightly raised TSH [11]. Hypothyroidism due to iodine insufficiency is more common in geographical places where the soil is poor in iodine, such as hilly and mountainous terrain, whereas autoimmune etiology (Hashimoto's thyroiditis [HT]) predominates in iodine abundant areas [12]. According to epidemiology, females are more likely to be affected than males, whereas alcoholics and smokers are less likely to be affected [13]. Etiopathogenesis includes genetic predisposition as well as environmental variables that have recently been linked to Vitamin D and selenium insufficiency.

Recent research has shown a possible link between serum Vitamin D levels and thyroid disorders.

METHODS

The present study was conducted in the Department of Biochemistry at MGM Medical College and LSK Hospital, Kishanganj, Bihar, during the study period of June 2021 to March 2022. In the present study, 50 patients and 50 healthy age and sex-matched controls were included in the study. The age range varied from 20 to 60 years.

Inclusion criteria

The following criteria were included in the study:

- Patients diagnosed with hypothyroidism.
- Patients aged between 20 and 60 years of either sex.
- Patients were given written consent.

Exclusion criteria

The following criteria were excluded from the study:

- Patients with comorbid disorders (connective tissue disorders, hemoglobinopathies, and bleeding disorders) causing anemia
- Patients taking drugs that alter thyroid hormone status (carbimazole, amiodarone, radio-iodine, propylthiouracil, and others)

- Post-thyroidectomy hypothyroid patients
- Patients with thyroid malignancies
- Any acute/stressful condition (MI, Shock, DKA, and Liver disease).

Methodology

After obtaining the written consent form from either the patients, all the study participants were subjected to complete history taking. Demographic characters such as age, sex, height, and weight of all participants were noted. Serum T3, T4, and TSH were measured by the electrochemiluminescence immunoassay method. Patients were diagnosed as hypothyroid patients if their TSH level was higher than 5.0 mU/L with lower levels of T3 and T4 than normal values. Diagnosis of serum 25(OH) Vitamin D level was measured by ELISA. Patients were categorized as Vitamin D deficient (<20 ng/ml), insufficient (20–30 ng/ml), and normal (>30 ng/ml).

Statistical analysis

All the parameters were tabulated. The mean and standard deviation were analyzed using SPSS 21 software. The Chi-square test was the test of significance used for qualitative variables to find the association between them. t-test was the test of significance used for comparing quantitative variables with qualitative variables. $p<0.05$ was considered significant.

RESULTS

Table 1 presents the demographic details of the study subjects. The mean age among the case group was 38.40±8.14 years, and among the control group was 38.46±8.98 years, with no statistically significant difference (p=0.497). As obvious, females are more prone to develop hypothyroidism, our study is no exception. Out of 50 cases of hypothyroidism, 39 (78%) were females. As we have chosen a sex-matched control group, there was no statistically significant difference regarding sex (p=0.639).

Table 2 presents the clinical presentation of the study subjects with primary hypothyroidism. Fatigue was the most common symptom involving 92% of patients, followed by generalized weakness (84%). The other findings were dyspnea (16%), puffy or sensitive face (10%), and decreased sweating (8%).

Table 1: Demographic characteristics

Variables	Case group (n=50)	Control group (n=50)	p-value
Mean age (years)	38.40±8.14	38.46±8.98	0.497
Sex (M/F)	11/39	13/37	0.639

Table 2: Clinical findings of hypothyroidism

Clinical findings	Frequency	Percentage
Fatigue	46	92.0
Generalized weakness	42	84.0
Dyspnea	8	16.0
Puffy or sensitive face	5	10.0
Decreased sweating	4	8.0

Table 3 presents the distribution of the study subjects according to the 25-hydroxyvitamin D level among the study participants. Patients were categorized as deficient (<20 ng/ml), insufficient (20–30 ng/ml), and normal levels of Vitamin D. The majority of the study subjects of both case and control groups had insufficient levels of Vitamin D (54% vs. 52%). While in the case group, 24% of patients had Vitamin D deficiency, whereas the prevalence of the same in the control group was only 8%. In the control group, 40% of patients had normal Vitamin D levels, while in the case group, only 22% had the same. We found that there was a significant difference in Vitamin D deficiency between the case and control group (p=0.036).

Table 4 presents the comparison of the mean levels of T3, T4, TSH, and Vitamin D levels between the case and control groups. Above analysis, we found obvious that there was a significant difference in the thyroid profile between the case and control group. Serum TSH level was significantly high among case group (9.61±2.17 vs. 1.36±0.28 uIU/mL, p=<0.0001) while the mean level of T3 (0.42±0.18 vs. 1.73±0.23 ng/mL, p=<0.0001) and T4 (2.63±0.70 vs. 8.92±1.23 µg/dL, p=<0.0001) was significantly low among the same. Moreover, while analyzing the mean level of Vitamin D, it was seen that there was a significantly low Vitamin D level among patients with hypothyroidism compared to controls (23.57±9.87 vs. 31.20±10.34 ng/ml, p=0.02).

Pearson's correlation between Vitamin D level and thyroid profile among hypothyroid cases, we found that there was a significant negative correlation between serum Vitamin D and TSH level (p=<0.00021). Data are shown in Table 5.

DISCUSSION

Vitamin D is essential for maintaining healthy bones . It also plays various other critical roles in the body, including controlling inflammation and immunological function. However, recent research showed that its deficiency is associated with various diseases such as cardiovascular disease, cancer, infection, and adiposity, as well as osteoporosis [14].

Recent research has linked low Vitamin D levels to autoimmune thyroid disorders (AITDs) such as HT and Graves' disease. Impaired Vitamin D signaling has been linked to thyroid cancer [15].

As a result, the present study was designed to see if there was a link between hypothyroidism and Vitamin D deficiency. The majority of the study participants with hypothyroidism in the present study were female.

Similar findings were discovered in research by Mackay *et al*., which included a bigger number of female hypothyroid individuals [16]. Other studies conducted in middle-income countries, such as India, as described by Velayutham *et al*. and Unnikrishnan *et al*., included a greater percentage of female hypothyroid patients [17,18]. This demonstrates that early in the middle ages, regular thyroid assessment of females is required to diagnose and commence treatment in the early course of the condition. Kim *et al*. discovered that premenopausal females have a higher risk of developing autoimmune hypothyroidism than men or even postmenopausal females [19].

Hypothyroidism and Vitamin D deficiency have been linked in this study.

Table 3: Prevalence of Vitamin D deficiency

25-hydroxyvitamin D level	Case Group (n=50)		Control Group (n=50)	
	Frequency	Percentage	Frequency	Percentage
Deficiency (<20 ng/ml)	12	24.0	4	8.0
Insufficiency (20-30 ng/ml)	27	54.0	26	52.0
Normal level (>30 ng/ml)	11	22.0	20	40.0
Total	50	100.0	50	100.0
Statistical inference	Chi-square: 6.632 p-value: 0.036			

Table 4: Comparison of thyroid profile and Vitamin D level

Variables	Case Group (n=50)	Control Group (n=50)	p-value
	Mean±SD	Mean±SD	
T3 (ng/mL)	0.42±0.18	1.73±0.23	<0.0001
T4 (µg/dL)	2.63±0.70	8.92±1.23	<0.0001
TSH (uIU/mL)	9.61±2.17	1.36±0.28	<0.0001
Vitamin D (ng/ml)	23.57±9.87	31.20±10.34	0.02

Table 5: Correlation between Vitamin D level with thyroid profile in hypothyroidism

Correlations			
		TSH	VIT-D
TSH	Pearson Correlation	1	−0.940**
	Sig. (2-tailed)		0.000
	N	50	50

**Correlation is significant at the 0.01 level (2-tailed), TSH: Thyroid stimulating hormone

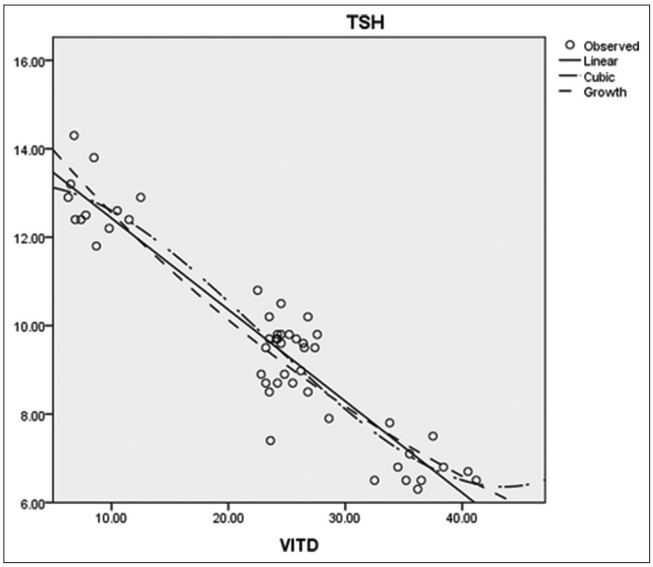

Fig. 1: Correlation between Vitamin D level with TSH in hypothyroidism

The current investigation discovered that the incidence of Vitamin D deficiency was significantly higher in hypothyroid patients (p=0.036). A significant difference in Vitamin D insufficiency was identified between the case and control groups (p=0.036). Blood TSH levels were significantly greater in hypothyroid people compared to the control group in the present study; nevertheless, serum T3 and T4 levels were significantly lower in hypothyroidism. Another notable finding from this study was that hypothyroid patients had lower levels of Vitamin D compared to healthy individuals (23.57 9.77 vs. 31.20 10.23 ng/ml, p=0.02). Pearson's correlation between Vitamin D level and thyroid profile in hypothyroid individuals discovered a significant negative relationship between blood Vitamin D and TSH level (p=0.0001).

A low Vitamin D status has been reported in AITD or HT in several clinical trials, demonstrating a relationship between Vitamin D deficiency and thyroid autoimmunity. According to Kivity *et al*., the prevalence of Vitamin D deficiency (25(OH)D level 25 nmol/L) was substantially greater in 50 AITD patients compared to 98 healthy individuals (72% vs. 30.6%; p 0.001), as well as in 28 HT patients compared to 42 non-AITD patients (79% vs. 52%; p 0.05). Vitamin D deficiency was also found to be related with the presence of anti-thyroid antibodies (p=0.01), showing that Vitamin D plays a role in the etiology of AITD [20]. Tamer *et al*. discovered that the prevalence of Vitamin D insufficiency (25(OH)D level 75 nmol/L) was significantly higher in 161 HT cases than in 162 healthy controls (92% vs. 63%; p 0.0001). Individuals with overt hypothyroidism (47/50, 94%) or subclinical hypothyroidism (44/45, 98%) were more likely to be Vitamin D deficient those with euthyroidism (57/66, 86%); however, the differences were not statistically significant [21]. Bozkurt *et al*. discovered that serum 25(OH)D levels were significantly lower in HT patients (180 treated and 180 untreated) than in controls, and that the severity of Vitamin D deficiency was correlated with the duration of HT, thyroid volume, and antibody levels, implying a potential role for Vitamin D in the development of HT and/or its progression to hypothyroidism [22]. By comparing 41 hypothyroid HT patients with 45 healthy euthyroid individuals, Mansoura *et al*. discovered a significant inverse association between serum 25(OH)D levels and HT (OR 0.81, 95% CI 0.68–0.96; p=0.018), such that each 12.5 nmol/L increase in serum 25(OH)D level resulted in a 19% decrease in the odds of HT [23].

In the study by Evliyaolu *et al*., patients with a Vitamin D level of 20 ng/mL were termed Vitamin D deficient, and they discovered that the prevalence of Vitamin D deficiency is higher in people with Hashimoto's than in normal people [24].

CONCLUSION

Vitamin D deficiency is one of the world's most common health problems, impacting people of all ages. Although its major purpose is to regulate bone and mineral metabolism, the current research indicates that it is also associated to a variety of diseases, including high blood pressure, heart disease, diabetes, cancer, mood disorders, multiple sclerosis, and autoimmune diseases. The present study intended to determine if there was a link between hypothyroidism and Vitamin D deficiency. The vast majority of hypothyroid patients, according to our data, are Vitamin D deficient. Furthermore, there was a significant inverse relationship between TSH and Vitamin D, as well as a positive relationship with serum T3 and T4. As a result, we may conclude that Vitamin D deficiency is strongly linked to hypothyroidism and that Vitamin D screening should be essential for all hypothyroid individuals.

AUTHORS CONTRIBUTION

The authors contribute equally.

CONFLICTS OF INTERESTS

At own interest.

AUTHORS FUNDING

None.

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