

Correlation between Vitamin D Deficiency and Hypothyroidism in a Tertiary Care Teaching Hospital

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Abstract

Background: The correlation between TSH (Thyroid-Stimulating Hormone) levels and vitamin D levels has gained attention in research, especially in thyroid disorders. Studies suggest low vitamin D levels may be linked to higher TSH levels, indicating potential involvement in thyroid dysfunction, particularly in autoimmune thyroid diseases like Hashimoto's thyroiditis. We in the current study tried to correlate the values of TSH with Vitamin D levels in cases with hypothyroidism and euthyroid controls.

Methods: This was a cross-sectional, case-control observational study conducted at a single center. Data on demographics, clinical examinations, and laboratory investigations, including TSH and Vitamin D levels, were collected and recorded in 50 hypothyroid patients, forming the case group, and compared with 50 matched controls. Vitamin D levels and TSH levels were measured using the Chemiluminescent Microparticle Immunoassay (CLIA) with 5 ml of venous blood.

Results: A comparative analysis of TSH and Vitamin D levels between 50 hypothyroid patients (cases) and 50 euthyroid individuals (controls) revealed significant differences between the two groups. Patients with hypothyroidism exhibited significantly higher TSH levels compared to the control group. Hypothyroid patients demonstrated significantly lower Vitamin D levels compared to the control group. This finding suggests a potential association between hypothyroidism and Vitamin D deficiency.

Conclusions: The study revealed a significant prevalence of Vitamin D insufficiency in both groups, with a statistically significant higher incidence in females than males. However, Vitamin D insufficiency was not found to be significantly more common among hypothyroid patients compared to euthyroid patients in the study population.

Keywords: Hypothyroidism, Vitamin D deficiency, Correlation, Euthyroid.

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Introduction

The role of Vitamin D has significantly evolved since its discovery in the early 20th century, transitioning from being recognized as a simple vitamin to being classified as a steroid prohormone [1]. Commonly referred to as the "sunshine vitamin," Vitamin D is either obtained through diet or synthesized in the skin upon exposure to ultraviolet radiation. Vitamin D exerts its effects by binding to Vitamin D receptors (VDR), which subsequently activate VDR-responsive genes. Vitamin D receptors are found in most tissues of the body, playing a key role in calcium and phosphorus homeostasis and maintaining bone strength. Both Vitamin D and thyroid hormones interact with similar receptors known as steroid hormone receptors [1]. The discovery of VDR in various tissues outside the skeletal system has

highlighted its potential involvement in autoimmune thyroid disorders. Furthermore, VDR gene polymorphisms have been linked to autoimmune thyroid diseases.

Vitamin D has also been observed to have non-skeletal roles in autoimmune conditions, such as Hashimoto's thyroiditis, Graves' disease, Type 1 Diabetes Mellitus, Rheumatoid Arthritis, Systemic Lupus Erythematosus (SLE), and atherosclerosis [2]. Impaired Vitamin D signaling is reported to contribute to the development of thyroid disorders [3-5]. Although previous studies have indicated lower Vitamin D levels in individuals with Hashimoto's thyroiditis, research in India has shown a weaker connection between Vitamin D deficiency and hypothyroidism. The definitive role of Vitamin D in thyroid disease remains

inconclusive, prompting further investigation. Given the widespread Vitamin D deficiency in a large portion of the population and its potential role in various illnesses, coupled with the high prevalence of hypothyroidism in the community with unclear etiology in some cases, this study was conducted to explore the possible association between Vitamin D levels and hypothyroidism in this population.

Studies suggest a higher prevalence of both Vitamin D deficiency and hypothyroidism in the Indian population [3]. Despite India's abundant sunshine, Vitamin D deficiency is prevalent in 50-90% of the population. Association studies examining the relationship between low Vitamin D levels and hypothyroidism have yielded mixed results [6, 7]. Several epidemiological studies have established a link between low Vitamin D levels and autoimmune diseases, such as Type 1 Diabetes Mellitus, Rheumatoid Arthritis, Multiple Sclerosis, and Inflammatory Bowel Disease. For instance, a study conducted by Amal et al. [8] in Saudi Arabia found a significant positive correlation between serum Vitamin D and serum calcium levels. However, a study by Goswami et al. [9] in Northern India revealed only a weak association between Vitamin D deficiency and autoimmune diseases.

If conclusive evidence were established, Vitamin D supplementation could provide a cost-effective approach to managing autoimmune thyroid disorders and potentially protect against the development of thyroid conditions. However, there is a scarcity of clinical trials examining the impact of Vitamin D supplementation on thyroid function. In this context, we conducted a study to explore the association between Vitamin D levels and hypothyroidism in patients attending our Tertiary care Hospital.

Material and Methods

This prospective study was conducted in the Department of General Medicine, Prathima Institute of Medical Sciences, Naganoor, Karimnagar. Institutional Ethical approval was obtained for the study after following the protocol for human research. Written consent was obtained for the study after explaining the nature of the study in vernacular language. The method of sampling used in the study was convenient sampling.

Inclusion Criteria:

1. Cases diagnosed as hypothyroid patients.
2. Controls were euthyroid subjects.
3. Aged 18 and above
4. Male and female
5. Willing to participate in the study voluntarily.

Exclusion Criteria

1. Patients with Diabetes Mellitus,
2. Chronic Kidney Disease,
3. Connective Tissue Disorders,
4. Patients on Vitamin D supplements, and
5. Cases with malignancies.

The case group consisted of 50 consecutive patients diagnosed with hypothyroidism and undergoing treatment. The control group also included 50 euthyroid participants, with normal TSH values. Both groups were matched for age, sex, and occupation (categorized as indoor or outdoor work). The research protocol was thoroughly explained, and written informed consent was obtained from both the case and control groups. Data on demographics, clinical examinations, and laboratory investigations, including TSH and Vitamin D levels, were collected and recorded in a proforma. Blood samples of 5mL were collected. The serum TSH is analyzed using an immunoassay method, commonly Chemiluminescent Immunoassay (CLIA). Vitamin D levels were measured using the Chemiluminescent Microparticle Immunoassay (CLIA). Vitamin D deficiency was defined as levels below 10 ng/ml, insufficiency as levels between 10 and 30 ng/ml, and sufficiency as levels above 30 ng/ml. The following data were gathered: age, gender, religion, occupation (indoor or outdoor), presence or absence of thyroid swelling, TSH values, Vitamin D levels, and hormone replacement dosage in hypothyroid patients.

Statistical Analysis: Data were collected in Excel format and analyzed using SPSS version 22 in Windows formats. The continuous variables were represented as mean, standard deviation, and categorical variables were calculated by chi-square test with p values (<0.05) considered as significant.

Results

A total of 50 cases of hypothyroidism and 50 age and sex-matched controls were included in the study. Table 1 represents the age and Sex distribution of cases included in the study. The table presents data on the relationship between vitamin D deficiency and hypothyroidism, categorized by age group and sex. Across all age groups, the number of females with hypothyroidism (cases) is significantly higher than males. This suggests a higher prevalence of hypothyroidism in women. The number of cases (hypothyroidism) tends to increase with age, especially in the 40-50 and 51-60 age groups for both males and females. This indicates a potential correlation between age and the development of hypothyroidism. While the total number of cases and controls is equal (50 each), the distribution within each age group and sex category is uneven although not statistically significant.

Table 1: Age and sex Distribution of correlation between Vitamin D Deficiency and Hypothyroidism

Age group in years	Cases			Controls		
	Male	Female	Total	Male	Female	Total
18 - 30	2	5	7	1	3	4
31 - 40	3	10	13	4	10	14
40 - 50	2	15	18	6	12	18
51 - 60	3	10	13	4	10	14
Total	10	40	50	15	35	50

Figure 1: The median is significantly higher in the "Cases" group compared to the "Controls" group. This indicates that the central tendency of TSH levels is elevated in the cases. The range of TSH levels is broader in the "Cases" group compared to

the "Controls". This suggests a higher degree of variability in TSH levels among the cases.

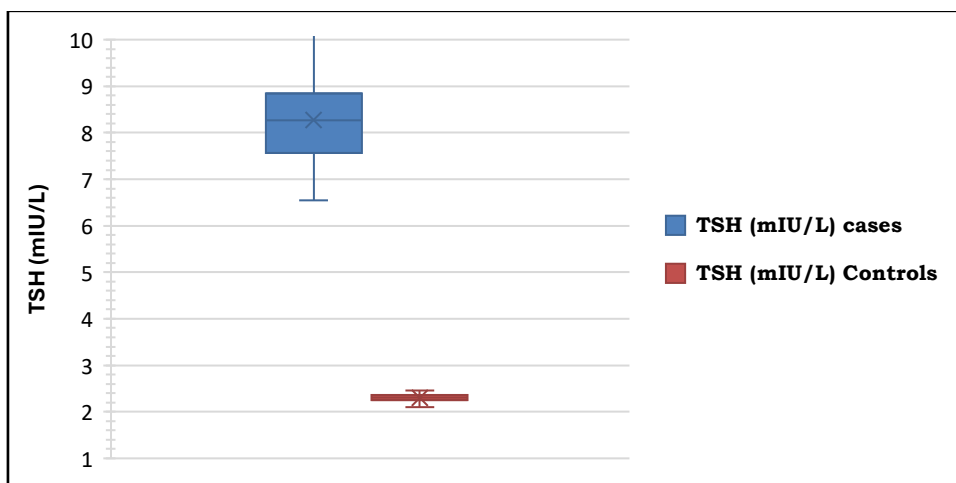


Figure 1: Box and whisker plot showing the levels of TSH in Case and control

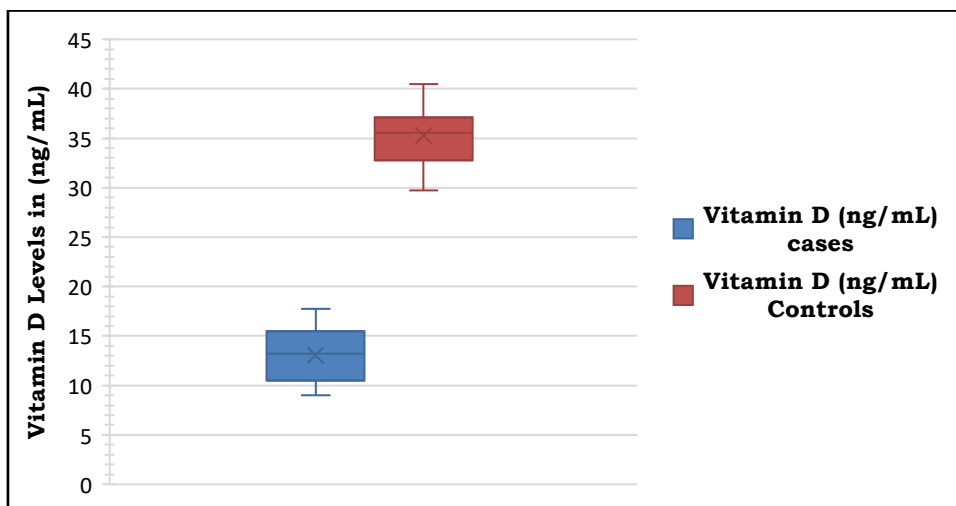


Figure 2: Box and whisker plot showing the levels of Vitamin D in Case and control

Figure 2 shows the median Vitamin D level is significantly higher in the "Controls" group compared to the "Cases" group. The range of Vitamin D levels (represented by the whiskers and box) is broader in the "Controls" group compared to the "Cases". This suggests a higher degree of variability in Vitamin D levels among the controls.

The figure clearly shows that individuals in the "Cases" group exhibit significantly lower Vitamin D levels compared to the "Controls" group. This finding suggests an association between lower Vitamin D levels and the condition represented by the "Cases" group.

Table 2: Correlation between TSH and Vit D among cases and controls

Parameters	Cases	Controls
TSH (mIU/L)	8.27 ± 0.93	2.30 ± 0.08
Vitamin D (ng/mL)	13.41 ± 2.7	35.29 ± 2.85
Coefficient correlation (r)	-0.07	-0.227

Table 2 shows significantly higher TSH levels in cases (8.27 mIU/L) compared to controls (2.30 mIU/L). This suggests a potential association between hypothyroidism (represented by cases) and elevated TSH levels. Vitamin D levels are considerably lower in cases (13.41 ng/mL) compared to controls (35.29 ng/mL). The correlation coefficients (r) are negative for both cases (-0.07) and controls (-0.227), indicating an inverse relationship between TSH and Vitamin D levels. This means that higher TSH levels tend to correspond with lower Vitamin D levels, and vice versa.

Discussion

The results of the present study showed that a large number of patients had inadequate vitamin D levels. The results also showed that females had a higher rate of vitamin D deficiency as compared to males, and the difference was statistically significant. They also found out that hypothyroid and euthyroid patients have lower vitamin D levels with the worst rate being in middle-aged adults. Likewise, the cross-sectional research done by Rajeev et al also observed that most hypothyroid patients had serum Vitamin D levels less than 20 ng/mL endorsing the current study. This could be due to a lack of adequate vitamin D in the diet, little movement, and restricted sun exposure. Surprisingly, deficiency of vitamin D is still a significant problem in India, even if the sun exposure in the country is rather high. A progressive decline in the levels of vitamin D is evident and a trend observed among females than males which is consistent with studies conducted in India [4, 5, 10, 11].

In the present study as in the previously published literature, a strong significant negative correlation between serum vitamin D and TSH was observed. Kim et al. whose study was conducted in 2016 indicated that patients with autoimmune thyroid disease have lower vitamin D levels coinciding with high TSH levels Kim et al. [12] thus, the decreased levels of the vitamin may lead to a worsening of the hypothyroid state by causing an increase in TSH and subsequent thyroid dysfunction. This is even though vitamin D is a potent immunomodulator that tends to suppress immune responses, particularly in autoimmune conditions such as hypothyroidism with elevated levels of anti-TPO Ab's, as seen in Hashimoto's thyroiditis [13]. Chaudhary et al. [14] observed that vitamin D positively helped in decreasing the anti-

TPO antibody levels, which may make vitamin D possess therapeutic benefits for autoimmune thyroid disorders.

The ways by which vitamin D impacts thyroid function may be about gene regulation and immunity. There are receptors of vitamin D in thyroid tissues, and vitamin D in sufficient amounts in the blood may affect the secretion of thyroid hormones besides the regulation of immunity processes [15]. Furthermore, there is possible vitamin D action to reduce autoimmune reactions which might cause thyroid disorder [16].

Kim et al. [2] as well as Priya et al. [17] strictly enhanced the thesis that a low level of vitamin D will lead to an increased level of TSH, which proves that vitamin D deficiency may make hypothyroid conditions worse. Additionally, therefore, Wang et al. [18] supported their meta-analysis by pointing out that AITD patients exhibited significantly depleted levels of vitamin D as compared to the controls and, thereby, established a strong link between vitamin D status and thyroid health further. However, Vieira et al. [19] discussed this association more elaborately about the fact that, although many published articles confirm that the two are linked, several research articles have also shown no relationship between blood levels of Vitamin D and thyroid hormones in some populations, which warrants more extensive investigations to unravel such contradictions [19]. A significant number of patients in both groups exhibited vitamin D insufficiency. There was a statistically significant difference, with females showing a higher prevalence of vitamin D deficiency compared to males. However, our study found that vitamin D insufficiency was not significantly more prevalent among hypothyroid patients compared to euthyroid patients.

Conclusion

The present study found that Individuals with hypothyroidism (cases) exhibited significantly higher TSH levels compared to the control group. The cases group demonstrated significantly lower Vitamin D levels compared to the control group. There appears to be a significant association between hypothyroidism (represented by the "Cases" group) and both elevated TSH levels and lower Vitamin D levels. Further research is warranted to elucidate the exact nature of the relationship between these variables and to explore

the potential therapeutic implications of Vitamin D supplementation in hypothyroid patients.

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