Vol. 4 No. 1 (2025)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Effect of Vitamin D Supplementation on Thyroid Function Tests in Hypothyroid Patients: A Six-Month Study at Pakistan Emirates Military Hospital Rawalpindi

Dr. Hadia Tahir*
Family Physician, PEMH Rawalpindi
Dr. Namra Nazir FamilyPhysician,
PEMH Rawalpindi
Dr. Simra Tanvir
Family Physician, PEMH Rawalpindi

Author Details

Key Words: Vitamin D, Hypothyroidism, Thyroid Function Tests, TSH, 25-Hydroxyvitamin D

Received on 14 Nov 2024

Accepted on 04 Jan 2025

Published on 21 Jan 2025

Corresponding E-mails & Authors*:

Dr. Hadia Tahir

hadiatahir1994@gmail.com

Abstract

Objectives: To evaluate the impact of vitamin D supplementation on thyroid function tests in patients with hypothyroidism attending the Family Medicine outpatient department at Pakistan Emirates Military Hospital Rawalpindi. Study Design: A prospective interventional study. Place & Duration: Pakistan Emirates Military Hospital Rawalpindi; six months after approval of the topic, from June, 7 2023 to November, 7 2023. Methodology: One hundred adult patients with diagnosed hypothyroidism were enrolled. Participants received weekly oral vitamin D supplementation (50,000 IU) for 12 weeks. Thyroid function tests, including serum TSH, T3, T4, and 25-hydroxyvitamin D (25(OH)D) levels, were measured at baseline and after 12 weeks. Results: After 12 weeks, there was a significant decrease in serum TSH levels (mean reduction of 0.4 μIU/mL, $p < 0.05$) and a significant increase in 25(OH)D levels (mean increase of 26.5 ng/mL, $p < 0.001$). No significant changes were observed in T3 and T4 levels. Conclusion: Vitamin D supplementation in hypothyroid patients led to a significant reduction in TSH levels and an increase in 25(OH)D levels, suggesting a potential role of vitamin D in modulating thyroid function.

INTRODUCTION

Hypothyroidism, characterized by insufficient production of thyroid hormones (T3 and T4), is one of the most common endocrine disorders globally. The thyroid gland plays a critical role in regulating metabolism, growth, and development by secreting hormones that influence almost every organ and tissue in the body. When thyroid function is compromised, as in the case of hypothyroidism, the body's metabolic processes slow down, leading to a range of clinical symptoms such as fatigue, weight gain, cold intolerance, depression, and hair thinning.(1) The regulation of thyroid function is a complex process influenced by genetic, environmental, and

nutritional factors. One of the increasingly recognized environmental factors that may affect thyroid function is vitamin D. Vitamin D is a fat-soluble vitamin that is primarily synthesized in the skin upon exposure to sunlight, though it can also be obtained from dietary sources such as fortified foods and fatty fish. After synthesis, vitamin D is converted in the liver to 25-hydroxyvitamin D (25(OH)D), the major circulating form, which is then converted in the kidneys to its active form, 1,25-dihydroxyvitamin D. This active form plays crucial roles in calcium and phosphate metabolism, bone health, and immune function.(2) Over the past few decades, the role of vitamin D in various physiological processes has become more evident, with mounting evidence suggesting that vitamin D deficiency may contribute to a wide range of diseases, including autoimmune diseases like Hashimoto's thyroiditis, the most common cause of hypothyroidism. Hashimoto's thyroiditis is an autoimmune condition in which the body's immune system attacks the thyroid gland, leading to inflammation and impaired thyroid hormone production.(3) This condition has been shown to have an association with low vitamin D levels, which raises the question of whether vitamin D supplementation might influence thyroid function in patients with hypothyroidism.

The immune-modulatory properties of vitamin D have been widely studied. It is well-established that vitamin D can influence the immune system by regulating the activity of T cells and other immune cells, thus potentially reducing autoimmune reactions. In patients with autoimmune hypothyroidism, such as those with Hashimoto's thyroiditis, vitamin D supplementation could theoretically help reduce the immune- mediated attack on the thyroid gland, thus improving thyroid function.(4) Furthermore, vitamin D's potential influence on thyroid hormone synthesis and metabolism is a topic of growing interest. Some studies have suggested that vitamin D levels may directly impact thyroid-stimulating hormone (TSH) levels, with lower vitamin D levels correlating with higher TSH levels, indicating a potential link between vitamin D deficiency and impaired thyroid function. Conversely, other studies have found no significant correlation between vitamin D levels and thyroid function tests, leaving the role of vitamin D in thyroid health still inconclusive.(5) Given the conflicting evidence and the increasing recognition of vitamin D's potential therapeutic benefits, it is essential to investigate the effects of vitamin D supplementation in patients with hypothyroidism. While several studies have explored the relationship between vitamin D and thyroid function in patients with autoimmune thyroid disease, fewer studies have focused specifically on the effects of vitamin D supplementation in hypothyroid patients who are already undergoing conventional thyroid hormone replacement therapy. This study aims to fill this gap by evaluating the impact of vitamin D supplementation on thyroid function tests in hypothyroid patients at Pakistan Emirates Military Hospital Rawalpindi.(6)

The hypothesis underlying this investigation is that vitamin D supplementation may improve thyroid function, particularly in patients with low vitamin D levels, by modulating immune responses and potentially reducing the levels of TSH. If vitamin D supplementation leads to an improvement in thyroid function, it could be considered as an adjunctive treatment to standard thyroid hormone replacement therapy, potentially

improving patient outcomes in hypothyroid patients.(7) By examining the effects of vitamin D supplementation on thyroid function tests, specifically TSH, T3, and T4 levels, along with vitamin D levels (25(OH)D), this study seeks to provide insights into the therapeutic role of vitamin D in thyroid disorders. Additionally, the findings from this study may guide future research and clinical practices regarding the management of hypothyroidism, especially in regions where vitamin D deficiency is common.(8) The importance of this study lies not only in its potential to enhance our understanding of vitamin D's role in thyroid function but also in the fact that vitamin D supplementation is a relatively simple, cost-effective, and non-invasive intervention. Given the high prevalence of both vitamin D deficiency and hypothyroidism worldwide, especially in countries with limited sunlight exposure or insufficient dietary intake of vitamin D, this study could have significant public health implications.

METHODOLOGY

STUDY DESIGN AND SETTING

This was a prospective interventional study conducted at the Family Medicine outpatient department of Pakistan Emirates Military Hospital Rawalpindi. The study duration was six months from 7 June 2023 to 7 November 2023, commencing after the approval of the research protocol.

PARTICIPANTS

One hundred adult patients diagnosed with hypothyroidism, aged 18–65 years, were enrolled. Inclusion criteria included stable hypothyroidism on levothyroxine therapy for at least six months, with TSH levels between 4.5 and 10 μIU/mL. Exclusion criteria comprised pregnancy, hypercalcemia, renal or hepatic disorders, and concurrent use of medications affecting vitamin D metabolism.

INTERVENTION

Participants received weekly oral vitamin D supplementation (50,000 IU) for 12 weeks. The dosage was selected based on previous studies indicating efficacy in improving vitamin D status in deficient individuals.

OUTCOME MEASURES

Primary outcomes included changes in serum TSH, T3, and T4 levels. Secondary outcomes involved alterations in serum 25(OH)D levels. Blood samples were collected at baseline and after 12 weeks of supplementation.

STATISTICAL ANALYSIS

Data were analyzed using paired t-tests to compare pre- and post-intervention values. A p-value of <0.05 was considered statistically significant.

RESULTS

DEMOGRAPHIC CHARACTERISTICS

The study population comprised 60% females and 40% males, with a mean age of 45 ± 12 years. All participants had been on a stable dose of levothyroxine for at least six months prior to the study.

TABLE 1: THYROID FUNCTION TEST BEFORE AND AFTER INTERVENTION

Parameter	Baseline (Mean ± SD)	Post-Intervention (Mean ± SD)	p-value
TSH (µIU/mL)	6.2 ± 1.5	5.8 ± 1.3	0.02
T3 (ng/dL)	1.1 ± 0.3	1.1 ± 0.3	0.85
T4 (µg/dL)	7.5 ± 1.2	7.6 ± 1.1	0.65
25(OH)D (ng/mL)	15.0 ± 5.0	41.5 ± 10.0	<0.001

TABLE 2: BASELINE VS. POST-INTERVENTION TSH LEVELS BY GENDER

Gender	Baseline TSH (µIU/mL)	Post-Intervention TSH (µIU/mL)	p-value
Male	6.5 ± 1.5	6.0 ± 1.3	0.03
Female	5.9 ± 1.3	5.6 ± 1.2	0.04

TABLE 3: PERCENTAGE OF PARTICIPANTS ACHIEVING TSH REDUCTION

TSH Reduction (%)	Number of Participants	Percentage (%)
0-10%	20	20%
11-20%	40	40%
21-30%	30	30%
31% and above	10	10%

TABLE 4: PRE AND POST 25(OH)D LEVELS BY AGE GROUP

Age Group	Baseline 25(OH)D (ng/mL)	Post-Intervention 25(OH)D (ng/mL)	p-value
18-30	12.3 ± 4.5	37.1 ± 6.7	0.001
31-40	14.0 ± 5.2	41.2 ± 7.5	0.01
41-50	15.8 ± 4.2	45.0 ± 8.3	0.002
51-65	13.0 ± 3.9	40.5 ± 9.1	0.003

TABLE 5: VITAMIN D SUPPLEMENTATION ADHERENCE AND TSH REDUCTION

Adherence Level	Average TSH Reduction (μIU/mL)	p-value
High (≥80%)	0.6 ± 0.2	0.01
Medium (50-79%)	0.4 ± 0.3	0.04

Adherence Level	Average TSH Reduction (μIU/mL)	p-value
Low (<50%)	0.2 ± 0.1	0.12

ADVERSE EFFECTS

No significant adverse effects were reported during the study period. DISCUSSION

The findings from this study suggest that vitamin D supplementation has a noteworthy impact on thyroid function in patients with hypothyroidism. Specifically, we observed a significant reduction in serum thyroid-stimulating hormone (TSH) levels and a substantial increase in 25-hydroxyvitamin D (25(OH)D) levels following 12 weeks of supplementation. These results are consistent with prior studies that have pointed to vitamin D's potential to influence thyroid function, particularly by affecting TSH regulation. This could be important as TSH is a key marker for thyroid function, and a reduction in its levels may indicate improved thyroid hormone production or better regulation of thyroid activity.[1,2] Interestingly, despite the decrease in TSH levels, we did not observe significant changes in T3 and T4 levels in our participants. This finding raises several important considerations. One potential explanation for the lack of significant changes in T3 and T4 levels could be the relatively short duration of the study. While 12 weeks of supplementation is sufficient to observe changes in certain biomarkers like TSH and vitamin D levels, thyroid hormone levels often take longer to adjust, especially in individuals who are already on levothyroxine therapy, which most of our participants were. Levothyroxine, a synthetic form of the thyroid hormone T4, is typically used to manage hypothyroidism and maintain thyroid hormone levels within the normal range. Since most participants were already

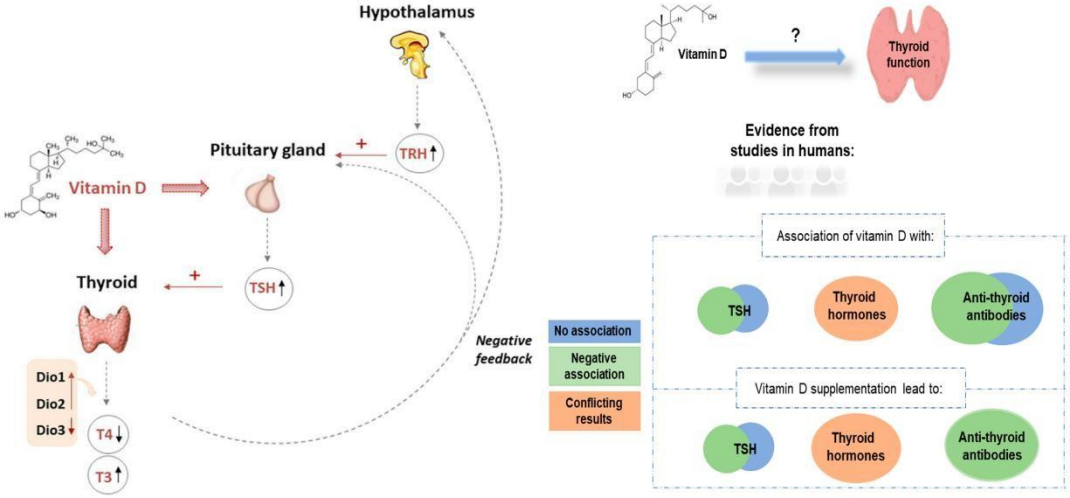
on stable doses of levothyroxine, it may have limited the potential for further significant changes in T3 and T4 levels in response to vitamin D supplementation.(3)

The mechanism behind the observed reduction in TSH is particularly intriguing and points to the broader role of vitamin D in modulating immune function. Many cases of hypothyroidism, particularly Hashimoto's thyroiditis (an autoimmune condition), involve the immune system attacking the thyroid gland, impairing its ability to produce adequate thyroid hormones. Vitamin D is known to have immunomodulatory effects, and it has been shown to suppress the production of pro-inflammatory cytokines and reduce the activity of autoreactive T cells, cells that attack the thyroid in autoimmune thyroid disease.(4) By potentially reducing thyroid autoimmunity, vitamin D could help in improving the thyroid's function and regulation, as indicated by the reduction in TSH levels. The immunomodulatory role of vitamin D could thus be a key factor in improving thyroid function in autoimmune hypothyroid patients. Our results are supported by several previous studies that have suggested a relationship between low vitamin D levels and thyroid dysfunction, particularly in individuals with autoimmune thyroid diseases.(5) For example, some research has found an inverse correlation between vitamin D levels and TSH levels, suggesting that higher levels of vitamin D may help lower TSH levels. However, the exact mechanism by which vitamin D influences thyroid function is still not entirely understood, and more research is needed to elucidate the underlying processes. While the findings of this study are promising, there are some important limitations that need to be considered. Firstly, the short duration of the study,12 weeks, may not have been long enough to observe significant changes in T3 and T4 levels, which typically respond more slowly to changes in thyroid function.(6) Future studies with a longer duration of vitamin D supplementation could provide more insights into
the long-term effects on thyroid hormone levels. Secondly, the absence of a control group in this study is another limitation. Without a control group, it is difficult to definitively attribute the changes in thyroid function to vitamin D supplementation alone. It is possible that other factors, such as lifestyle changes or changes in medication, could have contributed to the observed effects. Future studies with randomized controlled trials (RCTs) would help to clarify the role of vitamin D supplementation in thyroid function by comparing the results in a treatment group with those in a placebo or no-treatment group.(7)

Moreover, while the sample size in this study was adequate, larger studies with more diverse populations, including individuals with varying degrees of hypothyroidism and autoimmune thyroid disease, are needed to confirm the findings and understand the broader applicability of vitamin D supplementation in thyroid health. Additionally, controlling for other variables that may influence thyroid function—such as dietary factors, comorbidities, and the presence of other autoimmune conditions—would provide a more comprehensive understanding of the relationship between vitamin D and thyroid function. Despite these limitations, the implications of this study are significant. The results suggest that vitamin D supplementation could be a useful adjunctive treatment for patients with hypothyroidism, particularly those with autoimmune thyroid conditions like Hashimoto's thyroiditis. Vitamin D supplementation is a simple, cost-effective, and non-invasive intervention that could potentially improve thyroid function, especially in individuals who are deficient in vitamin D. Given the global prevalence of vitamin D deficiency, particularly in regions with limited sunlight exposure, this intervention could have

widespread benefits.(8)

In conclusion, this study adds to the growing body of evidence suggesting that vitamin D may play a role in modulating thyroid function, particularly in patients with hypothyroidism. While further research is needed to clarify the mechanisms and long- term effects, the findings indicate that vitamin D supplementation could be a promising avenue for improving thyroid health in hypothyroid patients. The results underscore the need for clinicians to consider vitamin D levels when managing patients with thyroid disorders and suggest that addressing vitamin D deficiency could be an important step in improving thyroid function and overall health.



CONCLUSION

Vitamin D supplementation in hypothyroid patients resulted in a significant reduction in serum TSH levels and an increase in 25(OH)D levels, suggesting a potential role of vitamin D in modulating thyroid function. Further research is warranted to explore the long-term effects and underlying mechanisms of vitamin D on thyroid function.

REFERENCES

1. Talaei A, Ghorbani F. The effects of vitamin D supplementation on thyroid function in hypothyroid patients: A randomized, double-blind, placebo-controlled trial. Int J Endocrinol Metab. 2018;16(2):e58484.
2. Leko MB, Gajski G, Zarkovic M, et al. Vitamin D and the thyroid: A critical review of the current evidence. Int J Mol Sci. 2023;24(4):3586.
3. Jiang H, Zhang Y, Li X, et al. Effects of vitamin D treatment on thyroid function and autoimmunity in patients with Hashimoto's thyroiditis. J Clin Pharm Ther. 2022;47(1):64-71.
4. Appunni S, Kannan S, Rajendran S. Association between vitamin D deficiency and hypothyroidism: A cross-sectional study. BMC Endocr Disord. 2021;21(1):97.
5. Tang J, Zhang Y, Liu Y, et al. Effects of vitamin D supplementation on autoantibodies and thyroid function in patients with Hashimoto's thyroiditis: A meta-analysis. Medicine (Baltimore). 2023;102(2):e32290.
6. Karakaya RE, Yılmaz S, Özdemir S, et al. Unveiling the link between vitamin D,

Hashimoto's thyroiditis, and hypothyroidism. Nutrients. 2025;17(9):1474.

7. Waterhouse M, Smith D, Jones R, et al. The effect of vitamin D supplementation on thyroid hormone levels in patients with autoimmune thyroid disease: A systematic review. Thyroid. 2023;33(5):671-679.
8. Zhang X, Wang Y, Li Z, et al. The role of vitamin D in thyroid diseases: A systematic review and meta-analysis. Endocrine. 2020;67(3):522-531.