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Research Article

Role of Serum Vitamin D3 and Immunoglobulin E in Allergic Rhinitis: Pilot Study

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ABSTRACT

Background: Allergic rhinitis (AR) is one of the commonest conditions with a significant impact on the quality of life. It is an inflammatory disease if nasal membrane, is characterized by symptoms such as sneezing, rhinorrhoea, nasal congestion and nasal itching.

AIM: The objective of the study was to estimate and compare serum Vitamin D3 and Immunoglobulin E in patients of allergic rhinitis and healthy controls.

Materials and Methods; The present Pilot study was conducted in the Departments of Biochemistry and the Department of ENT, SGT Medical College, Hospital & Research Institute, Gurugram, Delhi-NCR, India. A written and informed consent was taken after explaining the purpose and details of the study to all the subjects of both the groups. A total of 22 individuals with clinically confirmed allergic rhinitis, aged between 18 and 55 years, were seen in the ENT outpatient department at SGT Hospital. A total of twenty two healthy volunteers, matched in terms of age and gender, was selected from the general public to serve as controls at SGT hospital. The measurement of Serum Vitamin D was conducted using a Competitive ELISA kit-based approach, whereas the measurement of and serum IgE was conducted using a Sandwich ELISA kit-based method.

Results: It was observed that patients in the AR group had an average blood vitamin D level The present study showed decrease level of serum vitamin D in patients with allergic rhinitis as compared to that of healthy controls. On comparing the mean values using the t- test the mean value of serum vitamin D in allergic rhinitis patients was found to be 16:31±5.6 which was significantly decrease as compared to that of controls which was found to be 56.31±35.58($p< 0.05$. On comparing the mean values using the t-test the mean value of serum Immunoglobulin E in allergic rhinitis patients was found to be **243±51.96** which was significantly increase as compared to that of controls which was found to be **62.59±86.08** ($p< 0.05$).

Keywords: allergic rhinitis, vitamin d deficiency, serum immunoglobulin E

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INTRODUCTION

Allergic rhinitis is one of the commonest chronic conditions with a significant impact on the quality of life.[1]It is an inflammatory disease of nasal membrane, is characterized by symptoms such as sneezing, rhinorrhoea, nasal congestion, and nasal itching.[2]

Clemiers von pirquet in 1906 first termed the word allergy. AR is common health problem caused by inflammation reaction after allergen exposure and associated with an immunoglobulin

E(IgE) mediated Immune response against allergens.[3]Although allergic rhinitis is not a life threatening condition, complications can occur and the condition can significantly impair quality of life. It occurs when an atopic individual is exposed to allergen. Allergic rhinitis may be seasonal or perennial.[4]

The various treatment modalities for treatment of allergic rhinitis includes allergen avoidance, pharmacotherapy, immunotherapy and surgical intervention. Pharmacotherapy includes antihistamines, decongestants, steroids sprays, leukotriene receptor antagonist etc[5]

The Prevalence varies among countries due to geographic and aeroallergen differences.[6-9]

Allergic Rhinitis is most common type of chronic rhinitis, affecting 10-20% of the population, and evidence suggests that the prevalence of the disorder is increasing.[10]

The prevalence is relatively low in low income and middle-income countries. Although prevalence is increasing steadily in these countries.[11]

Results from the International Study of Allergy and Asthma in Children (ISAAC) study showed that Indian children aged 13-14 years had an overall 10% prevalence of allergic rhinitis. In Delhi had a prevalence of 11.6%.[10] Adults prevalence were estimated to be 11.7% in Delhi.[12]

In European study among general in adults population using Allergy Rhinitis and its impact on asthma (ARIA) definition for diagnosis the prevalence of allergic rhinitis was found to be around 25% in adults ranging from 17 % to 28.5%.[13,14]

Many different attempts have been made to prevent allergic diseases, although most of these attempts have been unsuccessful. There is a need for further research in light of these contrasting findings.Some parameters are sensitive for allergy rhinitis and may be measured as markers such as vitamin D3 and IgE.

Vitamin D has long been known to be an essential nutrient for the human body, particularly with regard to the absorption of dietary calcium and phosphate. Vitamin D has 2 major forms, cholecalciferol (VitaminD3) and ergocalciferol (VitaminD2). Both forms of vitamin D can be found in foods or supplements; however, only vitamin D3 is produced in skin.[16]Recently many studies have reported that vitamin D may be associated with the development of allergy rhinitis. Vitamin D Deficiency is very common in India across all ages and both sexes, with a prevalence of 70-80%.[17]

Many investigators have used total **serum immunoglobulin E (IgE**) for evaluating allergic disease.[20,21] Symptoms of AR are triggered by inflammatory mediators such as histamine and leukotrienes released as a result of increased immunoglobulin E(IgE) production from plasma cells. This increased production of IgE is mediated by cytokines released from inflammatory T cells invading the mucosa of the nasal cavity in response to the exposure of the mucosa to exogenous allergens.[18]

Many different attempts have been made to prevent allergic rhinitis, although most of these attempts have been unsuccessful. We have done pilot study to identify role of IGE and Vitamin D in allergic rhinitis patients. Estimation of IGE and Vitamin D can help in diagnosis of allergic rhinitis.

AIM AND OBJECTIVE

The objective of the study was to estimate and compare serum Vitamin D3 and Immunoglobulin E in patients of allergic rhinitis and healthy controls.

METHODS & MATERIALS

The Pilot study was conducted on 22 Male and Female patients (age group of 18-55 years) with Allergic Rhinitis attending OPD and IPD of Shree Guru Gobind Tricentenary University, Gurugram, Haryana.

The study group consist 22 patients of allergic rhinitis and control group included 22 age and sex matched healthy volunteers, who had no history of allergic diseases.

All patients involved in the study were informed and asked to sign the clinical research research informed consent form. This study was approved by ethical committee of SGT University.

Both controls and cases will be properly informed of the purpose of the study and written consent will be obtained subsequently, five (5) ml of a venous blood sample will be collected from the participants under aseptic condition by venepuncture using 5 ml sterile disposable syringe and needle. Serum will be separated by centrifuging for 15 minutes at 3500 rpm. The samples will be stored at -20°c.

Serum Vitamin D will be estimated by Competitive ELISA kit based method while Serum IgE will be estimated by Sandwich ELISA kit-based method

STATISTICAL ANALYSIS

Result of Vtamin D and IGE were calculated by using statistical package for social science version 23. Mean±S.D were calculated for all the parameters analysed were compared by Student's t-test and correlated by calculating Pearson's correlation coefficient P-value considered significant were as follows, $P<0.001$-highly significant, $P<0.05$- Significant.

RESULT

Comparison of Vitamin D between cases and control

Comparison IGE between cases and control

The pilot study comprised 44 sample, 22 cases and 22 controls. The studied sample was divided into two groups; the allergic group included allergic rhinitis patients of same age, sex and weight as the control group which included healthy volunteers. Among 44 samples mean of vitamin D patients and control shown in table no 1 and Immunoglobulin E mean value of patients and control shown in table no-2.

DISCUSSION

The allergic rhinitis symptoms arise as a result of local inflammation induced by aeroallergens such as pollens, molds, animal dander and house dust mites etc. The immune response involves the release of inflammatory mediators and the activation of recruitment of different inflammatory cells to the nasal mucosa. Infiltration of inflammatory cells is evident in both seasonal and perennial form, although the magnitude of theses cellular changes is somehow different in seasonal and perennial allergic rhinitis.

In allergic rhinitis, numerous inflammatory cells,including mast cells, CD4-positive T cells, B cells,macrophages, and eosinophils, infiltrate the nasal lining upon exposure to an

inciting allergen (most commonly airborne dust mite fecal particles, cockroach residues,
Animal dander, moulds, and pollens).([19,20])

Role of Vitamin D in allergic rhinitis

Vitamin D is an essential nutrient required for healthy bones and the immune sytem. It has two major forms (D2; ergocalciferol and D3; Cholecalciferol); both forms can be obtained from foods. However, only vitamin D3 can be made by the human body. The parameter that is directly tested to measure vitamin D3 level in the blood is 25(OH) D3. However 1,25(OH)D3 is the most biologically active metabolite of vitamin D3.

A link between allergic disorders and vitamin D levels had been reported in many epidemiological studies. [21]

Several mechanism were reported to be involved the immune modulation effect of 1,25(OH)D3 on immune cell and some cytokines. Among these mechanism T- cell proliferation inhibition, suppressing the differentiation and transcription of Th 17 cells, enhancing Th2 cell development, decreasing macrophage inflammation, T-cell stimulation and inhibiting immunoglobulin secretion, including IgE secretion can be noted.[21]

Similarly, vitamin D also inhibits the innate immune system. Vitamin D inhibit the differentiation, maturation, and immune-stimulating ability of dendritic cells by down regulating the expression of MHC class II molecules.

In 2012, Arshi et al[22] have reported a high prevalence of vitamin D deficiency in allergic rhinitis patients as compared to normal population.

In 2014 katarkar et al[23] found that prevalence of severe vitamin D deficiency was significantly higher in patients with allergic rhinitis than normal population.

On the other hand in 2014 Cheng et al[24] showed no correlation between allergic rhinitis and vitamin D deficiency.

In 2019, Haritosh et al[25] have reported a high incidence (83%) of vitamin D deficiency in allergic rhinitis patients.

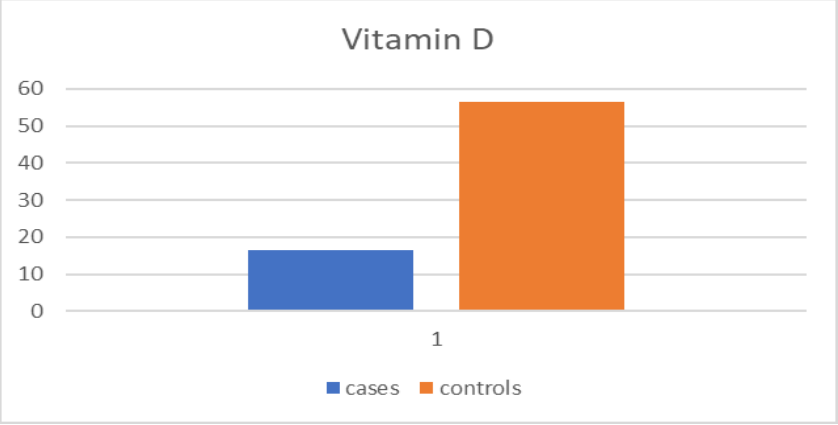
Hembrom et al[26] have found allergic rhinitis patients have low serum D3 level.

The present study found a statistically significant decreased in vitamin D. Table 1 shown the comparison of vitamin D between cases and controls. The present study showed decrease level of serum vitamin D in patients with allergic rhinitis as compared to that of healthy controls.

On comparing the mean values using the t- test the mean value of serum vitamin D in allergic rhinitis patients was found to be 16:31±5.6 which was significantly decrease as compared to that of controls which was found to be 56.31±35.58($p< 0.05$).

Table 1: Comparision of Vitamin D between cases and controls:-

Parameters	Cases(n=22) Mean±SD	Control(n=22) Mean±SD	t value	P value
Vitamin D	16.31±5.6	56.31±35.58	-2.4	<0.05



Role of IGE in allergic rhinitis:-

Symptoms of AR are triggered by inflammatory mediators such as histamine and leukotrients released as a result of increased immunoglobulin E(IgE) production from plasma cells. This increased production of IgE is mediated by cytokines released from inflammatory T Cells invading the mucosa of the nasal cavity in response to the exposure of the mucosa to exogenous allergens.[6]

In atopic individuals, it is inevitable that end-organ allergic reaction develops as a result of allergen exposure in the proper condi- tions with specific lgE antibodies. However, since the mechanisms that contribute to disease occurrence are usually more complex, the relationship between the atopic reaction and laboratory cannot be easily understood in clinical practice.

In this context, several laboratory techniques andtests are used to confirm the diagnosis in patientspresumed to have allergic rhinitis by anamnesis andphysical examination, and to define the etiologicalcause. There are numerous studies on understanding the relationship between allergies and laboratory.

Alnori H et al (2020)[27] compared the vitamin D and Immunoglobulin E Status in Allergic Rhinitis Patients. All the participants were divided into two groups , group A was AR group and group B was control group. They were found that the mean level of IgE and vit. D was found to be 326.3 and 10.2

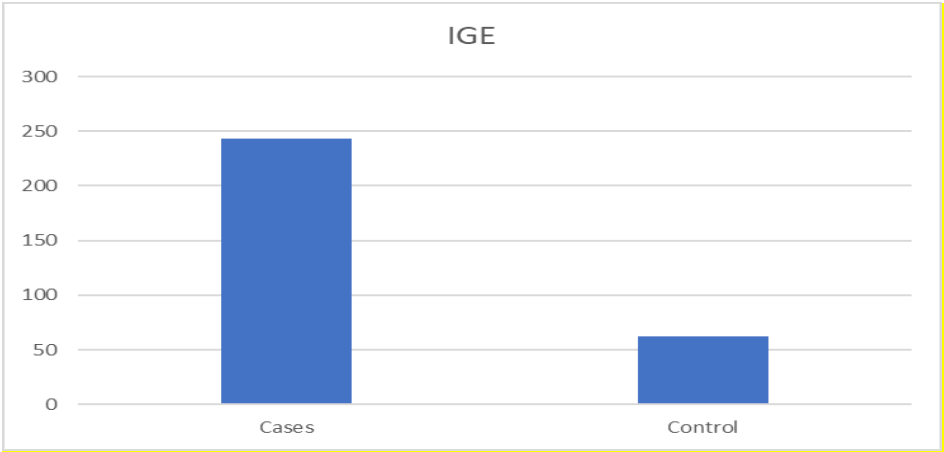
ng/ml in the AR group, respectively, and 30.8 and 23.3 ng/ml in the control group, respectively. Ninety-three percent of AR patients have shown a deficiency in vit. D level, where 56% of this group showed severe deficiency. On the other hand, 34% of the control group has shown an insufficient level of vit. D. Additionally, 64% of AR patients have shown serum levels of IgE at values ranging between 100-299 ng/ml. Higher serum levels of IgE at values ranging between 300-599 ng/ml and 600-1000 ng/ml were observed in 25% and 11% of AR patients, respectively. The prevalence of low levels of vit. D in the AR group was significantly higher than that in the control group. Vit. D deficiency is significantly related to severe AR symptoms and measuring serum vit. D level is recommended in the management plan of this group of patients.

Awan N U et al (2021)[28] determined the association of serum vitamin D and immunoglobulin E (IgE) levels with the severity of allergic rhinitis (AR). A total of 224 patients were included in the study, 112 patients in group A and 112 patients in group B. Mean serum vitamin D levels in group A were 16.24±6.7 ng/ml and in group B 26.92±35 ng/ml (p=0.0001). Mean serum IgE levels in group A were 383.69±154.86 IU/ml and in group B, they were 373.03±106.83 IU/ml (p=0.0001). Vitamin D deficient patients were 24 times more likely to develop moderate to severe AR disease. This study showed that in moderate-severe AR, IgE levels are raised statistically as compared to mild AR and the deficiency of Vitamin D is associated with increasing severity of allergic rhinitis symptoms.

The present study found a statistically significant increase in Immunoglobulin E. Table 2 shown the comparison of Immunoglobulin E between cases and controls. The present study showed increase level of serum Immunoglobulin E in patients with allergic rhinitis as compared to that of healthy controls.

On comparing the mean values using the t- test the mean value of serum Immunoglobulin E in allergic rhinitis patients was found to be **243±51.96** which was significantly increase as compared to that of controls which was found to be **62.59±86.08** ($p< 0.05$).

Parameters	Cases(n=22) Mean±SD	Control(n=22) Mean±SD	t value	P value
IGE	**243±51.96**	**62.59±86.08**	**13.58**	**<0.05**



CONCLUSION

Allergic rhinitis is common disorder that can significantly impact patients quality of life. Our findings underlined the importance of serum IgE and Vitamin D3 as feature of rhinitis. The level of IgE is being high in patients of allergic rhinitis. Vitamin D is a regulatory factor in immune system. Vitamin D3 deficiency is linked with the severity of allergic rhinitis and monitoring serum vitamin D levels is advisable in this group of patients.

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