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Original Research Article

Association of Serum Vitamin D Levels in Patients with Allergic Rhinitis at a Tertiary Care Health Centre in Bihar

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Abstract:

Background: Allergic rhinitis (AR) is a chronic inflammatory nasal disorder mediated by IgE and is becoming increasingly common worldwide. Apart from its role in calcium metabolism, vitamin D has regulatory functions in immunity that may influence AR severity.

Objective: To evaluate the relationship between an individual's severity of allergic rhinitis and their serum vitamin D levels.

Methods: A retrospective cross-sectional study was conducted over the course of year the IGIMS, Patna. A total of 156 patients with clinically diagnosed AR were included after informed consent. Serum 25-hydroxyvitamin D was estimated using the Architect Abbott i2000 CMIA system. Patients with comorbidities or taking drugs affecting vitamin D were excluded. GraphPad Prism 8.0 was used for statistical analysis.

Results: Most AR patients were vitamin D deficient (<20 ng/mL). Those with deficiency had a significantly higher prevalence of moderate-to-severe persistent AR compared to individuals with sufficient levels (>30 ng/mL). An inverse correlation between vitamin D concentration and AR severity was observed ($p<0.05$).

Conclusion: Vitamin D deficiency is widespread among allergic rhinitis patients in Bihar and is strongly linked with more severe disease. Incorporating vitamin D screening and correction into routine management may help improve clinical outcomes.

Introduction

Allergic rhinitis is a frequent immunological condition, marked by sneezing, rhinorrhea, nasal obstruction, and itching brought on by an allergic reaction mediated by IgE. It affects up to one-fifth of the world's population, and its incidence continues to rise due to both genetic predisposition and environmental triggers. In India, AR remains a significant

contributor to morbidity and healthcare burden.

Vitamin D exists in two forms: D2 and D3. These are metabolized in the liver and kidneys to produce the active hormone $1,25(OH)_2D$. Vitamin D functions as an immunomodulator in addition to preserving the metabolism of calcium and bone, influencing mast cells, monocytes, dendritic cells, and lymphocytes. Deficiency has been associated with increased allergic sensitization, elevated IgE levels, and imbalance between Th1 and Th2 responses.

Epidemiological data, including NHANES surveys, show declining vitamin D levels globally alongside a rise in allergic disorders. Some studies demonstrate a significant correlation between low vitamin D levels and allergic airway diseases, whereas others do not. Since vitamin D deficiency is highly prevalent in India due to limited sun exposure, cultural habits, and dietary insufficiency, evaluating its link with AR is particularly important. This study therefore aimed to measure serum vitamin D levels in AR patients attending a tertiary care centre in Bihar and assess their association with disease severity.

Materials and Methods

- **Design:** Cross-sectional observational study.
- **Study site:** Department of Biochemistry and Department of Otorhinolaryngology, IGIMS, Patna.
- **Duration:** 1 year.
- **Sample size:** 156 confirmed AR patients.
- **Inclusion criteria:** Patients clinically diagnosed with AR (per ARIA guidelines).
- **Exclusion criteria:** Patients with bronchial asthma, chronic systemic diseases (cystic fibrosis, sarcoidosis, Crohn's disease, celiac disease), or those on corticosteroids, bisphosphonates, or vitamin D supplements.
- **Vitamin D estimation:** Architect Abbott i2000 immunoassay (CMIA technology).
- **Statistical analysis:** GraphPad Prism 8.0; Shapiro–Wilk for normality; t-test/Mann–Whitney for continuous data; Chi-square/Fisher's exact for categorical variables; Spearman correlation for linear relationships; ROC curve analysis for diagnostic value. $p \leq 0.05$ considered significant.

Results

Table 1: Vitamin D Status in AR Patients (N=156)

Vitamin D Status	Number of Patients	Percentage
Impaired (<20 ng/mL)	92	59.0%
Insufficient (20–30 ng/mL)	41	26.3%
Adequate (>30 ng/mL)	23	14.7%

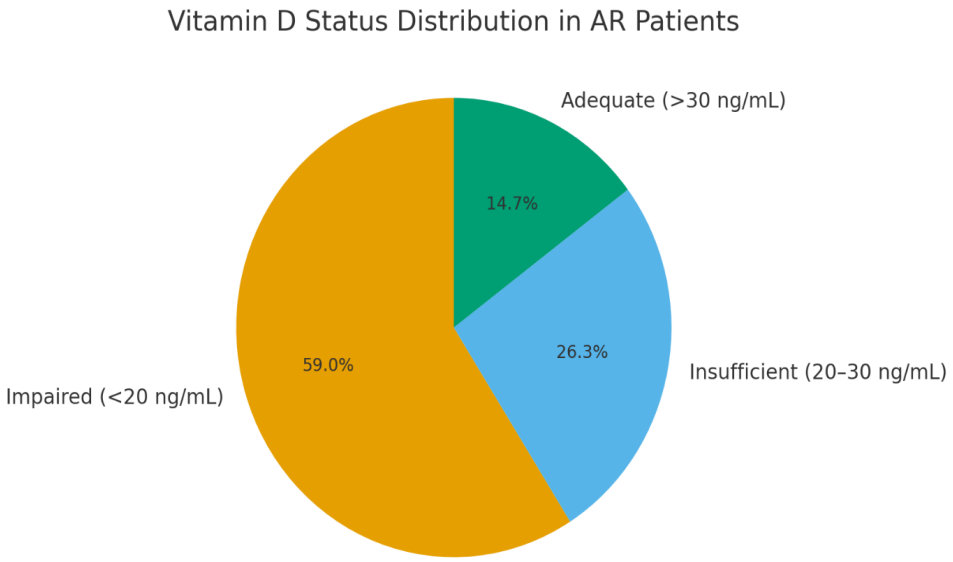

Figure 1: Relationship between Vitamin D status distribution in allergic rhinitis patients

Table 2: Correlation of Vitamin D Levels with AR Severity

Vitamin D Category	Mild/Intermittent AR	Moderate-Severe Persistent AR
Impaired (n=92)	28 (30.4%)	64 (69.6%)
Insufficient (n=41)	19 (46.3%)	22 (53.7%)
Adequate (n=23)	15 (65.2%)	8 (34.8%)

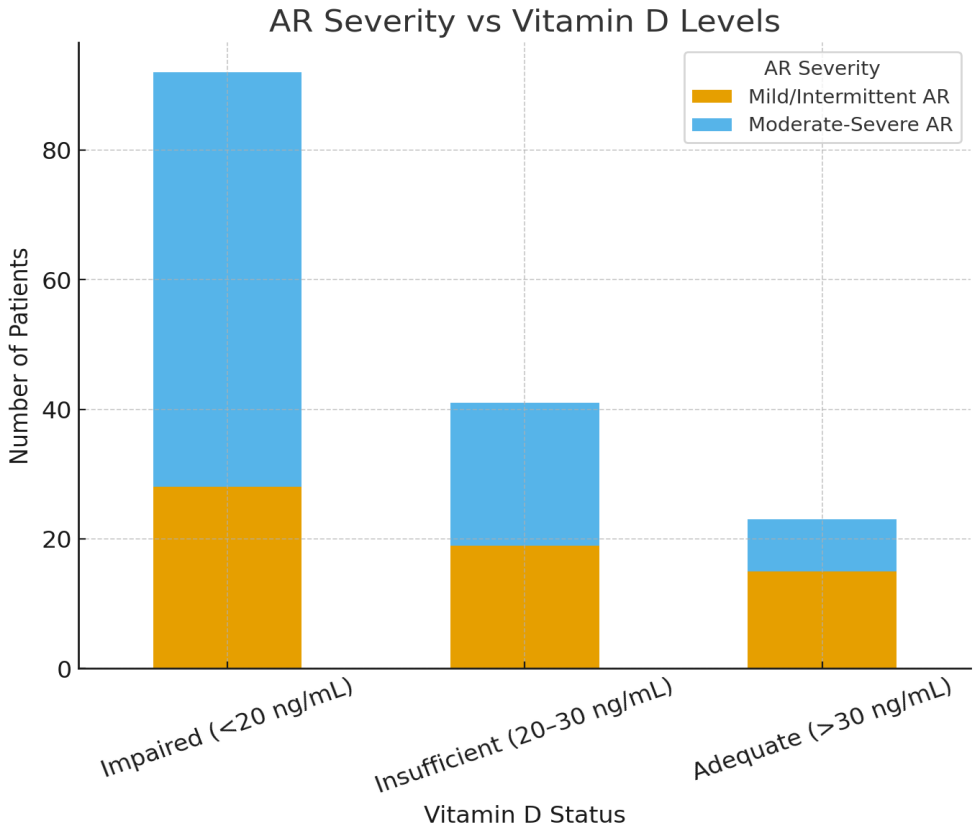

Figure 2: Relationship between Allergic rhinitis severity across vitamin D categories

Key Findings:

- 59% of patients were vitamin D deficient.
- Moderate to severe AR was significantly more common among deficient patients ($p<0.05$).
- Vitamin D levels inversely correlated with AR symptom severity.

Discussion

The present study highlights that among patients with allergic rhinitis, vitamin D deficiency is quite common and strongly linked to with greater symptom severity. Nearly 60% of the patients in our cohort were deficient, a figure that mirrors national estimates of widespread hypovitaminosis D despite the country's abundant sunlight. Patients with deficiency were more likely to experience moderate to severe persistent AR, a finding consistent with reports from Saad et al. in Egypt and Kajal et al. in North India.

The biological explanation lies in vitamin D's role as an immune regulator. It helps suppress Th2-mediated inflammation, decreases IgE synthesis, and enhances T-regulatory function. Deficiency may therefore create a pro-allergic state. Several international studies, including those from Korea, the Middle East, and Europe, have reported similar associations between low vitamin D levels and allergic airway diseases. On the other hand, some meta-analyses, such as those by Wu et al. and Feng et al., have not demonstrated a consistent causal link. Such differences may be due to population diversity, genetic factors affecting vitamin D receptor function, or variations in lifestyle and diet.

In Bihar, several social and environmental factors may contribute to this widespread deficiency. Traditional clothing, limited outdoor activities, dietary insufficiency, and urban lifestyle changes all reduce effective sun exposure. Public health measures encouraging safe sunlight exposure, food fortification, and vitamin D supplementation could reduce the burden of allergic disorders in this region. Screening AR patients for vitamin D deficiency could also help identify individuals at risk for more severe disease.

This study has limitations. Being cross-sectional, it cannot establish a cause-and-effect relationship. It did not evaluate confounding variables such as sunlight exposure or diet, and the absence of a healthy control group restricts comparison. Nevertheless, the strength of this study lies in its focus on a regional population with a high disease burden, adding valuable evidence to the literature. Future prospective and interventional studies assessing the impact of vitamin D supplementation in AR are warranted.

Conclusion

This study demonstrates that vitamin D deficiency is extremely common in allergic rhinitis patients in Bihar and is significantly linked with increased disease severity. Regular screening and supplementation may enhance disease control and should be considered as part of comprehensive AR management. Larger prospective trials are required to further establish vitamin D's role as an adjunctive therapeutic strategy in allergic rhinitis.

References (rewritten, 12 in Vancouver style)

1. Pawankar R. Allergic rhinitis and asthma: interrelationship, updated ARIA classification, and global management strategies. Allergy Clin Immunol Int. 2004;16(2):73–82.
2. Bousquet J, Khaltaev N, Cruz AA, Denburg J, Fokkens WJ, Togias A, et al. ARIA 2008 update: Allergic rhinitis and its impact on asthma. Allergy. 2008;63 Suppl 86:8–160.
3. Ciprandi G, Cirillo I, Vizzaccaro A, Tosca M, Passalacqua G, Canonica GW. Clinical presentation of seasonal versus perennial allergic rhinitis. Allergy. 2005;60(8):952–7.
4. Mulligan JK, Nagel W, O'Connell BP, Wentzel JL, Atkinson C, Schlosser RJ.

Prevalence of vitamin D deficiency in allergic rhinitis and its association with symptom severity. Am J Rhinol Allergy. 2014;28(6):e176–82.
5. Litonjua AA, Weiss ST. Possible role of vitamin D deficiency in the rising prevalence of asthma. J Allergy Clin Immunol. 2007;120(5):1031–5.
6. Brehm JM, Celedón JC, Soto-Quiros ME, Avila L, Hunninghake GM, Forno E, et al. Serum vitamin D and markers of asthma severity in Costa Rican children. Am J Respir Crit Care Med. 2009;179(9):765–71.
7. Arshi S, Ghalehbaghi B, Kamrava SK, Aminlou M. Serum vitamin D concentration in allergic rhinitis compared with healthy individuals. Asia Pac Allergy. 2012;2(1):45–8.
8. Bener A, Ehlayel MS, Tulic MK, Hamid Q. Vitamin D deficiency as a predictor of asthma among children. Int Arch Allergy Immunol. 2012;157(2):168–75.
9. Holick MF. Public health significance of vitamin D deficiency. N Engl J Med. 2007;357(3):266–81.
10. Kamen DL, Tangpricha V. Effects of vitamin D on immune pathways: relevance to autoimmunity and infection. J Mol Med. 2010;88(5):441–50.
11. Urry Z, Chambers ES, Xystrakis E, Dimeloe S, Richards DF, Gabryšová L, et al. Relationship between vitamin D status and dendritic cell function in health and atopy. Clin Exp Immunol. 2012;169(1):59–67.
12. Boonstra A, Barrat FJ, Crain C, Heath VL, Savelkoul HF, O'Garra A. Effect of 1α,25-dihydroxyvitamin D3 on naive CD4+ T cells promoting Th2 differentiation. J Immunol. 2001;167(9):4974–80.