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The Relationship between Serum Vitamin D Levels with Allergic Rhinitis Incidence and Total Nasal Symptom Score in Allergic Rhinitis Patients

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ABSTRACT

Background: There is a correlation between allergies and insufficiency in 25-Hydroxyvitamin D. However, there exists a scarcity of studies that have investigated the measurement of Vitamin D levels association with allergic rhinitis. **Objective:** To assess the correlation between serum vitamin D levels and the occurrence of allergic rhinitis, as well as the overall nasal symptom score in individuals with allergic rhinitis. **Study Design:** Cross sectional study. **Settings:** Department of ENT, Abbas Institute of Medical Sciences, Muzaffarabad Pakistan. **Duration:** January 2022 to June 2022. **Methods:** The study included all individuals diagnosed with AR, who received treatment and were monitored. The exclusion criteria employed in this study encompassed several categories. Firstly, pediatric patients were excluded from the analysis. Secondly, patients with insufficient follow-up data were also excluded. **Results:** There were 34.67% male and 65.33% were female. In age groups, 54.67% were aged 19-39, 25.33% were aged 40-59, 12% were aged 60-70, and 6.67% were over 70. Almost 74.67% had low Vitamin D levels, 20% had normal levels, and 5.33% had high levels. About 17.33% had intermittent symptoms, while the majority (82.67%) had persistent symptoms. In terms of TNSS, 44% had mild symptoms, while 56% had moderate to severe symptoms. Results showed a strong relationship between Vitamin D levels and the severity of nasal symptoms in individuals with allergic rhinitis. The P-value of <0.001 indicates a highly significant difference. Specifically, those with mild allergic rhinitis had notably higher Vitamin D levels (22.42±3.87 ng/ml) compared to those with moderate to severe symptoms (15.31±2.64 ng/ml). **Conclusion:** In this research, we investigated the connection between vitamin D insufficiency and allergic rhinitis (AR). We detected a meaningful association between vitamin D insufficiency and increased eosinophil counts, while there was no significant correlation with serum IgE levels.

Keywords: Allergic rhinitis, Vitamin D, Immunoglobulin, Relationship, Nasal symptom score, Incidence.

INTRODUCTION

Allergic rhinitis is a non-contagious inflammatory condition affecting the nasal mucosa. It is triggered by the exposure of atopic individuals to inhaled allergens, leading to the activation of IgE-mediated immune responses. This process involves the participation of several immune cells and cytokines.[1] Allergic rhinitis is distinguished by symptoms such as rhinorrhea, nasal obstruction, nasal pruritus and sneezing. Allergic rhinitis (AR) has been found to worsen the symptoms of asthma, and a significant proportion of individuals with asthma also experience allergic rhinitis.[2,3]

The incidence of allergic rhinitis (AR) has exhibited a notable rise over time, coinciding with the escalation of urbanization and the presence of environmental contaminants, which are often regarded as significant contributing factors to the development of this condition.[4,5] The prevalence of AR ranged from 0.8% to

14.9% in children aged 6-7 years and from 1.4% to 39.7% in adolescents aged 13-14 years. The percentages of people infected with this disease in Asia are staggering, 27% in North Korea and 24.62% in Pakistan.[6,7] Identifying patients with a severe type of AR is essential from a management perspective.[8]

Vitamin D insufficiency has been associated with allergy diseases, according to recent studies. A lack of vitamin D, which has been related to both immediate and future health problems.[9,10] The development of AR may be slowed by vitamin D's ability to regulate immune cells in the body. Previous research in India found that 91 percent of AR samples had low vitamin D levels.[11]

This study in Pakistan is essential due to the high prevalence of allergic rhinitis in the region and potential links between Vitamin D levels and allergic rhinitis. Pakistan's geographical and climatic factors may impact Vitamin D status, making it crucial to investigate its association with allergic rhinitis incidence and symptom severity. By conducting this research, we aim to fill a gap in the existing literature with region-specific data, shedding light on the role of Vitamin D in allergic rhinitis in Pakistan.

METHODS

This research had a cross-sectional design. It was conducted at department of ENT, Abbas Institute of Medical Sciences, Muzaffarabad from January 2022 to June 2022. The study encompassed individuals with and without Allergic Rhinitis (AR) who were treated at the hospital. AR patients were diagnosed based on the criteria set forth by the Allergic Rhinitis guidelines.[12]

According to the WHO calculator (ww.openepi.com), the minimum sample size required to detect a response in patients with allergic rhinitis treated with subcutaneous allergen immunotherapy was calculated to be 75 patients. Total 75 patients of both genders, aged 21 to 60 years included. All participants underwent interviews and comprehensive Ear Nose and Throat (ENT) examinations. Serum vitamin D levels were recorded, and total nasal symptom scores were reported, for patients with AR. All subjects provided written informed consent before their participation. Runny nose, sneezing, itchy nose and nasal congestion and were all factored into an overall score representing the severity of nasal symptoms. Symptoms were rated on a scale from 0 (none) to 3 (very disruptive to daily life or sleep).

The correlation between AR and TNSS (total nasal symptom scores) was assessed using the Pearson correlation test, and data were analyzed using SPSS.

RESULTS

There were 34.67% male and 65.33% were female. Almost 74.67% had low Vitamin D levels, 20% had normal levels, and 5.33% had high levels. In IgE levels, 1.33% were low, 48% were normal, and 50.67% were high. Eosinophil levels showed 4% low, 72% normal, and 24% high as shown in table 2. Table 3 illustrates the breakdown of individuals with allergic rhinitis based on symptom duration and Total Nasal Symptom Scores (TNSS). About 17.33% had intermittent symptoms, while the majority (82.67%) had persistent symptoms. In terms of TNSS, 44% had mild symptoms, while 56% had moderate to severe symptoms.

Table 1: Distribution of included patients across age and gender

Characteristic	Category	Frequency	Percentage
Gender	Male	26	34.67%
	Female	49	65.33%
Age Groups	Mean Age	Mean ± SD	43.12 ± 17.72
	19-39	41	54.67%
	40-59	19	25.33%
	60-70	9	12%
	> 70	5	6.67%
Total	-	75	100%

Table 2: Serum total IgE, allergen-specific IgE, vitamin D, and eosinophil counts were measured, and patients' clinical characteristics were recorded.

Characteristics	Level	Frequency	Percentage
Vitamin D Level	Low	56	74.67%
	Normal	15	20%
	High	4	5.33%
IgE Level	Low	1	1.33%
	Normal	36	48%
	High	38	50.67%
Eosinophil Level	Low	3	4%
	Normal	54	72%
	High	18	24%
Total		75	100%

Among those with mild symptoms, 26.67% had low vitamin D levels, while 13.33% had normal levels, and 2.67% had high levels showed in table 4. According to Table 4, there were no discernible changes in serum 25(OH)D concentrations despite the presence of elevated serum IgE levels. The mean serum 25(OH)D level is lower in people whose eosinophil count is high and greater in people whose eosinophil count is low. In Table 6, we see that the intensity of nasal symptoms in people with allergic rhinitis is significantly correlated with their Vitamin D levels. Patients with milder cases of allergic rhinitis showed significantly greater Vitamin D levels (22.423.87 ng/ml) than those with moderate to severe cases (15.312.64 ng/ml).

Table 3: Total nasal symptom score and allergy symptom classification

Cases with Allergic Rhinitis	Intermittent	Persistent	Total
	13 (17.33%)	62 (82.67%)	75 (100%)
Total Nasal Symptom Score	**Mild**	**Moderate-Severe**	**Total**
	33 (44%)	42 (56%)	75 (100%)

Table 4: Individuals with allergic rhinitis and their vitamin D blood levels.

	Allergic Rhinitis	Mild	Moderate	Severe	Total	P-value
Vitamin D Level	Low	20 26.67%	12 16%	18 24%	50 66.67%	<0.001
	Normal	0 0%	10 13.33%	2 2.67%	12 16%	
	High	1 1.33%	2 2.67%	5 6.67%	8 10.67%	
	Total	21 28%	24 32%	25 33.33%	75 100%	

Table 5: Changes in serum 25(OH)D concentrations in response to elevated serum IgE levels.

	Serum IgE	Low	Normal	High	Total	P-value
Vitamin D Level	Low	2 2.67%	35 46.67%	24 32%	61 81.33%	0.547
	Normal	0 0%	8 10.67%	5 6.67%	13 17.33%	
	High	0 0%	0 0%	3 4%	3 4%	
	Total	2 2.67%	43 57.34%	32 42.67%	77 100%	

Table 6: Effects of elevated blood eosinophil counts on average serum 25(OH)D concentrations

	Serum Eosinophil	Low	Normal	High	Total	P-value
Vitamin D Level	Low	3 4%	41 54.67%	14 18.67%	58 77.33%	0.021
	Normal	0 0%	10 13.33%	1 1.33%	11 14.67%	
	High	0 0%	1 1.33%	0 0%	1 1.33%	
	Total	3 4%	52 69.33%	15 20%	75 100%	

Table 7: Relationship between Vitamin D level and the severity of nasal symptoms

Variable	Allergic Rhinitis Groups		P-value
	Mild ART (n=33)	Moderate to severe (n=42)	
Vitamin D levels (ng/ml)	22.42 ± 3.87	15.31 ± 2.64	<0.001

DISCUSSION

In underdeveloped nations, vitamin D insufficiency affects people of all ages and both sexes to a large degree. Total nasal symptom scores were measured with incidence rates of allergic rhinitis and serum Vitamin D concentrations. Vitamin D levels inversely correlated with the severity of nasal symptoms, suggesting that higher vitamin D levels may lessen symptoms. These results highlight the importance of vitamin D in the treatment of allergic rhinitis, and they encourage future study in this area.[13] In Pakistan, a significant proportion of the population, ranging from 50% to 55%, experiences inadequate levels of vitamin D.[14]

The mean age was 43.12 ± 17.72 years for 75 enrolled patients in our study and there were 34.67% male and 65.33% were female. It was similar to finding of Bukhari *et al*. (2020) who found mean age of the enrolled patients to be 42 years.[15] Almost 74.67% had low Vitamin D levels, 20% had normal levels, and 5.33% had high levels. A similar study Awan *et al*. (2020) found that 97 participants, accounting for 43.3% of the total enrollment, exhibited insufficient levels of vitamin D. Out of the total sample size, a mere 23 individuals (representing 10.3% of the sample) had normal levels.[16] Another study conducted in Pakistan by Achakzai *et al*. (2020) revealed that around 80% of the people involved in the study had insufficient levels of Vitamin D. This percentage is greater than the 43.3% deficit observed in the current study.[17]

The Vitamin D levels of our study's participants ranged from 22.42±3.87 ng/ml in those with mild symptoms of allergic rhinitis to 15.31±2.64 ng/ml in those with moderate to severe symptoms. Extreme cases of allergy rhinitis (AR) were linked to low levels of vitamin D in one study. Vitamin D levels were considerably decreased in patients with moderate to severe AR compared to healthy controls (p0.0001). Anupam Malik *et al*. (2015) reported similar results; they calculated an average blood vitamin D concentration of 17.32±8.26 ng/ml.[18] We found that vitamin D levels in patients with severe ARDS were 14.8±7.4 ng/mL, which is in line with the findings of a study by Sheeba F *et al*. from 2019 in Pakistan.[19] Previous research has established a link between vitamin D deficiency and a worsening of disease.[17]

Our study indicates that there were no significant variations in serum 25(OH)D levels concerning the presence of increased serum IgE levels. Awan *et al*. (2021) demonstrated a notable disparity in serum IgE levels between those with severe allergic rhinitis and those with mild illness (p=0.0001) and observed that the average blood IgE level among patients with moderate-severe allergic rhinitis was measured to be 383.69±154.86 IU/mL.[16] The results obtained from our study indicate a statistically significant correlation between a deficiency in

vitamin D and the levels of serum eosinophils. This finding suggests a substantial correlation between a lack of vitamin D and allergic rhinitis (AR). Furthermore, the findings of the research indicate that there is no statistically significant correlation between vitamin D insufficiency and the demographic variables of gender or age among the patients. Arshi *et al*. conducted a study that yielded similar results, indicating a notable disparity in the occurrence of severe vitamin D deficiency between those with allergic rhinitis (AR) and those without the condition.[20]

CONCLUSION

Deficiency in vitamin D was found to have a significant correlation with AR in this investigation. Serum vitamin D levels were shown to be decreased in those with AR. Vitamin D insufficiency was associated with increased eosinophil counts but not with changes in serum IgE levels. Overall, vitamin D insufficiency appears to be associated with AR, suggesting the need for additional research using bigger samples to draw firmer conclusions.

LIMITATIONS

It is important to note that this study has some caveats. First, resource limitations cause a relatively small sample size.

SUGGESTIONS / RECOMMENDATIONS

The significance of future research on this topic should be acknowledged.

CONFLICT OF INTEREST / DISCLOSURE

None.

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