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Original Research Article

Allergic Rhinitis: A Controlled Prospective Study to Determine the Relationship between Vitamin D Deficiency and Allergic Rhinitis, at a Tertiary Care Hospital in Kashmir

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Abstract:

Background and Aim: Allergic Rhinitis (AR) is a chronic disease that hampers the daily activities of patients. There are limited studies examining the relationship between Vitamin D and AR. The present study investigated the relationship between Vitamin D deficiency and AR.

Methods: A total of 120 patients were enrolled in the study. A control group matching the case study group characteristics was also formed. Various baseline characteristics and Vitamin D levels were checked and recorded. The architect 25-OH Vitamin-D assay to measure the serum Vitamin D levels.

Results and conclusion: A significant difference in serum 25-dihydroxy vitamin D levels was found in the case group and the control group ($p<0.001$). Our results also suggested a direct relationship between Vitamin D deficiency and AR.

Keywords: 25-dihydroxy Vitamin D; allergic rhinitis; Rhinitis; Allergy; Vitamin D.

Introduction

Allergic Rhinitis (AR), a common Immunoglobulin – E (IgE) mediated allergic disorder, is characterized by sneezing, nasal congestion, nasal itching and rhinorrhea (nasal discharge). It is a symptomatic disorder of the nose that is induced when the immune system overreacts to allergens in the air which leads to immunoglobulin E (IgE) – mediated inflammation of the membranes lining the nose. [1]

AR is one of the most prevalent chronic conditions in high income countries, showing a prevalence of as much as 50%, and its prevalence is steadily increasing in low- and middle-income countries as well. [2] Around 20-30% of the Indian population suffers from AR and 15% develop asthma. [3] AR affects the quality of life and contributes to missed and unproductive work at work and school. [4] It also causes sleep problems and, in children, decreased involvement in outdoor activities. [5] AR predisposes the affected patients to sinusitis, nasal polyps, and ear infections. [6]

The hormonal form of Vitamin D affects immune functions involved in the development of allergies. [7] Genetic factors of the vitamin D metabolism are involved in the development of allergic conditions showing a direct association between vitamin D receptor polymorphisms and atopic asthma. [8] Furthermore, studies on an animal model provided evidence for a link between early vitamin D supplementation and the later allergy where several vitamin D regulated genes seem to be involved. [9] Vitamin D in the form of 1,25-dihydroxy vitamin D is a potent immune system modulator and at the molecular level has been shown to be involved in the suppression of dendritic cell maturation and consecutive Th1 cell development. [10,11]

In fact, vitamin D may suppress the production of IL-12, thereby reducing the production of T helper Th2-type IL-4. Type1 (Th1) cells and potentially leading to increased proliferation of allergy-associated T helper type(Th2)cells. [12] Vitamin D deficiency is defined as serum 25(OH)D < 10 ng/ml. Also, there is also an increasing concern for vitamin D insufficiency, which is characterized by 25(OH)D levels between 21 and 29 ng/ml. [13]

Vitamin D deficiency has been inconsistently associated with atopic diseases, although large-scale prospective and randomized studies are lacking. [11] In light of several conflicting hypotheses, vitamin D levels have been both

positively and negatively correlated with allergic disease prevalence. For example, high asthma prevalence and increased asthma symptoms have been observed in patients with low vitamin D levels and in children whose mothers had low intake of vitamin D during pregnancy. [8,9,14,15] It has been found that in India Vitamin D deficiency is quite common & it is like that across all ages and both sexes.

The prevalence of Vit D deficiency has been found around 70%-80%. Therefore, the present study was planned as there are a limited number of studies on the relationship between allergic rhinitis and vitamin D and their conclusions are controversial.

Materials and Methods

We conducted a Prospective case control study in the postgraduate department of ENT & head and Neck Surgery, Government Medical College Srinagar for a period of 18 months from May 2020 to October 2021.

Participants

A total of 120 patients of all age groups and both sexes with diagnosis of Persistent Allergic Rhinitis were included in the study. An equal number of controls were taken up in the study by matching the age and gender to each case individually.

Patients with concomitant CRS, patients on vitamin-D supplements, and patients on any medications known to affect the Vitamin-D levels in body were excluded from the study.

Detailed and informed consents were taken from the patients for their participation in the study.

Methods

We interviewed all the cases and controls and collected their history and baseline data. This included age, gender, symptoms, smoking status, family history of AR, family history of allergies, and daily average sleeping hours. Blood samples were taken from each case/control for 25-hydroxy Vitamin-D assessment. We used the architect 25-OH Vitamin-D assay to measure the serum Vitamin D3 levels. The results were calculated automatically based on a previously established calibration curve.

Statistical Analysis: Data obtained was exported to Microsoft Excel spreadsheet and exported to the data editor of Statistical Package for Social Sciences (SPSS Ver. 23). Categorical values were described as frequencies and percentages. Continuous variables were described as mean and standard deviation. Chi-square test was used to analyze the relationship between two categorical variables and T-test was used to compare the two continuous variables. A p-value of <0.5 was considered as statistically significant.

Results

We took a 1:1 case-control ratio as has been tabulated in Table 1 below.

Table 1: Distribution of patients according to Cases and Controls.

Subject	Frequency	Percentage
Case	120	50.0
Control	120	50.0
Total	240	100.0

Majority of our participants were females. Male: Female ratio was same in both case and control groups. Gender distribution is tabulated below.

Table 2: Distribution of participants according to Gender.

Gender	Subject		Total
	Case	Control	
Male	103 (85.8%)	103 (85.8%)	206 (85.8%)
Female	17 (14.2%)	17 (14.2%)	34 (14.2%)
Total	120 (100%)	120 (100%)	240 (100%)

Mean age of the participants in our study was 22 years. The age distribution of all the participants is reported in Table 3.

Table 3: Age distribution of study participants.

S. No	Variable	Value
1	Number	240
2	Minimum age in years	15
3	Maximum age in years	32
4	Mean age in years	22.03
5	Standard Deviation	3.21

We observed that most (57.1%) of the patients belonged to the rural areas, and that smoking was prevalent in only 7.5% of the participants. We reported all the baseline characteristics of the participants in **Table 4**.

Table 4: Baseline characteristics of the participants.

S. No	Characteristic	Status	Frequency	Percentage
1	Area	Rural	137	57.1
		Urban	103	42.9
2	Smoking status	Non-smoker	222	92.5
		Smoker	18	7.5
3	Family history of AR	Present	21	8.8
		Absent	219	91.3
4	Family history of allergies	Present	35	14.6
		Absent	205	85.4
5	Daily average sleeping hours	< 7 hours	59	24.6
		7 to 9 hours	139	57.9
		>9 hours	42	17.5

The mean Vitamin-D level of participants was 20.88 ng/ml. The overall distribution is elucidated in, below.

Table 5: Vitamin-D level distribution among study participants.

S. No	Variable	Value
1	Number	240
2	Minimum value of Vit D (ng/ml)	4.8
3	Maximum value of Vit D (ng/ml)	45.2
4	Mean value of Vit D (ng/ml)	20.88
5	Std. Deviation	10.43

On comparison, the Vitamin-D levels in our cases (14.10 ng/ml) were significantly lower than the control group participants (27.66 ng/ml). We observed a statistically significant p-value (<0.001).

Table 6: Comparison of Vitamin-D levels between cases and controls

Group	Frequency	Mean	Std. deviation	Mean difference	P-value
Cases	120	14.10	8.082	13.56	<0.001
Controls	120	27.66	7.775		

Discussion

Allergic rhinitis (AR), a symptomatic disease of the nose, is an IgE mediated disease characterized by rhinorrhea (nasal drainage), sneezing, and/or nasal itching. [16] Our present controlled study investigated the effects of various baseline characteristics, in general, and Vitamin D deficiency, in particular on the susceptibility of developing AR. Studies suggest that AR often begins in early age, with prevalence of more than 5 percent at 3 years of age. [17,18] Our study revealed a mean age of 22 years for patients participating in the study. The International Study of Asthma and Allergies (ISAAC) revealed that AR in children and adolescents was more prevalent than in adults in high-income countries.18 However, another study conducted by Deb et al in India suggested the prevalence of AR in adults. [19] This could be explained by lack of awareness and services in low- and middle-income countries. Our study saw a predominance of males over females. However, studies have reported more prevalence of adult females over males. [19,20] These differences are, however, more pronounced in patients with asthma and AR occurring concomitantly. [20] However, patients with allergies showed exacerbation of symptoms like nasal discharge, obstruction, sneezing, and increased sensitivity to seasonal variation. ISAAC phase three study also revealed the prevalence of severe symptoms in low- and middle-income countries. [21]

Vitamin D deficiency is known to affect both adaptive and innate immune functions involved in the development of allergies. [7] Our cases showed lower levels of Vitamin D (25 OH Vit D) as compared to the controls (p<0.001). This was in conformity with the study conducted by Bonanno et al, who concluded that low levels of 25 OH Vit D might represent a risk factor for the development of concomitant asthma and rhinitis in children. [22] Another study showed an inverse relationship between 25 OH Vitamin D and blood eosinophils in patients with persistent AR. [23]

Conclusion

Our results suggest a direct relationship between Vitamin D deficiency and Allergic Rhinitis. However, studies with larger subject cohorts are warranted to establish the same.

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