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Prevalence of Hypovitaminosis D in Hypothyroid Patients in Tertiary Care Hospital of Bihar.

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KEYWORDS
Hypothyroidism, Vitamin D deficiency, Thyroid function, Free T3, TSH, Free T4, anti-TPO, Bihar, autoimmune thyroid disease, cross-sectional study.

ABSTRACT:

Background: Globally, hypothyroidism, an endocrine disorder linked to metabolic abnormalities, is rising. The association between vitamin D insufficiency and thyroid dysfunction is unclear, but it has been suggested. Indian researchers, especially in Bihar, where hypothyroidism and vitamin D deficiency are common, need to study the relationship.

Objective: At Patna's Indira Gandhi Institute of Medical Sciences (IGIMS), researchers investigated whether hypothyroid patients' vitamin D levels affected thyroid function. We measured free thyroxine (FT3), free ferritin (FT4), and thyroid-stimulating hormone (TSH).

Methods: A six-month hospital-based cross-sectional observational study included 75 hypothyroid patients aged 18–70. Patient data came from outpatient and inpatient departments. Morning blood samples (10 ml) were taken to test Vitamin D and thyroid function (FT4, FT3, TSH, and anti-TPO). Statistical analysis included correlation and association tests such as Chi-square and t-tests.

Results: Among the 75 participants, 58% had a deficiency in Vitamin D, 34% had insufficiency, and only 8% had sufficient Vitamin D levels. An important positive correlation was found among low Vitamin D levels and elevated TSH ($p < 0.05$). Additionally, higher anti-TPO antibody levels were found in Vitamin D deficient patients, suggesting a potential autoimmune link. Deficiency of Vitamin D was more predominant amongst those with more severe hypothyroidism.

Conclusion: The outcomes of this study recommend an important association between hypothyroidism and Vitamin D deficiency. Routine Vitamin D screening in hypothyroid-affected people may be beneficial, especially in regions with a high incidence of deficiency.

INTRODUCTION

Worldwide, people are suffering from vitamin D insufficiency. Over one billion individuals do not get enough vitamin D [1, 2]. The regulation of phosphorus and calcium metabolism is the primary biological action of vitamin D. From its original function as a vitamin to its current status as a steroid pro-hormone, our understanding of vitamin D's function has expanded since its discovery. Its role in immune system regulation, bone and muscle formation, and other processes has recently come to light. Inflammatory bowel disease (IBD), Multiple Sclerosis (MS), type 1 diabetes (T1DM), vitamin D deficiency, and Rheumatoid Arthritis (RA) are all autoimmune illnesses, and research has demonstrated that taking vitamin D supplements can stop these diseases in their tracks [4]. In most cases,

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hypothyroidism develops as a result of Hashimoto's thyroiditis; the prevalence of this condition tends to rise with age, and women are eight to fifteen times more likely to develop it than men. [5]. Serum vitamin D3 metabolites are higher in people with hypothyroidism.

Vitamin D is being studied for its potential anti-inflammatory and anti-proliferative effects and its link to various medical conditions [6,7]. The immune system and anti-inflammatory responses are both boosted by vitamin D because of its direct and indirect effects on cytokine production inhibition [8]. The primary way to get vitamin D is to be exposed to UVB light, which ranges from 290 to 320 nm. In the classical endocrine pathway, 1, 25 dihydroxy vitamin D is created when vitamin D is assured to a D-binding protein and enters the bloodstream in the liver to 25(OH) D. The last step in this process happens in the kidneys [9]. The most commonly used serum 25(OH) D measure, vitamin D position, reflects the combined effects of cutaneous synthesis and is the richest mingling precursor of active vitamin D [10]. Parathyroid hormone, calcium, and phosphate strongly influence vitamin D, which has a short life span in circulation [11]. In addition, a severe vitamin D deficiency may not be noticeable until serum 1, 25-(OH) 2D levels are lower [12]. Therefore, vitamin D reserve is evaluated by measuring the 25(OH) level. An adequate amount of 25(OH)D is 30–32 ng/mL, an inadequate level is 20–29 ng/mL, and a severe vitamin D shortage is specified by levels below 12 ng/mL.in [13]. There is a lack of research on the following topics: the requirement of screening vitamin D levels in all patients with hypothyroidism, whether vitamin D is a reason or an effect of hypothyroidism, and in case there is a statistical relation between hypothyroidism and vitamin D levels. The normal range for TSH, FT3, and FT4 is 0.48–6.30 mU/l, 3.39–5.82 pmol/l, and 9.00–17.15 pmol/l, respectively, according to reference [14].

Studies linking vitamin D deficiency to thyroid issues have increased. Multiple studies have found conflicting results on vitamin D's thyroid function benefits. South Indian researchers studied vitamin D and hypothyroidism [15]. According to research, hypothyroidism patients, particularly individuals with autoimmune thyroid diseases, had low vitamin D levels. High TSH and anti-TPO antibodies may increase thyroid dysfunction risk, and vitamin D deficiency may worsen it, according to the study. Although more controlled trials were needed to prove causation, the authors recommended vitamin D supplementation for hypothyroidism. [16] examined how vitamin D affected thyroid hormone regulation in 250 Eastern European hypothyroidism patients. Their investigation found lower vitamin D levels related to higher TSH levels. Researchers hypothesized that vitamin D might modulate immune responses, especially in autoimmune thyroiditis, and that restoring vitamin D levels may improve thyroid function. Multiple global studies support Ashok T and Sulejmanovic M's findings that hypothyroidism is linked to low vitamin D levels. [17] find that hypothyroid people with lower vitamin D levels had increased anti-TPO antibody levels in the US. This suggests that vitamin D deficiency may cause autoimmune thyroid disease. In a Chinese study, low vitamin D levels were linked to abnormal thyroid function, especially in older people. However, these findings do not explain how vitamin D affects thyroid function.

Numerous international studies have examined vitamin D deficiency and hypothyroidism, but more is needed about Bihar, India. Most studies have been conducted in Western and Southern India and other countries with diverse genetic, environmental, and dietary factors. Bihar, a state with high malnutrition rates and low sun exposure due to geography and cultural nutritional habits, needs to learn more about vitamin D deficiency and thyroid function. Current research focuses on vitamin D and hypothyroidism rather than Bihar-specific factors like socioeconomic status, healthcare accessibility, and local eating habits. Regional investigations are essential to determine the causes of this group's vitamin D inadequacy and thyroid dysfunction. This study examines Bihar hypothyroid patients' thyroid function and vitamin D levels to fill this knowledge gap. The results may inform local healthcare providers, improving patient care and solving their problems.

Materials and Method

Study Design

This is an observational cross-sectional study that was done at a hospital to find out how common hypovitaminosis D is in people who have hypothyroidism.

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Study Setting

The research occurred at the IGIMS Department of General Medicine in Patna, India.

Study Duration

Over six months, the investigation was done.

Sample Size

Seventy-five hypothyroid individuals matched the criteria and were enrolled.

Inclusion Criteria:

1. Recognised hypothyroidism cases, regardless of their treatment status.

2. Patients between the ages of 18 and 70.

3. Patients who are ready to contribute and offer signed knowledgeable consent.

Exclusion Criteria

1. Patients on Vitamin D supplementation or with a history of Vitamin D supplement.

2. Pregnant or breast-feeding women.

3. Patients are unwilling to provide consent.

Data Collection

People from the outpatient department (OPD) and the inpatient department (IPD) of the General Medicine Department at IGIMS, Patna, were asked to participate. Recruitment was done based on the study's set criteria for participating and not participating. Each participant's medical history was written down, including demographic information, clinical findings, and previous therapies. Before they were enrolled in the investigation, each patient gave their written permission.

Sample Collection

In the morning, 10 milliliters of venous blood were collected from each subject using rigorous aseptic procedures to prevent contamination and guarantee the sample's integrity. Yellow-topped serum separating tubes and plain vacutainers collected blood from a large peripheral vein. Serum vitamin D levels were quantified using biochemical assays to ascertain the 25(OH)D concentration. Thyroid function parameters, with FT3, FT4, TSH, and anti-thyroid peroxidase antibodies, were measured throughout our routine laboratory tests.

Parameters Assessed

From the serum 25(OH) D levels, vitamin D stages are divided as either sufficient or deficient. Standard laboratory techniques evaluate thyroid function parameters with FT3, TSH, FT4, and anti-TPO levels.

Results

Patient Demographics

The study included 75 hypothyroid-affected people, with a mean age of 45.2 ± 12.4 and a range of ages from 18 to 70. The cohort was composed of 60% women (n = 45) and 40% men (n = 30), which is indicative of the higher prevalence of hypothyroidism among females.

Table 1: Patient Demographics

Parameter	Mean ± SD / Proportion	Range / Observations
Age (years)	45.2 ± 12.4	18–70
Gender Distribution	60% female; 40% male	-

Vitamin D Levels

Vitamin D levels were categorized as sufficient, insufficient, or deficient based on serum 25(OH)D levels.

Table 2: Vitamin D Levels

Vitamin D Category	Proportion (%)	Number of Patients (n)
Deficient (<20 ng/ml)	52%	39
Sufficient (≥30 ng/ml)	12%	9
Insufficient (20–29 ng/ml)	36%	27

The majority of hypothyroid patients had a Vitamin D deficiency (52%), followed by insufficiency (36%), while only a small proportion (12%) exhibited sufficient levels. This highlights the prevalence of Vitamin D inadequacy in the hypothyroid population. Patients with severe hypothyroidism (elevated TSH levels and low FT3/FT4) predominantly exhibited Vitamin D

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deficiency, indicating a potential association between Vitamin D status and thyroid dysfunction severity.

Thyroid Profile

The thyroid function tests revealed the following mean values:

Table 3: Thyroid Profile

Parameter	Mean ± SD	Range
TSH (μIU/ml)	9.8 ± 3.5	3.5–25
FT3 (pg/ml)	2.4 ± 0.6	1.0–3.9
FT4 (ng/dl)	0.8 ± 0.2	0.4–1.2
Anti-TPO Antibodies	Elevated in 48%	-

The thyroid profile reveals elevated TSH levels (mean 9.8 μIU/ml) among the study participants, reflecting hypothyroidism. Reduced FT3 and FT4 values and elevated anti-TPO antibodies in nearly half the participants suggest a strong autoimmune component in this cohort.

Statistical Analysis

A significant reverse correlation was practical among Vitamin D levels and TSH values ($r = -0.52$, $p < 0.01$), signifying that lesser Vitamin D levels are related to advanced TSH levels. Similarly, positive connections were noted between Vitamin D and FT3/FT4 levels ($r = 0.45$, $p < 0.05$). Chi-square examination revealed a substantial correlation between the presence of elevated anti-TPO antibodies and Vitamin D deficiency ($p < 0.05$), signifying that Vitamin D insufficiency is a contributing factor to autoimmune thyroid disorders.

Discussion

This study offers important insights into the connection between Vitamin D deficiency and hypothyroidism. The findings align with several previous studies highlighting the high occurrence of deficiency in Vitamin D in people with hypothyroidism. For instance, a study by [18] demonstrated that over 50% of hypothyroid patients had deficient Vitamin D levels, consistent with our finding of 52% deficiency among the participants. Similarly, studies in other populations have also noted a connection between low Vitamin D levels and autoimmune thyroid dysfunction, particularly in patients with raised anti-TPO antibodies.

Exploration of Hypothesis

A significant aspect of this research is the exploration of deficiency with Vitamin D, which is a cause of hypothyroidism. While the cross-sectional design limits causal inference, potential mechanisms can be discussed. Vitamin D is critical in immune regulation, suppressing inflammatory cytokines, and modulating T-cell responses. Deficiency in Vitamin D may exacerbate autoimmune processes, as seen in Hashimoto's thyroiditis, which was prevalent in our cohort, evidenced by elevated anti-TPO antibodies in 48% of participants. Conversely, hypothyroidism may impair Vitamin D metabolism due to altered enzymatic activity in the liver and kidneys, where Vitamin D is hydroxylated to its active form.

Potential Mechanisms Linking Vitamin D to Thyroid Function

Vitamin D is identified to control the expression of immune-related genes, which may directly or indirectly influence thyroid function. Vitamin D receptors in thyroid tissue suggest that sufficient Vitamin D levels are necessary for optimal thyroid gland functioning. Deficiency may lead to dysregulated thyroid hormone synthesis or exacerbate inflammatory responses in autoimmune thyroid disorders. Moreover, Vitamin D insufficiency might impair calcium homeostasis, further influencing thyroid health.

Clinical Implications

The outcomes recommend that vitamin D status be considered in hypothyroidism treatment. Routine screenings can uncover deficiency of vitamin D in hypothyroidism patients, allowing early treatment. Vitamin D supplementation may improve bone health, hypothyroid symptoms, and autoimmune burden in deficiency of vitamin D patients. Vitamin D deficiency and hypothyroidism are common in the area, so hypothyroid patients should be checked regularly. Early detection and correction of deficiency may improve health and alter thyroid disorders. Health could be enhanced by Bihar public health campaigns to reduce vitamin D deficiency by encouraging people to eat fortified foods and get enough sun safely.

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Strengths and Limitations

The study's advantages include its comprehensive vitamin D and thyroid evaluation and focus on one patient group. However, significant constraints exist. A limited sample size (n=75) makes generalizing results to larger populations hard. This study is cross-sectional, so we cannot conclude that hypothyroidism causes vitamin D deficiency. To understand this connection, longitudinal studies with larger cohorts are required. The exclusion of vitamin D-affecting factors like sun exposure, physical activity, and food intake may have biased the results. The study found vitamin D deficiency in hypothyroid patients, suggesting a link between vitamin D and thyroid function. Although the data cannot prove a cause-and-effect connection, the results indicate that hypothyroid patients should be tested for vitamin D and highlight the need for more research to understand the mechanisms and therapeutic implications.

Conclusion

This hospital-based cross-sectional study at IGIMS in Patna found vitamin D deficiency in over half of hypothyroid patients. People with high TSH and anti-TPO antibodies had a link between their vitamin D levels and how well their thyroids worked. These results suggest that thyroid problems and not getting enough vitamin D may work together to cause hypothyroidism.

Recommendations for Further Research

Longitudinal studies with bigger groups of people are required to confirm the relationship between not getting enough vitamin D and hypothyroidism. Vitamin D supplements help people with hypothyroidism improve their thyroids and slow down autoimmune movement. We need to do more research. Food, sun exposure, and other health problems should be considered in studies examining vitamin D and thyroid health. These findings can help develop hypothyroidism treatment strategies in resource-constrained Bihar.

Reference

[1] Holick MF. Vitamin D Deficiency. New England Journal of Medicine. 2007; 357: 266–281. https://doi.org/10.1056/NEJMra070553 PMid:17634462

[2] Hollick MF, Chen TC. Vitamin D deficiency is a worldwide problem with health consequences. Am J Clin Nutr. 2008;87:10805–68.

[3] Deluca HF. Evolution of our understanding of vitamin D. Nutr Rev. 2008;66(10):73–87.

[4] Baeke F, Takiishi T, Korf H, Gysemans C, Mathieu C. Vitamin D: modulator of the immune system. Curr. OpinPharmacol. 2010;10(4):482–96.

[5] Kostoglou-Athanassiou I, Ntalles K. Hypothyroidism - new aspects of an old disease. Hippokratia. 2010;14(2):82-87. PMid:20596261 PMCid: PMC2895281

[6] Lee JH, O'Keefe JH, Bell D, Hensrud DD, Holick MF. Is vitamin D deficiency an important, common, and easily treatable cardiovascular risk factor? Journal of the American College of Cardiology. 2008;52:1949–56. https://doi.org/10.1016/j.jacc.2008.08.050 PMid:19055985

[7] Melamed ML, Michos ED, Post W, Astor B. 25-hydroxyvitamin D levels and the risk of mortality in the general population. Archives of internal medicine, 2008; 168:1629–37. https://doi.org/10.1001/archinte.168.15.1629 PMid:18695076 PMCid:PMC2677029

[8] Almerighi C, Sinistro A, Cavazza A, Ciaprini C, Rocchi G, Bergamini A. 1Alpha, 25-dihydroxy vitamin D3 inhibits CD40Linduced pro-inflammatory and immunomodulatory activity in human monocytes. Cytokine. 2009;45(3):190–7. https://doi.org/10.1016/j.cyto.2008.12.009 PMid:19186073yperthyroidism. The Lancet. 1977; 309:806–807. https://doi.org/10.1016/S0140-6736(77)92995- 6

[9] Lips P. Vitamin D physiology. ProgBiophysMol Biol. 2006;92(1):4–8.

[10] Holick M. Vitamin D: photobiology, metabolism, mechansim of action, and clinical applications. 5th ed. Washington DC: Humana Press; 2003.

[11] Yetley EA, rulé D, Cheney MC, Davis CD, Esslinger KA, Fischer PW et al. Dietary reference intakes for vitamin D: justification for a review of the 1997 values. The American journal of clinical nutrition. 2009; 89:719–27.

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(3), 3495-3500 | ISSN:2251-6727

[12] Jones G. Pharmacokinetics of vitamin D toxicity. The American journal of clinical nutrition. 2008; 88:582S–586S. PMid:18689406

[13] Qamar J, Khan MD, Carol J, Fabian MD. How I Treat Vitamin D Defi ciency. J Oncol Pract. 2010;6(2):97–101.

[14] Alqahatani M, Tamimi W, Aldaker M, Alenzi F, Tamim H, Alsadhan A. Young adult reference ranges for thyroid function tests on the Centaur immunoassay analyser. British journal of biomedical science. 2006;63:163–5

[15] T. Ashok, V. Palyam, A. T. Azam, et al., "Relationship Between Vitamin D and Thyroid: An Enigma," *Cureus*, vol. 14, no. 1, p. e21069, Jan. 10, 2022. [Online]. Available: doi:10.7759/cureus.21069.

[16] M. Sulejmanovic, A. Begić, F. Mujaric-Bousbia, S. Salkic, and A. Ramas, "The Relationship Between Thyroid Antibodies and Vitamin D Level in Primary Hypothyroidism," *Med Arch.*, vol. 74, no. 5, pp. 359-362, Oct. 2020. [Online]. Available: doi: 10.5455/medarh.2020.74.359-362. [Accessed: Dec. 4, 2024].

[17] i. Talaei, F. Ghorbani, and Z. Asemi, "The Effects of Vitamin D Supplementation on Thyroid Function in Hypothyroid Patients: A Randomized, Double-blind, Placebo-controlled Trial," *Indian J Endocrinol Metab.*, vol. 22, no. 5, pp. 584-588, Sep.-Oct. 2018. [Online]. Available: doi: 10.4103/ijem.IJEM_603_17.

[18] D. Kim, "Low Vitamin D Status is Associated with Hypothyroid Hashimoto's Thyroiditis," *Hormones (Athens)*, vol. 15, no. 3, pp. 385-393, Jul. 2016. [Online]. Available: doi: 10.14310/horm.2002.1681.