

# Allergy Profile of Patients Visiting a Tertiary Care Hospital in Hilly Areas of Solan, Himachal Pradesh, India

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## ABSTRACT

**Introduction:** Allergic diseases are common and affect a large population worldwide. Not many studies are available regarding the same and almost none in Solan district.

**Aim:** To assess the prevalence of allergies in this region, the major symptoms involved, the major allergens causing them and their association with vitamin D insufficiency.

**Materials and Methods:** This prospective case-control study was conducted in Maharishi Markandeshwar Medical College and Hospital, Himachal Pradesh, India (March 2017 to October 2017). A total of 159 patients in allergic group were evaluated for age and sex distribution, common symptoms involved, spirometry, nasal endoscopy findings and the common allergens responsible. They were compared with 148 patients in the control group for utility of Skin Prick Tests (SPT), Total IgE levels and to

study the impact of vitamin D insufficiency on the disease.

**Results:** Allergies were common in younger age group of 21 to 40 years of age (61%) and in females the most common complaints were nasal (63%) and the most common allergens involved were dust mite mix, cockroach and pine mix in this region. Majority of the patients had obstructive disease with reversibility suggestive of asthma and most common nasal finding is bilateral inferior turbinate hypertrophy (65%). SPT are more sensitive and specific as compared to total IgE levels. There is good association between allergic diseases and vitamin D insufficiency (odds ratio 3.4).

**Conclusion:** Present study focussed on the nature of allergens among allergic patients in the Solan district and found SPT to be the most reliable and vitamin D insufficiency to be one of the factors for allergies.

**Keywords:** Allergens, Asthma, Skin prick tests

## INTRODUCTION

Nowadays, the number of patients suffering from allergic diseases including asthma, allergic rhinitis, food and skin allergies are increasing rapidly in both urban and rural regions of India and even more in Solan region. As per a estimate, 20% of world population suffers one form of allergy or the other [1]. There are no major studies on allergic diseases in this region. Most studies have been done in developed countries.

Allergy is defined as immediate type I hypersensitivity reaction to an antigen. Allergic rhinitis is most common over the world and affects quality of life [2]. Still, allergic diseases are still under diagnosed and under treated worldwide [3]. Asthma if diagnosed early can be treated with low doses of inhaled steroids [4]. Studies have shown that vitamin D deficiency can lead to exacerbation of asthma [5]. Allergy skin testing (SPT) is a well established diagnostic procedure used for more than 100 years. It develops a wheal and flare over a period of 15 to 20 minutes following the introduction of allergen to which a person is sensitised [6]. It is a reliable and cheap technique for diagnosis of IgE mediated allergic diseases which was first described by Dr. Charles Blackley in 1867 [7]. The immunoglobulin IgE is associated with type I hypersensitivity and is an important component of allergic disorders [8]. Atopic individuals have higher levels of IgE than normal individuals. These diseases cause lot of stress, loss of sleep, affects quality of life and even financial loss [9]. So, present study aimed to assess the nature of allergic diseases in this region, the major complaints of patients with allergic diseases and the common allergens of the area. Present study also aimed to study the association between allergic diseases and vitamin D insufficiency.

## MATERIALS AND METHODS

This prospective case-control study was conducted in allergy and asthma special clinic attached to Ear, Nose and Throat (ENT) Outpatient Department (OPD) of Maharishi Markandeshwar Medical

College and Hospital, Solan, Himachal Pradesh, India (March 2017 to October 2017). Approval approved by Institutional Ethics Committee. Patients who visit clinic with allergic complaints and gave their consent for the study, were included in the study group (allergy group). A total of 159 patients were included in the study group, after explaining the whole procedure to the patients. Another 148 patients without any allergic symptoms who visited regular ENT OPD and gave their consent for the study were included in control group (non allergic).

The patients with recent history of anaphylaxis or recent intake of anti allergic medications like anti histaminics, anti leukotriene, on anti psychotic drugs and recent exacerbations of asthma or recent history of hospitalisation due to the same or with severe dermatographism were excluded from the study.

Patients in both the groups underwent SPT for common allergens, total IgE and vitamin D level measurements were done; results were compared and analysed.

Patients in allergic group were also analysed for:

- Age and sex distribution,
- Major complaints of patients,
- SPT findings of allergen sensitisation,
- Spirometry findings in patients with pulmonary complaints,
- Diagnostic nasal endoscopy findings in patients with nasal complaints.

The SPT was done for common allergens like dust mite, cockroach, mould mix, grass pollen mix, wheat and common regional allergen pine mix as pine trees are common in Solan region.

The positive control used was histamine and negative control was saline. A wheal 3 mm or more than negative control was considered positive for allergen [6]. The allergens used were standardised allergens imported from Hollister Steir Company from United State of America (USA) through Pranav Pharma Bangalore.

Regarding vitamin D testing, testing of 25 hydroxyl vitamin D or vitamin D3 was done. Testing of total IgE levels was done using automatic biochemistry siemens analyser by chemiluminescence method.

Spirometry findings were obtained and classified according to Global Initiative for Asthma Guidelines (GINA) [10]. Patients were evaluated by Forced Vital Capacity (FVC), Forced Expiratory Volume in 1st second (FEV-1) and the ratio of both (FEV-1/FVC), Forced Expiratory Flow at 25-75% of FVC (FEF 25-75%) [10]. The spirometer used was RMS Helios 401 spirometer.

Diagnostic nasal endoscopy was done using 0 and 30° Karl Storz Hopkins nasal endoscopes. Three pass method was used for nasal endoscopy. In first pass the examination of inferior meatus and nasopharynx was done. In second pass examination of superior meatus was done and in third pass examination of middle meatus was done [11].

The range, percentage, sensitivity and specificity, likelihood ratio and odds ratio were calculated. Odds ratio, sensitivity and specificity was calculated using 2x2 table and likelihood ratio using sensitivity and specificity.

## RESULTS

Regarding age and sex distribution, most of the patients with allergic diseases were of younger and middle age group of up to 40 years (87% of patients). The youngest patient was of seven years age and the eldest was of 76 years. There were more female allergic patients as compared to males with ratio of 1.5:1 [Table/Fig-1].

The most common complaint of allergic patients were nasal (63% of allergic patients) sneezing, nasal discharge, nasal obstruction, nasal

Age groups	Males	Females	Total (%)
<20 years	05	06	11 (07%)
21-40 years	36	61	97 (61%)
41-60 years	17	24	41 (26%)
>60 years	05	05	10 (06%)
Total	63	96	159

[Table/Fig-1]: Age and sex distribution among patients with allergic diseases.

Major complaints	Number of patients	Percentage of total patients (%)
Nasal	100	63%
Pulmonary	52	32%
Dermatological	52	32%
Eyes	50	31%
Ears	12	08%
Gastrointestinal	10	06%

[Table/Fig-2]: Major complaints of patients with allergic diseases.

itching followed by pulmonary breathlessness, chest tightness, cough day time or nocturnal, wheezing and dermatological pruritus, erythema and wheal formation and eye complaints watering from eyes, itching, redness of eyes [Table/Fig-2].

All the patients with allergic diseases were (159) taken as study group and a control group without any allergic complaints (148) and were compared for SPT sensitisation, total IgE levels and vitamin D levels. Regarding the SPT sensitisation, we found sensitivity and specificity of SPT to be around (82%) and (21%) respectively and a positive likelihood ratio of 3.9 which shows a good utility of SPT for allergic diseases [Table/Fig-3]. Regarding SPT findings in allergic group, out of 131 patients sensitised maximum (65%) were to dust mite mix and (59%) were to cockroach and (46%) to pine mix [Table/Fig-4].

Groups	Sensitised	Percentage of sensitised (%)
Allergic (study) (n=159)	131	82%
Non allergic (control) (n=148)	30	21%

[Table/Fig-3]: Skin prick test sensitisation.

Allergens	Number of patients sensitised	Percentage of sensitised (%)
Dust mite mix	85	65%
Cockroach	77	59%
Grass pollen mix	34	26%
Mould mix	32	24%
Peanut	22	17%
Wheat	04	03%
Cattle dander	Nil	00%
Cat pelt	Nil	00%
Pine mix	60	46%

[Table/Fig-4]: Skin prick test findings.

Regarding total IgE levels, patients with high total IgE levels ( $\geq 158$  IU/mL) were compared in both study and control group and the test was found to have sensitivity and specificity of 64% and 61% respectively with positive likelihood ratio of 1.6 which shows a lesser utility of this test for allergic diseases [Table/Fig-5] [12]. Regarding vitamin D insufficiency, the values of  $<30$  ng/mL was taken as low levels [13]. The test had an odds ratio of 3.4 which shows a good association between vitamin D insufficiency and allergic diseases [Table/Fig-6].

Groups	High levels	Percentage (%)
Allergic (study) (n=159)	102	64%
Non allergic (control) (n=148)	58	39%

[Table/Fig-5]: Total IgE levels.

Groups	Low levels	Percentage (%)
Allergic (study) (n=159)	120	76%
Non allergic (control) (n=148)	70	47%

[Table/Fig-6]: Vitamin D levels.

Regarding the spirometry findings in allergic patients with pulmonary complaints, maximum number of patients had obstructive lung disease with reversibility suggestive of asthma [Table/Fig-7].

Regarding diagnostic nasal endoscopy findings in allergic patients with nasal complaints, maximum of them (65%) had bilateral inferior turbinate hypertrophy [Table/Fig-8].

Findings	Number of patients (n=52)	Percentage (%)
Normal	05	09%
Early/Small airway obstruction	20	39%
Obstructive with reversibility	21	40%
Obstructive without reversibility	03	06%
Restrictive	Nil	00%
Obstructive as well as restrictive	03	06%

[Table/Fig-7]: Spirometry findings.

Findings	Number of patient (n=100)	Percentage (%)
Nasal polyp	10	10%
Pus in meatus	08	08%
Deviated nasal septum	30	30%
B/L inferior turbinate hypertrophy	65	65%

[Table/Fig-8]: Diagnostic nasal endoscopy findings in allergic patients with nasal complaints.  
B/L-Bilateral

## DISCUSSION

The data on allergic diseases and their causes is still lacking especially in India. It is during infancy and early childhood that sensitivity to allergens develop which depends on immunological memory generated [14]. T cell selection of T helper cells (Th2 cells) increases tendency of allergic diseases [15]. SPT is the gold standard for diagnosis of allergic diseases [3]. It is said to be more sensitive and specific, simple and inexpensive [16]. In present study

we also found a good utility of SPT for allergic diseases by means of sensitivity, specificity and positive likelihood ratio [Table/Fig-3].

Regarding the common found allergens we found dust mite mix to be the most common allergen followed by cockroach and pine mix in Solan region [Table/Fig-4]. Allergens are said to vary according to geographical flora and climate [9]. Various studies have found sensitisation to aeroallergens between 80-90% [17]. In a study by Giridhar BH et al., the common offending allergen was cockroach [1]. Another study by Oladeji SM et al., has shown the most common allergen to be house dust mite followed by tree pollen [18]. Duc J et al., found similar results with house dust to be most common allergen [19]. Other common allergens are cat and dog fur and fungi [1].

The most common complaint of allergic patients were nasal sneezing, nasal discharge, nasal obstruction, nasal itching seen in 63% of patients in present study [Table/Fig-2]. According to another study by Bousquest J et al., allergic rhinitis affect 10-40% of population [20]. Another study by Wiqar SA, reported allergic rhinitis constitute about 55% of all allergies in India [21]. These results go along with present study.

We also tested the patients for total IgE and found much lower sensitivity and specificity of 64% and 61% respectively with positive likelihood ratio of 1.6 which shows a lesser utility of this test for allergic diseases [Table/Fig-5]. Similar results were obtained by another study which showed a sensitivity of 70.8% [22]. So, total IgE levels are not a good indicator for diagnosing allergic diseases.

Humans receive at least 80% of vitamin D through sunlight [5]. According to Litonjua AA and Weiss ST, since most of the time is spent indoor, could lead to vitamin D deficiency or insufficiency and could be reason for allergies and asthma [23]. In the present study we also found a good association between allergic diseases and vitamin D insufficiency [Table/Fig-6].

In the present study we found allergic diseases to mainly affect the younger and middle age group [Table/Fig-1]. Another study has found similar results with mean age of 29.3 years [24]. There was female predominance among allergic patients in the present study. Rasool R et al., got similar results with female predominance [25]. Another study by Giridhar BH et al., have also shown allergic disorders to be more common in females [1]. Present study found obstructive lung diseases with reversibility suggestive of asthma to be the most common spirometry finding among patients. Bilateral inferior turbinate hypertrophy was found to be the most common nasal sign in patients with allergies in the present study [Table/Fig-8]. Similar results were obtained for middle and inferior turbinates by other studies [26].

## LIMITATION

The limitation of present study was that it not a community based study but hospital based study. So, a larger population based studies need to be conducted. Further season based studies needs to be done regarding pine allergens depending on the season of pollination, to achieve better preventive measures.

## CONCLUSION

Allergic diseases are common in Solan region with increased prevalence among younger age groups and females. Most of the patients suffer from nasal complaints and have findings of bilateral inferior turbinate hypertrophy. SPT are the gold standard for diagnosing allergic sensitisation. Dust mites and cockroaches are

the most common allergens. Pine allergies are also found common along with dust mites and cockroaches in Solan region. There is a strong association between vitamin D insufficiency and allergies.

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## REFERENCES

- [1] Giridhar BH, Kumar S, Verma AK, Singh A, Kumar D, Prasad R, et al. A study on profile of allergens sensitivity and associated factors in naso-bronchial allergic patients. *Natl J Med Res.* 2012;2(1):70-76.
- [2] Bousquet J, Khaltaev N, Cruz AA, Denburg J, Fokkens WJ, Togias A, et al. Allergic rhinitis and its impact on asthma (ARIA) 2008 update (in collaboration with the world health organization, GA(2)LEN and AllerGen). *Allergy.* 2008;63(Suppl86):08-160.
- [3] Asha'ari ZA, Yusof S, Ismail R, Che Hussin CM. Clinical features of allergic rhinitis and skin prick test analysis based on the ARIA classification: a preliminary study in Malaysia. *Ann Acad Med Singapore.* 2010;39(8):619-24.
- [4] Bush A, Zar HJ. WHO universal definition of severe asthma. *Curr Opin Allergy Clin Immunol.* 2011;11(2):115-21.
- [5] Holick MF. Vitamin D deficiency. *N Engl J Med.* 2007;357(3):266-81.
- [6] Nelson H. Diagnostic procedures in allergy: allergy skin testing. *Ann Allergy.* 1983;51(4):411-18.
- [7] Kunoor A, Peruvamba H, James PT, Rakesh PS. Allergen profile of patients from central Kerala India. *Int J Pharm Bio Sci.* 2017;8(1):b588-92.
- [8] Gould HJ, Sutton BJ, Beavil AJ, Baevil RL, McCloskey N, Coker HA, et al. The biology of IgE and the basis of allergic diseases. *Annu Rev Immunol.* 2003;21:579-28.
- [9] Moghtaderi M, Hejrati Z, Kolahi N, Heidari B. Sensitization to aeroallergens in patients with allergic rhinitis, asthma, and atopic dermatitis in Shiraz, Southwestern Iran. *Indian J Allergy Asthma Immunol.* 2015;29:79-83.
- [10] Chhabra SK. Clinical application of spirometry in asthma. Why when and how often? *Lung India.* 2015;32(6):635-37.
- [11] Kaluskar SK. Office nasal endoscopy. *Endoscopic sinus surgery.* Springer, London. 1997;pp21-31.
- [12] Kowalak JP, Welsh W, Jackson K, Mills EJ. Diagnosing allergies. *Handbook of allergic disorders.* Lippincott Williams & Wilkins. Philadelphia. 2003;pp20-36.
- [13] Kennel KA, Drake MT, Hurley DL. Vitamin D deficiency in adults: when to test and how to treat. *Mayo Clin Proc.* 2010;85(8):752-58.
- [14] Holt PG. Infections and the development of allergy. *Toxicol Lett.* 1996;86:205-10.
- [15] Holt PG. A potential vaccine strategy for asthma and allied atopic diseases during early childhood. *Lancet.* 1994;344:456-58.
- [16] Ten RM, Klein JS, Frigas E. Allergy skin testing. *Mayo Clin Proc.* 1995;70:783-84.
- [17] Prabhakar RP, Harikishan G, Neeharika B. Comparative allergen profile in Krishna Godavari regions. *Indian Journal of Mednodent and Allied Sciences.* 2013;1(1-3):01-05.
- [18] Oladeji SM, Nwawolo CC, Adewole OO. Allergic rhinitis among adult bronchial asthmatic patients in Lagos, Nigeria. *J West Afr Coll Surg.* 2013;3(2):01-14.
- [19] Duc J, Kolly M, Pecoud A. Frequency of respiratory allergens involved in rhinitis and bronchial asthma in adults. Prospective study. *Schweiz Med Wochenschr.* 1986;116(36):1205-10.
- [20] Bousquest J, Van Cauwenberge P, Bachert C, Canonica GW, Demoly P, Durham SR, et al. Requirements medications commonly used in the treatment of allergic rhinitis. *Academy of allergy and clinical immunology (EAACI), allergic rhinitis and its impact on asthma (ARIA).* *Allergy.* 2003;58(3):192-97.
- [21] Wiqar SA. Allergic rhinitis in allergy and asthma-a clinical primer. *IJCP.* 1999;65.
- [22] Vidal C, Gude F, Boquete O, Fernández-Merino MC, Mejjide LM, Rey J, et al. Evaluation of phadiatop test in diagnosis of allergic sensitization in a general adult population. *J Investig Allergol Clin Immunol.* 2005;15(2):124-30.
- [23] Litonjua AA, Weiss ST. Is vitamin D deficiency to blame for the asthma epidemic? *J Allergy Clin Immunol.* 2007;120(5):1031-35.
- [24] Desalu OO, Salami AK, Iseh KR, Oluboyo PO. Prevalence of self reported allergic rhinitis and its relationship with asthma among adult Nigerians. *J Investig Allergol Clin Immunol.* 2009;19(6):474-80.
- [25] Rasool R, Shera IA, Nissar S, Shah ZA, Nayak N, Siddiqi MA, et al. Role of skin prick test in allergic disorders: a prospective study in Kashmiri population in light of review. *Indian J Dermatol.* 2013;58(1):12-17.
- [26] Ameli F, Brocchetti F, Tosca MA, Signori A, Ciprandi G. Nasal endoscopy in children with suspected allergic rhinitis. *Laryngoscope.* 2011;121(10):2055-59.

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