

Original Article

The Possible Protective Role of Vitamin D against Allergic Rhinitis in Saudi Adults

Sami Alharethy

Division of Facial Plastic Surgery, Department of ENT & HNS, King Abdulaziz University Hospital, King Saud University, Saudi Arabia

Kuwait Medical Journal 2018; 50 (2): 173 - 176

ABSTRACT

Objective: Several novel roles for Vitamin D have emerged. Besides its role in bone mineralization, it has a protective role against cancer, diabetes mellitus, multiple sclerosis, and immunological disorders. Our aim is to determine the possible role of vitamin D against allergic rhinitis in Saudi adults.

Design: A cross-sectional study. Patients were asked to answer a questionnaire and blood samples were collected to analyze vitamin D level, 25(OH) D, blood count, and renal profile.

Setting: Department of Otorhinolaryngology, King Abdulaziz University Hospital, King Saud University, Saudi Arabia

Subjects: A total of 976 patients from 1 January to 30 September, 2014

Intervention: Data on age, gender and blood samples of patients were obtained. Continuous variables were described

as means \pm standard deviation (SDs). Categorical variables were described as frequency and percentage. Chi-square test and logistic regression analysis were performed to determine the odds for allergic rhinitis.

Main Outcome Measures: Vitamin D level

Results: The mean vitamin D level was 43.3 ± 3.17 ng/ml. Vitamin D deficiency (vitamin D < 10 ng/ml) was present in 51 (5.2%) participants, and vitamin D insufficiency (vitamin D: 10.1 - 29.9 ng/ml) was present in 634 (65%) while 291 (29.8%) patients were normal. Allergic rhinitis was present in 221 (22.7%) patients and they had significantly lower levels of vitamin D than those without rhinitis (21.57 ± 2.84 vs. 46.66 ± 3.076 , $p = 0.001$).

Conclusion: There is a potential association between Vitamin D level and allergic rhinitis in Saudi adults. Further studies are needed to evaluate the effect of Vitamin D supplementation on prevention or progress of allergic rhinitis.

KEY WORDS: allergy, asthma, rhinitis, vitamin D

INTRODUCTION

Interest in vitamin D is expanding worldwide due to its immense protective role against cardiovascular diseases (CVD)^[1], diabetes mellitus (DM)^[2], cancer^[3], immunological disorders^[4], allergic conditions^[5], and multiple sclerosis^[6], in addition to its role in bone mineralization and the prevention of bone fractures^[7]. Several recent studies have shown the association of vitamin D deficiency with bronchial asthma and atopic dermatitis^[8-10]. However, the association of vitamin D and allergic rhinitis is less defined. There are no studies on the correlation of vitamin D deficiency and allergic rhinitis in this region. Allergic rhinitis is a frequent and troublesome condition that reduces quality of life,

increases sleep disturbance, and decreases working capacity of a patient^[11]. The prevalence of allergic diseases, including allergic rhinitis, is increasing due to the increase in environmental allergens caused by urbanization and food allergens^[12]. Further, recent studies have proposed an association between vitamin D deficiency and allergic disorders. Vitamin D influences allergy-mediating immune cells, such as T-cells, and immune functions of cells that form a barrier against allergens, for example epithelial cells. Similarly, vitamin D affects several aspects of innate immunity. Vitamin D affects allergy-mediating cells, such as mast cells, and increased levels of vitamin D can increase IL -10, which suppresses inflammation^[13-16].

Address correspondence to:

Sami Alharethy, MD, Division of Facial Plastic Surgery, Department of ENT & HNS, King Abdulaziz University Hospital, King Saud University, P.O Box 245, Riyadh 11411, Saudi Arabia. Tel: 4786100 (ext: 3410), Fax: +96614775791, E-mail: samiharthi@gmail.com

Table 1: The socio-demographic characteristics of the study population

Variables	Category	Number n (%)	Mean (SD)
Age (years)			33.95 ± 8.1
Gender	Male	566 (58%)	
	Female	410 (42%)	
Body mass index			23.96 ± 5.9
Hypertension	Present	258 (26.5%)	
Diabetes mellitus	Present	192 (19.7%)	
Bronchial asthma	Present	18 (1.8%)	43.3 ± 31.7
Vitamin D level - all patients (ng/ml)			15.8 ± 5.8
Vitamin D level - lower quartile (ng/ml)			83.8 ± 33.8
Vitamin D level - upper quartile (ng/ml)			21.57 ± 28.4
Vitamin D level in allergic rhinitis group (ng/ml)			46.66 ± 30.76
Vitamin D level in control group (ng/ml)			
Prevalence of allergic rhinitis	Present	221 (22.7%)	

Vitamin D deficiency is frequent in KSA, despite the availability of plenty of sunshine throughout the year, due to local traditions of covering the entire body with clothes and very limited outdoor activities in the sun, especially for females^[7]. Comprehensive studies regarding the link between vitamin D and allergic rhinitis are lacking from this region. Since vitamin D deficiency is a modifiable risk factor and can be easily corrected, vitamin D supplementation may have a great public health benefit. The present study aims to correlate vitamin D levels and allergic rhinitis in Saudi adults.

SUBJECTS AND METHODS

The present study was a cross-sectional study conducted from 1 January to 30 September, 2014 after Institutional Research Board approval at King Saud University (E-14-978). A total of 976 patients consented to participation. The usefulness and purpose of the study was explained to the participants. A questionnaire regarding their socio-demographic details, dietary habits, degree of sun exposure (including both total time per day and frequency of such exposure per week), and symptoms of rhinitis (e.g., runny nose, nasal blockade, post-nasal drip, nasal obstruction, and smell impairment) was also explained. The presence of other co-morbidities, such as DM, hypertension (HTN), and bronchial asthma were recorded. Blood samples were collected by trained phlebotomists to analyze the levels of vitamin D, blood calcium, total blood count, liver profile, and renal profile.

RESULTS

A total of 1023 patients were included in the current study. However, after data cleaning and management, 47 patients were excluded either because of missing or inconvenient data or for not fulfilling the inclusion

criteria. Thus, the final study sample was 976 patients (566 male (58%) and 410 female (42%)). The socio-demographic characteristics of the study population is given in Table 1. The mean age of patients was 33.95 ± 8.1 years while the mean BMI was 23.96 ± 5.9 kg/m². Among the recruited sample, 192 (19.7%) patients were diabetic, and 258 (26.5%) were hypertensive. The mean creatinine, calcium and albumin levels were 70.4 ± 16.9 mmol/l, 2.3 ± 2.2 mmol/l, and 41.9 ± 5.1 g/liter, respectively.

Table 2 shows the vitamin D levels of the study population. The mean vitamin D level was 43.3 ± 3.17 ng/ml for all the patients. Severe vitamin D deficiency (vitamin D < 10 ng/ml) was present in 51 patients (5.2%), and vitamin D insufficiency (vitamin D: 10.1 - 29.9 ng/ml) was present in 634 patients (65%). The remaining 291 patients (29.8%) had normal vitamin D levels. Allergic rhinitis was present in 221 patients (22.7%).

Table 2: Vitamin D levels in the study population.

Vitamin D Grading	Vitamin D level (ng/ml)	n(%)
Vitamin D deficiency	< 10	51 (5.2)
Vitamin D insufficiency	10.1 - 29.9	634 (65)
Vitamin D normal	> 30	291 (29.8)

An inverse relationship was found between vitamin D status and allergic rhinitis. The patients with allergic rhinitis had significantly lower levels of vitamin D than the patients without rhinitis. The mean vitamin D level was 21.57 ± 2.84 ng/ml in patients with allergic rhinitis vs. 46.66 ± 3.076 ng/ml in normal controls without allergic rhinitis (p = 0.001).

Table 3 shows the correlates of allergic rhinitis. Conduct of multivariate analysis (binary logistic regression) kept allergic rhinitis as a dependent variable and age < 40 and > 40 years, gender, BMI <

Table 3: Correlation of the study variables to allergic rhinitis

Variables	Odd Ratio	95% Confidence Interval (CI)
Vitamin D deficiency	3	1.9 - 4.7
Females	1.6	1.1 - 2.3
Age > 40 years	1.5	1.0 - 2.3
Body mass index > 30	1.3	1.09 - 1.7

30 and > 30 kg/m², hypertension (yes or no), asthma (yes or no) and vitamin D deficiency (yes or no) as independent variables. Of all the study variables, vitamin D deficiency (yes or no) had the maximum odds for allergic rhinitis, followed by a shorter duration of outdoor activity (more than 3 hours or less than 3 hours), female gender and age < 40 and more than 40 years.

The prevalence of allergic rhinitis was greater in patients in the lower quartiles of vitamin D levels than in patients in the higher quartile of vitamin D levels. The patients with allergic rhinitis had a mean vitamin D level of 21.57 ± 28.4 ng/ml. The patients without allergic rhinitis had a mean vitamin D level of 46.66 ± 30.76 ng/ml.

DISCUSSION

Due to the recent tremendous increase in environmental and food allergens, proper and effective allergy prevention has become a mandatory public health priority^[18]. Allergic rhinitis, asthma, and other allergic disorders are major healthcare problems. Worldwide, allergic rhinitis is often underestimated, though it often leads to asthma^[19] and greatly reduces quality of life. Sleep disturbances lead to reduced work performance. Vitamin D deficiency is also a global issue. Recent studies have shown that vitamin D deficiency is a potential contributor to allergic diseases. Vitamin D receptors are located on lymphocytes^[17]. In 2014, Michelle B. Lierl indicated that studies are underway to evaluate whether vitamin D supplementation can improve these allergic conditions^[19]. Vitamin D directly acts on activated helper T, B and regulatory T cells^[20]. Vitamin D receptor (VDR) and α -1-hydroxylase have been found on and in most cell types and tissues of the body. VDRs are activated by 1,25(OH)₂D₃ and affect expression of over 200 genes, up regulating nearly two-thirds and down regulating one-third of those genes. Therefore, VDRs found in different alleles have different effects. A mutated VDR in hereditary vitamin D-resistant rickets prevents induction of bronchial hyperreactivity and inflammation. VDR ApaI allele is associated with better childhood asthma control and improvement in ability for daily activities. Overall, these findings made us study vitamin D's role on

asthma and allergic disease development^[21]. In a 2014 study, vitamin D supplementation clinically improved the natural course of allergic rhinitis^[22-23].

The present study revealed a high prevalence of allergic rhinitis in the study population (22.7%). Compared to other studies^[24], the prevalence of allergic rhinitis in the present study was almost the same but was slightly more prevalent in females than in males. The present study revealed a definite and significant vitamin D deficiency in patients with allergic rhinitis indicated by a low mean vitamin D level in participants with allergic rhinitis. Similar to these findings, Arshi *et al* also demonstrated a vitamin D deficiency in allergic rhinitis patients^[25]. The present study reveals that the lower quartile of vitamin D levels is associated with a greater prevalence of allergic rhinitis. Vitamin D regulates several immune cells such as T lymphocytes, B lymphocytes, and epithelial cells. These cells play a major role in adaptive immunity.

In the present study, of the contributing variables, such as female sex, obesity, age > 40 years, low exposure to sun, and the presence of other allergic conditions including asthma, vitamin D deficiency had the greatest odds for allergic rhinitis. Additional studies are being performed to evaluate whether vitamin D supplementation can improve the outcomes of allergic rhinitis.

LIMITATIONS

The diagnosis of allergic rhinitis on the study population depends on typical history and nasal examination. No laboratory test for allergy was taken.

CONCLUSION

The present study revealed a correlation between vitamin D levels and allergic rhinitis in Saudi adults. The study showed a possible protective role of vitamin D against allergic rhinitis in Saudi adults. This finding has therapeutic value. Vitamin D is a widely available, safe, and affordable product. Vitamin D supplementation can be an attractive intervention to protect high-risk patients from allergic rhinitis. However, several trials are needed before its implementation, and frequent screening of vitamin D status is needed in high-risk patients.

ACKNOWLEDGMENT

I would like to thank my co-doctors from King Abdulaziz University Hospital who provided insight and expertise that greatly assisted the research.

I express my deepest thanks to Dr. Mohammed Saddiqui and Dr. Falah Syouri for assistance in diagnosing the study population and to Mr. Ahmed Mousa for the statistical analysis of the data. Without

them, this work may not have been completed. I am also grateful to Ms. Norjanah Dimatunday for her help in checking and editing the required format of this article.

Again, I humbly extend my thanks to all concerned persons who cooperated with me in this article.

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