

Research Article

Vitamin D Deficiency in Adult Allergic Rhinitis Patients: A Gender-Specific Analysis

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Abstract

Objective: To investigate the prevalence and gender-specific differences in vitamin D deficiency among adult patients with allergic rhinitis (AR).

Methods: A cross-sectional study was conducted on 200 adult AR patients (≥ 18 years), comprising 100 males and 100 females. Serum 25-hydroxyvitamin D [25(OH)D] levels were measured using ELISA. Allergic rhinitis severity was assessed using the Total Nasal Symptom Score (TNSS) and the Allergic Rhinitis and its Impact on Asthma (ARIA) classification.

Results: Vitamin D deficiency (25(OH)D < 20 ng/mL) was highly prevalent in both male (72%) and female (84%) AR patients. Notably, females exhibited significantly lower mean 25(OH)D levels (13.2 ng/mL) compared to males (15.8 ng/mL) ($p < 0.05$). No significant gender differences were observed in the relationship between vitamin D levels and AR severity.

Conclusion: Vitamin D deficiency is highly prevalent in adult AR patients, with females exhibiting a higher prevalence and lower vitamin D levels compared to males. These findings highlight the importance of gender-specific considerations in vitamin D assessment and supplementation strategies for AR patients.

Keywords: Allergic rhinitis, vitamin D deficiency, 25-hydroxyvitamin D, gender differences, Total Nasal Symptom Score, ARIA classification

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INTRODUCTION

Allergic rhinitis (AR) is a widespread chronic inflammation of the nasal mucosa caused by allergens that affects a significant proportion of the world's population. It is characterized by a constellation of symptoms such as sneezing, nasal congestion, rhinorrhoea and itching, which can significantly affect the quality of life of those affected.

Vitamin D, a fat-soluble vitamin with pleiotropic functions, has attracted considerable attention in recent years due to its immunomodulatory properties. Extensive research has shown a

possible link between vitamin D deficiency and various inflammatory and allergic diseases, including AR.

Epidemiologic studies have consistently shown a higher prevalence of vitamin D deficiency in AR patients compared to the general population. Furthermore, emerging evidence suggests a possible association between vitamin D deficiency and increased severity of AR symptoms.

This study aims to delve deeper into the association between vitamin D deficiency and AR, with particular attention to gender differences. Understanding the nuances of this relationship in men and women will allow us to develop tailored approaches to

vitamin D assessment and supplementation, potentially optimizing AR treatment strategies.

Materials and methods

Study design and participants A cross-sectional study was conducted in a center specializing in allergy and immunology. Two hundred adult AR patients (≥ 18 years), consisting of 100 males and 100 females, were recruited from the allergy outpatient clinic. The diagnosis of AR was made on the basis of a comprehensive examination that included a clinical history, physical examination, and positive skin prick test or positive serum specific IgE test to common aeroallergens.

Inclusion criteria:

- Age ≥ 18 years
- Diagnosis of allergic rhinitis based on established criteria
- Willingness to participate and informed consent

Exclusion criteria:

- Current use of vitamin D supplements within the last three months
- Chronic kidney disease
- Liver disease
- Malabsorption syndromes
- Pregnancy or lactation
- Other significant medical conditions known to affect vitamin D levels

Data collection

Demographic data (age, gender, body mass index) and clinical information (duration of AR, ARIA classification, medication use) were carefully collected using standardized questionnaires and a thorough review of medical records. Venous blood samples were collected from all participants for quantification of 25-hydroxyvitamin D [25(OH)D] serum levels.

Laboratory analysis

Serum 25(OH)D concentrations were measured using a commercially available enzyme-linked immunosorbent assay (ELISA) kit. The test was performed according to the manufacturer's instructions, ensuring strict adherence to quality control measures. Vitamin D deficiency was defined as 25(OH)D < 20 ng/ml, insufficiency as 20-30 ng/ml and sufficiency as > 30 ng/ml.

Assessment of the severity of allergic rhinitis

The severity of AR was assessed using two validated instruments: the Total Nasal Symptom Score (TNSS) and the Classification of Allergic Rhinitis and its Impact on Asthma (ARIA). The TNSS is a patient-reported outcome measure that rates four cardinal nasal symptoms (sneezing, nasal congestion, rhinorrhea and itching) on a scale of 0 to 3. The total score ranges from 0 to 12, with higher scores indicating a higher severity of symptoms. The ARIA classification divides AR into intermittent or persistent and mild or moderate, based on the frequency and intensity of symptoms.

Statistical analysis

Data analysis was performed using SPSS statistical software. Descriptive statistics were used to summarize demographic and clinical characteristics. The chi-square test or Fisher's exact test was used to compare the prevalence of vitamin D deficiency between men and women. The independent t-test or Mann-Whitney U test was used to compare 25(OH)D levels between groups. A correlation analysis was performed to assess the relationship between 25(OH)D levels and TNSS scores, both overall and stratified by gender. Statistical significance was defined as a p-value < 0.05 .

Results

Demographic and clinical characteristics

A total of 200 adult AR patients (100 males, 100 females) were enrolled in this study. The mean age of male patients was 36.8 ± 11.9 years, while the mean age of female patients was 34.5 ± 12.5 years. There were no statistically significant differences in age or body mass index between the two groups.

Among AR patients, the distribution of intermittent and persistent AR and ARIA classification was similar in men and women. The most commonly used medications for the treatment of AR included intranasal corticosteroids, oral antihistamines and leukotriene receptor antagonists.

Prevalence and gender differences in vitamin D deficiency

The prevalence of vitamin D deficiency was strikingly high in both male (72%) and female (84%) AR patients. Importantly, women had a significantly higher prevalence of vitamin D deficiency compared to men ($p < 0.05$). In addition, women had significantly lower mean 25(OH)D levels (13.2 ng/ml) compared to men (15.8 ng/ml) ($p < 0.05$).

Table 1: Prevalence of Vitamin D Status in Male and Female AR Patients

Vitamin D Status	Male AR Patients (n = 100)	Female AR Patients (n = 100)	p-value
Deficient (< 20 ng/mL)	72 (72%)	84 (84%)	< 0.05
Insufficient (20-30 ng/mL)	22 (22%)	12 (12%)	0.06
Sufficient (> 30 ng/mL)	6 (6%)	4 (4%)	0.56

Table 2: Serum 25(OH)D Levels in Male and Female AR Patients

Group	Mean 25(OH)D (ng/mL)	Standard Deviation	p-value
Male AR Patients (n = 100)	15.8	5.9	< 0.05
Female AR Patients (n = 100)	13.2	6.1	

Table 3: Correlation between Serum 25(OH)D Levels and TNSS Scores in Male and Female AR Patients

Group	Correlation Coefficient (r)	p-value
Male AR Patients (n = 100)	-0.48	< 0.001
Female AR Patients (n = 100)	-0.55	< 0.001

Discussion

The results of our study underline the high prevalence of vitamin D deficiency in adult patients with allergic rhinitis, regardless of gender. However, an important finding is the significant gender difference in vitamin D status, with women having a higher prevalence of deficiency and lower vitamin D levels compared to men.

This gender-specific difference can be attributed to several factors. Hormonal fluctuations, particularly during the menstrual cycle and pregnancy, can affect vitamin D metabolism and utilization in women. In addition, lifestyle factors such as sun exposure and dietary habits may differ between men and women, contributing to the observed difference.

The negative correlation between vitamin D levels and the severity of AR observed in both men and women suggests that vitamin D deficiency may play a role in the pathophysiology of AR. Vitamin D is known to modulate immune responses, and vitamin D deficiency may lead to immune dysregulation, potentially exacerbating allergic inflammation. In addition, vitamin D may influence epithelial barrier function in the nasal mucosa, affecting susceptibility to allergens and the severity of AR symptoms.

Conclusion

Vitamin D deficiency is a common finding in adult patients with allergic rhinitis, with females being disproportionately affected. This highlights the need for gender-specific considerations in vitamin D assessment and supplementation strategies for AR patients.

References

- Arshi S, Fallahpour M, Nabavi M, et al. The effects of vitamin D supplementation on airway functions in mild to moderate persistent asthma. *Ann Allergy Asthma Immunol.* 2014;113(4):404-409.
- Bener A, Ehlayel MS, Tulic MK, Hamid Q. Vitamin D deficiency as a strong predictor of asthma in children. *Int Arch Allergy Immunol.* 2012;157(2):168-175.
- Ginde AA, Mansbach JM, Camargo CA Jr. Association between serum 25-hydroxyvitamin D level and upper respiratory tract infection in the Third National Health and Nutrition

- Examination Survey. *Arch Intern Med.* 2009;169(4):384-390.
- Holick MF. Vitamin D deficiency. *N Engl J Med.* 2007;357(3):266-281.
- Kajal S, Shrestha P, Gupta Y, Deepak R, Verma H. Vitamin D Deficiency and Interleukin Levels in Allergic Rhinitis: A Case-Control Study. *Indian J Otolaryngol Head Neck Surg.* 2022;74:1720-1724.
- Litonjua AA, Weiss ST. Is vitamin D deficiency to blame for the asthma epidemic? *J Allergy Clin Immunol.* 2007;120(5):1031-1035.
- More D. Vitamin D Deficiency and Its Link to Allergies. *Verywell Health.* 2021.
- Placebo controlled trial of vitamin D supplementation in allergic rhinitis. *Eur Respir J.* 2015;46:PA2559.
- The Role of Vitamin D in Respiratory Allergies Prevention. *MDPI.* 2020.