

Analysis of Distribution of Allergens and its Seasonal Variation in Allergic Rhinitis

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ABSTRACT

Introduction: Allergic diseases are common and they have increased in frequency over the last few decades. More than 30% of the population suffers from allergic rhinitis (AR). It is defined as a combination of two or more symptoms, namely, watery rhinorrhea, nasal obstruction, itching, and sneezing. Allergic rhinitis occurs when these symptoms are the result of immunoglobulin E (IgE)-mediated inflammation following exposure to allergens. The common inhalant allergens causing AR are house dust mites, pollens, fungi, and insects. Skin prick test (SPT) is the gold standard test in the diagnosis of AR.

Aim: To study the distribution of inhalant allergens in AR and to find out seasonal variations in allergens by SPT.

Materials and methods: A descriptive study was done in 120 patients who came with symptoms of AR to ear, nose, and throat (ENT) outpatient department (OPD) of tertiary care hospital. The study was done from November 2017 to October 2018. The patient was clinically evaluated and the SPT was performed to analyze the distribution of inhalant allergens and its seasonal variations.

Results: The majority of the patients are males between 21 and 30 years of age. Majority of the people are urban residents. Dust mites followed by pollens yielded the highest number of positive responses among inhalant allergens. Dust mites and dusts are more common during winter season, pollens are more common during summer season, and fungi and insects (5.83%) during rainy season.

Conclusion: Analyzing the distribution of specific allergens for a particular geographical area and its seasonal variation helps in appropriate diagnostic evaluation of allergens, educating the patient on what allergen to avoid and also to find the best formulation of allergen immunotherapy for effective AR treatment.

Keywords: Allergens, Allergic rhinitis, Dust mite, Seasonal.

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INTRODUCTION

Allergic rhinitis (AR) is an inflammatory nasal mucosal disease characterized by attacks of sneezing, profuse watery nasal flow, nasal congestion, and itching. This reaction is caused by immunoglobulin E (IgE)-mediated type I hypersensitivity reaction and is secondary to the allergic contact of the nasal mucosa. Physical examination typically reveals conchal hypertrophy, pale color of the concha mucosa, and excessive serous secretion. Allergic rhinitis has been classified as seasonal, perennial, and occupational AR based on the period of exposure to the allergen. Perennial AR is usually caused by house dust mites, fungi, insects (cockroaches), and animal feathers. Seasonal AR is caused by various extraneous allergens such as pollen and fungi. Distinguishing these two types may not always be straightforward. For example, a patient with seasonal AR may have allergies to a variety of pollens that develop at different times of the year, and their symptoms may suggest perennial rhinitis. Also, in some regions, pollens and fungi may be present throughout the year. On the contrary, symptoms of perennial allergy may not persist throughout the year.¹

Epidemiological studies obtained from different countries show the prevalence of respiratory allergy as 15–30%.² In an allergic population, sensitivity in urban areas is greater than that in rural areas.² Aeroallergens (airborne allergens) play an important role in respiratory allergic diseases, especially asthma and AR. Sampling from aeroallergens provides information that is clinically useful in determining possible reason for allergic symptoms in sensitive people. Aeroallergens, including pollens (plant pollens), fungi, dusts, domestic mites, domestic animals, and insects, are the most important factors initiating allergic diseases.²

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The prevalence of AR has increased eventually over the years. It is estimated that 400 million people suffer from AR, which affects 20% of adults and 40% of children in the US and UK (Bousquet et al., 2007; Gupta, Sheikh, Strachan, and Anderson, 2004). In India, 20–30% of the population is suffering from AR.³

Allergic disorders such as asthma are often underdiagnosed and undertreated, creating considerable burden on individuals and families.⁴ It is responsible for approximately 1% of all disability-adjusted life years lost worldwide.⁴ Allergic disorders and its complications have also been reported to increase healthcare costs of the individual.⁵ Therefore, even though mostly a non-life-threatening condition, they can impair the person's ability to function. It thus has a huge socioeconomic impact and can adversely influence psychological well-being and quality of life.^{6–8}

Allergic rhinitis is closely associated with the release of type-2 helper cells (TH2)-type immune response, antigen-presenting

cells, eosinophils, basophils, and macrophages as the main cellular elements and IgE as well as all other mediators such as histamine, leukotrienes, and interleukins, granulocyte-macrophage colony-stimulating factor and various chemokines. Moreover, pollen is considered as one of the most abundant and inevitable elements in AR.⁹

Skin prick test (SPT) is a standardized test widely used in the diagnosis of suspected cases of IgE-mediated allergy. It is considered as the gold standard in the diagnosis of allergy.¹⁰ This method does not require spending long time and high cost, and compared to the same experiments, its sensitivity and features are very high. This test can play a determining role in adopting prevention methods and patients' treatment and desensitization. Usually, positive skin reaction rate is highly associated with clinical findings, and it can even determine the severity of the disease. Avoiding allergens shall be considered as the first-line prevention in controlling AR, even when it is not completely effective.

This method may reduce the need for further treatment. Identifying the most common aeroallergens to which the patients are allergic plays an important role in diagnosis and treatment of AR.

Identifying the aeroallergens of each region helps preventing AR disease in an advisable time, while it is effective in selecting the type of allergy vaccine for appropriate treatment when prevention and medical treatment are not effective and allergy vaccines are required.

For the above reasons, we decided to study the prevalence of allergens and their relationship with AR in our own region.

MATERIALS AND METHODS

This descriptive study was conducted in Allergy Clinic, Department of ENT in a tertiary care hospital from November 2017 to October 2018. The approval of Institutional Ethical Committee was taken.

Patients coming to the ENT OPD with symptoms of AR (clinical symptoms including sneezing, runny nose, itching, or nasal congestion along with eye or throat involvement) were considered for the SPT and studied.

The inclusion criteria are patients coming to the hospital complaining of sneezing, runny nose, itching, or nasal congestion along with eye or throat involvement and diagnosis of AR, patients of age 10–40 years, willing to undergo the necessary examinations, and giving consent for SPT.

The exclusion criteria included underlying all other types of rhinitis such as vasomotor and infectious rhinitis, taking antihistamine and corticosteroid drugs over the past 2 weeks, heart disease, acute asthma exacerbation, deviated nasal septum, any nasal mass, or nasal polyposis. In this study, the skin test with 5 types of aeroallergens that includes 18 aeroallergens was performed on all patients who fits into the inclusion criteria enumerated above.

Seasons were defined as November, December, January, and February (winter); March, April, May, and June (summer); and July, August, September, and October (rainy season).

Patients coming to the ENT OPD were asked about their history and then the ENT examination was performed to rule out deviated nasal septum, nasal polyps, or any mass in the nasal cavity. Patient was sent for the following investigations: complete blood count-erythrocyte sedimentation rate (CBC-ESR) and absolute eosinophil count (AEC). Diagnostic nasal endoscopy was done.

Before doing the SPT, the patients were explained about the test and its local and systemic complications. Consent was taken from the patient. The skin test was considered valuable if the patients had a positive reaction to histamine (positive control) with

erythema of greater than 6 mm, and a negative reaction to normal saline with edema and erythema of about zero. Otherwise, they were excluded from the study.

While performing the tests, the used kits were frequently checked for expiry date. The tests were performed using 18 aeroallergens.

The allergen extracts were put on the skin of both forearms with at least 2 cm distance from each other, and the prick test was performed using a lancet device. The skin reaction was measured on-site after 15–20 minutes through formation of skin erythema. Erythema with a diameter of more than 6 mm was considered as a positive skin reaction. The test results were recorded on the sheet related to skin test.

Data Analysis

All the data collected were compiled and entered into a Microsoft Excel worksheet. Descriptive statistics was used to present the data. Qualitative variables were presented as frequencies and percentages. The data were analyzed using Statistical Package for Social Sciences (SPSS software v.21.0).

RESULTS

In this study, the questionnaire and skin test were completed for 120 individuals.

In this study, most common age-group is 21–30 years (Fig. 1).

In this study, 62.5% of the patients are urban residents and 37.5% are rural residents (Figs 2 and 3).

DISCUSSION

In this study, the most common age-group presented was 21–30 years, i.e., 66.66% belong to 21–30 years' age-group (49.99% are males and 16.66% are females), while only 15% of the patients belong to the age-group of 31–40 years. In the Tecumseh Michigan study (2000), the highest prevalence of AR in males occurred in the age-group of 16–24 years (16.3%) and in females in the age-group of 23–34 years (15.3%).¹¹

This proved that AR occurs less in older age-group as immunosuppression and atrophy of nasal mucosa occur, and the number of T cells in the blood declines with age, whereas these are higher in younger age-group. This is also the age-group in India when people start to move to a different location for their study or work and females move after marriage.

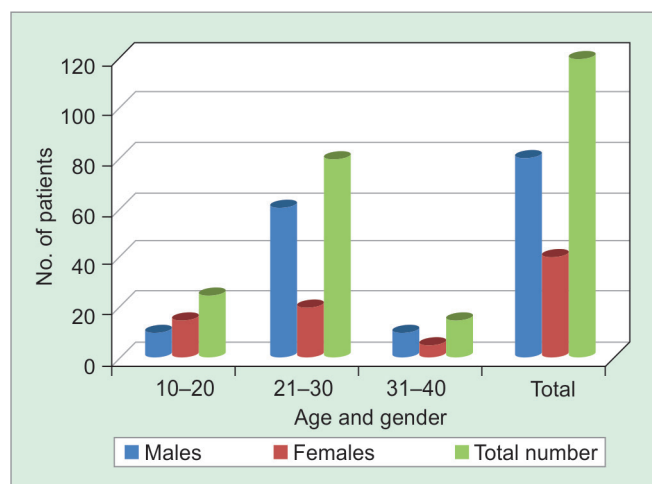


Fig. 1: Distribution of subjects according to age and gender

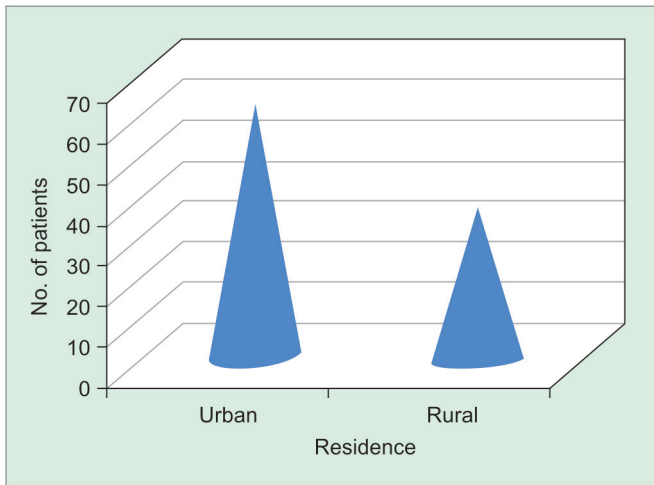


Fig. 2: Distribution of patients showing residence

Table 1: Distribution of the subjects according to age and gender

| Age | Males | Females | No. of subjects | Percentage |
|-------|-------|---------|-----------------|------------|
| 10–20 | 10 | 15 | 25 | 20.85 |
| 21–30 | 60 | 20 | 80 | 66.64 |
| 31–40 | 10 | 5 | 15 | 12.49 |
| Total | 80 | 40 | 120 | 100 |

Table 2: Distribution of residents

| Resident | No. of subjects | Percentage |
|----------|-----------------|------------|
| Urban | 75 | 62.5 |
| Rural | 45 | 37.5 |
| Total | 120 | 100 |

It was observed in our study that AR is more common in males than in females, with 66.66% in males and 33.33% in females. These observations were consistent with those of Ciprandi et al.¹² The higher incidence of AR observed in males compared with females is possibly because of more exposure of males to workplace-related allergens and stress. Another factor that can be considered is the conservative nature of people in India, with females not showing up at hospital for their ailments (Tables 1 to 4).

In our study, 62.5% of the patients belong to urban residence, while 37.5% belongs to rural residence. Nilsson et al. reported that a higher prevalence of allergic diseases was observed with urban residence than with rural residence.¹³

Dust mites (20.82%) and dusts (12.49%) are more common during winter season, pollens (17.49%) are more common during summer season, and fungi (4.9%) and insects (5.83%) during rainy season. The study conducted in Mexico showed that tree pollens and grasses and weed pollens are more common during the dry winter and summer seasons, respectively.² Mold is more common in winters.¹⁴ In another study, the rate of sensitization to dust mite was lower in summers.¹⁵ These studies go along with the findings we obtained. Another study has shown dust mite allergies to be maximum during fall (autumn).¹⁶

Most common allergen in this study is dust mite (32.48%) followed by pollens (27.48%), dusts (18.32%), fungi (10.82%), and insect (9.16%). On comparing these findings with a study carried out in Central India (Nagpur), the most common allergen was mite

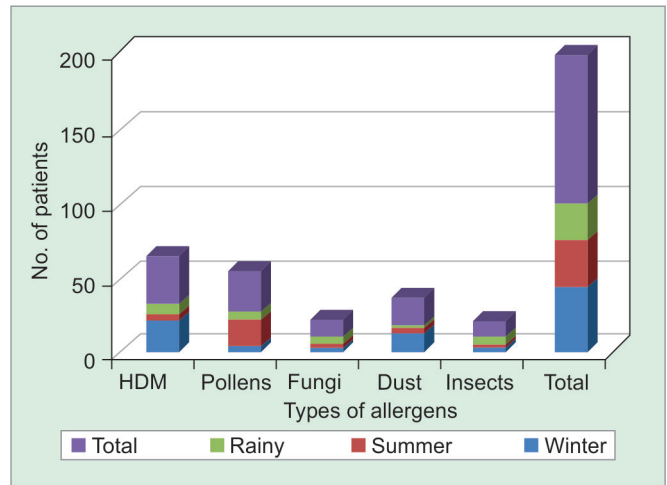


Fig. 3: Distribution of allergens in relation to seasonal variation *Total—total number of allergens, *HDM—house dust mite (dust mite), most common allergen in this study is dust mite (32.48%) followed by pollens (27.48%), dusts (18.32%), fungi (10.82%), and insect (9.16%). Dust mites (20.82%) and dusts (12.49%) are more common during the winter season, pollens (17.49%) are more common during the summer season, and fungi (4.9%) and insects (5.83%) during the rainy season

(49%), followed by pollen (21.8%), dust (15.4%), insect (10.6%), fungus (3%), and animal epithelia (0) in AR patients.¹⁷ In Lucknow, the most common offending allergen was insects (21.2%), followed by dusts (12.0%), pollens (7.8%), animal dander (3.1%), and fungi (1.3%).^{18,19} A study from North India also showed markedly positive skin reactions to antigenic extracts of 13 pollens, varying from 2.4% to 16.9%, with an average of 9.65%. The overall incidence of SPT reactivity was the highest against the antigenic extract of pollen belonging to the family Asteraceae and Moraceae.²⁰

In the present study, 23.48% were positive to pollen. The most common among pollen was *Parthenium hysterophorus* (11.6%) followed by *Ricinus communis* (5.83%), *Xanthium strumarium* (5.83%), and *Chenopodium album* (4.16%). Studies carried out in the southern India revealed that *Casuarina*, *Parthenium*, *Spathodea*, *Cheno/Amaranth*, *Cocos*, *Eucalyptus*, *Poaceae*, *Peltophorum*, and *Cyperaceae* are dominant pollens.^{21,22} Subbarao et al.²³ recorded allergenicity to *Parthenium hysterophorus* pollen extracts in 12% bronchial asthma patients.

In the present study, 10.82% were positive to fungi. The most common fungi were *Aspergillus flavus* (4.99%), *Candida albicans* (3.73%), *Aspergillus niger* (1.66%), and *Trichoderma* (0.833%). In a study conducted by Agrawal et al.,²⁴ it was reported that *Aspergillus fumigatus* (16%) showed marked skin positivity followed by *Candida albicans* (10%) and *Aspergillus niger* (10%).

In the present study, 9.16% were positive to insects. Gaur et al.²⁵ found allergy to moth, mosquito, locust, cockroach, and grasshopper were the most common allergen in nasobronchial allergy (NBA). Achary et al.²⁶ also found moth, mosquito, and ant to be the most common allergen in NBA.

CONCLUSION

Dust mites followed by pollens yielded the highest frequency of distribution. They are the most common allergens in patients affected by AR. Dust mites followed by dusts were more common during the winter season. Fungi and insects were found to be more common in the rainy season and pollens in the summer season.

Table 3: Distribution of allergens affecting the patient in relation to season

| Season | Dust mites | Pollens | Fungi | Insects | Dust | Total |
|--------|------------|---------|-------|---------|------|-------|
| Winter | 25 | 5 | 3 | 4 | 15 | 52 |
| Summer | 6 | 21 | 4 | 2 | 5 | 38 |
| Rainy | 8 | 7 | 6 | 7 | 2 | 30 |
| Total | 39 | 33 | 13 | 13 | 22 | 120 |

Table 4: Distribution of allergens among subjects

| Allergen | No. of patients sensitive to | Percentage |
|---|------------------------------|------------|
| <i>Parthenium hysterophorus</i> (pollens) | 14 | 11.66 |
| <i>Ricinus communis</i> (pollens) | 7 | 5.83 |
| <i>Xanthium strumarium</i> (pollens) | 7 | 5.83 |
| <i>Chenopodium album</i> (pollens) | 5 | 4.16 |
| <i>Aspergillus flavus</i> (fungi) | 6 | 4.99 |
| <i>Candida albicans</i> (fungi) | 4 | 3.33 |
| <i>Aspergillus niger</i> (fungi) | 2 | 1.66 |
| <i>Trichoderma</i> (fungi) | 1 | 0.833 |
| Cockroach (insect) | 9 | 7.49 |
| Ant (insect) | 1 | 0.83 |
| Grasshopper (insect) | 2 | 1.66 |
| Moth (insect) | 1 | 0.83 |
| Cotton dust (dust) | 10 | 8.33 |
| Wheat dust (dust) | 5 | 4.16 |
| Hay dust (dust) | 7 | 5.83 |
| <i>Dermatophagoides farinae</i> <i>D. farinae</i> (dust mite) | 18 | 14.99 |
| <i>D. pteronyssinus</i> (dust mite) | 14 | 11.66 |
| <i>Biomia</i> sp. (dust mite) | 7 | 5.83 |
| Total | 120 | 100 |

D. pteronyssinus—*Dermatophagoides pteronyssinus* *D. farinae* (14.99%) is the most common allergen followed by *D. pteronyssinus* (11.66%) and *Parthenium hysterophorus* (11.66%)

More males were affected and the urban population was affected more than the rural. We would like to emphasize that diagnostic evaluation of allergens is needed to educate the patient on what allergen to avoid and also helps to find the best formulation of treatment.

REFERENCES

- Konuk S. Skin prick test in allergic rhinitis in Duzce province of Turkey. *Biomed Res* 2017;28(15).
- Mahram M, Barikani A, Nejatian N. The frequency of common allergens in allergic rhinitis among the patients Referred to the allergy clinic of Qods hospital in Qazvin during 2007-2010. *J Aller Ther* 2013;4:130. DOI: 10.4172/2155-6121.1000130.
- University A analyst at PG is M in PS has worked as an AP in PBDS, Drugs is a published research scholar S has worked on several Projects like A-U, Formulations SR, books FTFH lies in, writing, Travel SL to, et al. Prevalence allergic rhinitis and its diagnosis with therapeutic considerations [Internet]. Knowledge Tank. 2017 [cited 2019 Oct 24].
- Bousquet J, Bousquet PJ, Godard P, et al. The public health implications of asthma. *Bull World Health Organ* 2005;83(7):548-554.
- Weinmann S, Kamtsiuris P, Henke KD, et al. The costs of atopy and asthma in children: assessment of direct costs and their determinants in a birth cohort. *Pediatr Allergy Immunol* 2003;14(1):18-26. DOI: 10.1034/j.1399-3038.2003.02085.x.
- Samolinski B, Sybilski AJ, Raciborski F, et al. Prevalence of rhinitis in polish population according to the ECAP (epidemiology of allergic

- disorders in Poland) study. *Otolaryngol Pol* 2009;63(4):324-330. DOI: 10.1016/S0030-6657(09)70135-0.
- Lobo F, Lobo B. Quality of life in asthmatic outpatients. *J Asthma* 2008;45:27-32. DOI: 10.1080/02770900701815495.
- Wang DY. Risk factors of allergic rhinitis: genetic or environmental? *Ther Clin Risk Manag* 2005;1(2):115-123. DOI: 10.2147/tcrm.1.2.115.62907.
- Violeta VB, Naser B, Besa L, et al. Sensitivity to pollen allergens in consecutive patients with allergic rhinitis referred to an allergy clinic in Prishtina. *Mac J Med Sci* 2010;2:121-125.
- Asha'ari ZA, Yusof S, Ismail R, et al. 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):619-624.
- Schoenwetter WF. Allergic rhinitis: epidemiology and natural history. *Allergy Asthma Proc* 2000;21(1):1-6. DOI: 10.2500/108854100778248971.
- Ciprandi G, Pistorio A, Tosca M, et al. Body mass index, respiratory function and bronchial hyperreactivity in allergic rhinitis and asthma. *Respir Med* 2009;103(2):289-295. DOI: 10.1016/j.rmed.2008.08.008.
- Nilsson L, Castor O, Löfman O, et al. Allergic disease in teenagers in relation to urban or rural residence at various stages of childhood. *Allergy* 1999;54(7):716-721. DOI: 10.1034/j.1398-9995.1999.00896.x.
- Sharma R, Gaur SN, Singh VP, et al. Association between indoor fungi in Delhi homes and sensitization in children with respiratory allergy. *Med Mycol* 2012;50(3):281-290. DOI: 10.3109/13693786.2011.606850.
- Choi IS, Ki WJ, Kim TO, et al. Seasonal factors influencing exercise-induced asthma. *Allergy Asthma Immunol Res* 2012;4(4):192-198. DOI: 10.4168/aair.2012.4.4.192.
- Kim E, Kim MJ, Lee JS, et al. Association between autumnal exacerbation and dermatophagoides pteronyssinus specific IgE in childhood asthma. *Pediatr Allergy Respir Dis* 2007;17:242-248.
- Arbat A, Tirpude S, Dave MK, et al. Purview of allergens through skin test in Central India. *Environ Dis* 2016;1(3):99-104. DOI: 10.4103/2468-5690.191983.
- Kumar R, Kumar M, Bisht I, et al. Prevalence of aeroallergens in patients of bronchial asthma and/or allergic rhinitis in India based on skin prick test reactivity. *Indian J Allergy, Asthma and Immuno* 2017;31(2):45-55. DOI: 10.4103/ijaa.ijaa_i_23_17.
- Dave L, Srivastava N. A study of sensitization pattern to various aeroallergens by skin prick test in patients of united airway disease (UAD) in Bhopal, Madhya Pradesh, India. *RJPBCS* 2014;5(4):1397.
- Gill NK, Singh A, Dhaliwal AK, et al. House dust mites and pollens as risk factors in allergic manifestations. *Indian J Sci Res* 2016;7(1):131-142.
- Anonymous: All India Coordinated Project on Aeroallergens and Human Health. Report. Ministry of Environment and Forests, New Delhi; 2000.
- Singh AB, Kumar P. Common environmental allergens causing respiratory allergy in India. *Indian J Pediatr* 2002;69(3):245-250. DOI: 10.1007/BF02734234.
- Subbarao M, Prakash O, Subba Rao PV. Reaginic allergy to parthenium pollen: evaluation by skin test and RAST. *Clin Allergy* 1985;15(5):449-454. DOI: 10.1111/j.1365-2222.1985.tb02294.x.
- Agrawal RL, Chandra A, Jain S, et al. Identification of common allergens by skin prick test associated with United airway disease in Allahabad, Uttar Pradesh, India. *Indian J Allergy Asthma Immunol* 2008;22:7-13.
- Gaur SN, Kapoor MK, Garg DC, et al. Etiological significance of insects in nasobronchial allergy. *Aspects Allergy Appl Immunol* 1985;18:19-27.
- Acharya PJ. Skin test response to some inhalant allergens in patients of nasobronchial allergy from Andhra Pradesh. *Aspects Allergy Appl Immunol* 1980;8:34-36.

