Original Article

Association of Vitamin D Deficiency with Hypothyroidism

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ABSTRACT

Background: The main function of vitamin D is to regulate bone metabolism, although its position as an immunological modulator has lately been highlighted. Over the last few years, evidence has accumulated that vitamin D has a crucial role in the prevention of autoimmune disorders. However, there is no solid evidence that it has a role in non-autoimmune thyroid illness.

Objective: The primary objective of this study is to assess the link between vitamin D deficiency and hypothyroidism in patients at tertiary care hospital.

Methodology: This was prospective cross-sectional study, conducted at Department of Pathology, Chandika Medical College, Larkana for a period of one year. The levels of serum vitamin D (25-OH) were tested in 47 healthy people and 47 hypothyroid patients. Vitamin D insufficiency was defined as a concentration of less than 10 ng/ml.

Results: Serum 25(OH) vitamin D levels in hypothyroid patients were substantially higher than in controls (t=11.1, p = 0.003). Female patients had a lower level of it than male patients (t=0.383, p=.712).

Conclusion: A significant association was found between vitamin D deficiency and hypothyroidism in patients as compared to healthy controls, making it important investigation to be performed in routine patients with hypothyroidism.

Keywords: Hypothyroidism, vitamin D deficiency, association, metabolism.

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INTRODUCTION

Vitamin D is essential for calcium homeostasis, as well as the formation and maintenance of the bone skeleton. [1] However, its importance in ion homeostasis, cellular immunity, cell proliferation, and cell differentiation has lately been highlighted. [2] Vitamin D works by binding to receptors located in nearly all organs. Vitamin D receptors (VDRs) are also found in the thyroid gland; the VD receptor in the thyroid belongs to a category of receptors known as nuclear receptors, which are also thyroid hormone receptors. [3]Vitamin D inhibits the occurrence of numerous autoimmune illnesses, inflammatory diseases, and infections through binding to these receptors. [4] Vitamin D insufficiency has been linked to several musculoskeletal illnesses, diabetes, renal disease, cardiovascular disease, and infections in recent studies. [5-9]

Vitamin D has been linked to the control of pro-inflammatory cytokines, regulatory T cells, and immunological response by several studies. [10]They discovered that a lack of vitamin D raises the risk of autoimmune disorders. Vitamin D is also involved in the pathophysiology of DCs, macrophages, CD4 + T, CD8 + T, and B cells during the immune system's Development. [3, 11] Furthermore, it functions as a selective immune inhibitor, suppressing and avoiding the onset of autoimmune disorders such as rheumatoid arthritis, type 1 diabetes, systemic lupus erythematosus, and intestinal inflammatory diseases, as well as encephalopathy. [12, 14]Vitamin D insufficiency has been linked to autoimmune thyroiditis, such as Hashimoto thyroiditis and Grave's disease, according to research. [15-16]

Vitamin D is classified as a fat-soluble nutrient. The main source of vitamin D production in the body is exposure to UV-B radiation (290–320 nm). It enters the circulation after binding to a D-binding protein, then undergoes hydroxylation into 25(OH) D in the liver and formation of the active metabolite, 1, 25 dihydroxy vitamin D (1, 25-(OH)2 D) or calcitriol, in the kidney. The most abundant circulating precursor of active Vitamin D, serum 25(OH)D, is one of the most widely accepted markers of vitamin D status, reflecting both cutaneous and intestinal contributions. [17-18]Serum 25(OH)D has a two- to three-week half-life, whereas 1,25-(OH)2D has a short circulating half-life and is closely regulated by calcium phosphate and parathyroid hormone across a narrow range. [19-20]1,25-(OH) Because a drop in 2D may not appear until severe vitamin D shortage, it is not a good indicator of vitamin D status. As a result, we conducted this research to see how vitamin D insufficiency affects hypothyroidism in comparison to healthy controls.

METHODOLOGY

This was a prospective, cross-sectional study. The study was conducted at Department of Pathology, Chandka Medical College, Larkana for a period of one year (September 2020 to August 2021). A total of 94 participants were included for the study. All participants in this study gave their written informed concerned . Patients with age more than 18 years, non-pregnant, and no history of any chronic illness were included in the study. Patients with age less than 18 years, history of thyroidectomy, pregnancy, ablation by radioiodine, malabsorption disease, chronic comorbid disease, history of calcium or vitamin D supplements, history of alcohol consumption were excluded in this study.

Group A consists of patients with hypothyroidism. If the TSH level was higher than 6.2mlU/ml and the T3 (Ref. range =0.69-2.02ng/ml) and T4 (Ref. range = 4.4-11.6µg/ml) levels were lower than normal, they were identified as hypothyroid patients. Group B consists of healthy control individuals. They had normal clinical and physical examination, no thyroid disease history or chronic disease and those who were not on any vitamin D supplements. Following a thorough medical history and examination, laboratory tests (serum vitamin D and thyroid profile) were performed.

After aseptic precautions, a blood sample was taken from a fasting person via venipuncture, the serum was separated by centrifugation, and the serum was stored at –20oC for a week before being tested. Serum 25(OH)D levels were measured using a chemiluminescent immunoassay technique to determine vitamin D status (Roche Diagnostic Immunoassay E411). When serum 25(OH)D levels are less than 10ng/ml, they are deemed inadequate, and when they are between 10 and 30ng/ml, they are regarded insufficient.

***Statistical* Analysis**

SPSS version 23 for Windows was used to perform statistical analysis on the data. For each variable, the mean and standard deviation (SD) were determined. The outcomes of all examined instances in study groups were compared using the analysis of variance F test (ANOVA). The student's "t" test was used to determine the differences between mean values for each tested variable. Correlation coefficients were used to show the relationships between serum Vitamin D and TSH (r2). When the p value is less than 0.05, the results are considered significant.

RESULTS

Table 1 shows the mean values and standard deviations of all analyzed parameters, as well as the age and sex distribution in all studied groups. In terms of age and sex, there was no statistical difference (P > 0.05) between groups. Table 1 shows that serum 25(OH) vitamin D levels in hypothyroid patients were substantially lower than in controls (11.15, p = 0.05) when the t-test was used to compare the two groups. When serum 25 (OH) vitamin D levels in hypothyroid individuals were compared by sex distribution, they were shown to be insignificantly lower not females than in males (t=0.383, p=0.712) (Table 2). When the two groups were compared, hypothyroid patients had significantly greater blood TSH levels than controls (t=7.800, p=.000). Table 2 shows that when blood TSH levels in hypothyroid individuals were compared by gender, there was no statistically significant difference between males and females (t= -1.192, p=.267). Serum T4 levels in controls were substantially greater than in hypothyroidism patients (t= -1.959, p=0.046). Serum T3 levels were greater in controls than in hypothyroidism patients (t= -1.262, p =0.213), but the difference was negligible.

There were substantial negative correlations between serum 25 (OH) vitamin D and TSH (r = -0.016, p0.05) in the control group, as well as a strong negative connection with T3 (r = -.311, p=0.033). It was not significantly associated with T4 in any other way. (p=0.078, r = -0.260). However, in the hypothyroid group, there were significant negative correlations between serum 25 (OH) vitamin D and TSH (r = -0.231, p0.05), as well as non-significant positive correlations with T4 and T3 (r = 0.099, r=0.014, and p= > 0.05).

Table 1: Characteristics of Cases and Control (n=94)

Parameters	Case Group	Control Group	p-value
Gender			
Male	9	12	0.41
Female	38	35	0.58
Vitamin D levels (ng/mL)	14.8 ± 2.1	44.5 ± 15.0	0.003
TSH (mIU/mL)	14.40 ± 10.60	2.0 ± 1.1	<0.001
T_3 (pg/mL)	1.10 ± 0.50	1.30 ± 1.30	0.21
T_4 (ng/dL)	7.10 ± 2.70	8.20 ± 2.20	0.04

Table 2: Association of parameters with gender distribution (n=94)

Parameters	Male	Female	p-value
Age (years)	40.90 ± 13.02	40.4 ± 13.10	0.04
TSH (mIU/mL)	16.9 ± 12.7	13.8 ± 10.1	0.26
Vitamin D levels (ng/mL)	15.0 ± 11.3	10.2 ± 8.3	0.04

DISCUSSION

The major function of vitamin D is to maintain bone and mineral homeostasis. However, it has recently been discovered that its insufficiency is linked to a variety of disorders, including autoimmune, inflammatory, and viral diseases. [4]Vitamin D insufficiency has also been linked to several musculoskeletal illnesses, diabetes, renal disease, cardiovascular disease, and infections in recent studies. [5-9]It was also recently shown that vitamin D has significant immunomodulatory effects and takes part in females without any link to sunshine exposure. The findings of this study revealed that hypothyroidism patients have significantly lower vitamin D levels than healthy people. The fact that most of the individuals in this study were females (81 percent in the case group) suggests that hypothyroidism is significantly more common in women. Our findings are in line with those of Vanderpump et al.[21]

In this study, we discovered that mean 25(OH) Vitamin D levels were lower in females than in males in the case group (10.27±8.35, 14.99±11.37 t=0.383, p=0.712) and control group (10.27±8.35, 14.99±11.37 t=0.383, p=0.712). The decline in 25(OH)Vitamin D levels in females may be linked to dress habits that result in insufficient skin exposure to ultraviolet B rays of sunshine. Sunscreen use has increased in recent years for both skin cancer protection and cosmetic purposes. These products with high sun protection factors (SPF) may cause a considerable reduction in previtamin D generation, resulting in vitamin D levels that are insufficient to protect against a variety of chronic diseases. [22]The minimal decline could, however, be ascribed to our study's small sample size. Females had lower levels of 25(OH) Vitamin D, according to Goswami et al's study, however the difference was not significant (p=>0.05). [23]

In this study, we discovered that the hypthyroid group had lower mean Vitamin D levels than the control group. In the hypothyroid group, there was likewise a negative connection between 25(OH)D and TSH (r = -0.231, p0.05). Similarly, Pallavi et al, Amal Mohammed HuseinMackawy et al, Colbay M et al, Mackawy et al, and Fawzy et al found a negative connection between TSH and vitamin D levels. [24-28]

We discovered a positive association between blood Vitamin D and T4, T3 levels in the hypothyroid group in our investigation, and Fawzy et al. observed a similar result. [28] As a result, a Vitamin D deficit may enhance the demise of thyroid follicular cells, resulting in lower thyroid hormone synthesis and, eventually, higher TSH levels. Zhang et colleagues discovered that Vitamin D is involved in thyroid hormone binding to the nuclear receptor, suggesting that a lack of Vitamin D may contribute to lower thyroid hormone levels and higher TSH levels. [29] In an experimental investigation, Byron Richards looked at the effects of vitamin D shortage on the thyroid gland and found that a lack of vitamin D related to the probability of low thyroid hormones. [30]

Patients with hypothyroidism have hypovitaminosis D, according to our findings. Furthermore, the positive significant correlation between blood vitamin D, thyroid hormones, and TSH levels, as well as the negative significant correlation with TSH levels, revealed that serum vitamin D insufficiency was strongly linked to hypothyroidism. As a result, all hypothyroid individuals should be tested for Vitamin D deficiency.

CONCLUSION

Finally, we infer that there is a link between hypothyroidism and vitamin D deficiency. The routine performance of vitamin D levels in patients with hypothyroidism may help in evaluation of multifactorial etiology of underlying cause for proper management. The small number of patients in this study may restrict its capacity to establish that vitamin D insufficiency is directly related to the pathophysiology of hypothyroidism or occurs because of hypothyroidism. As a result, further large prospective clinical trials are needed to investigate the direct impact of vitamin D in patients with thyroid problems.

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