International Journal of Medical Science and Health Research

Vol.9, No. 01; 2025

ISSN: 2581-3366

Mapping the Major Aeroallergens Causing Allergic Rhinitis in Telangana State in India

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doi: 10.51505/ijmshr.2025.9109 URL: http://dx.doi.org/10.51505/ijmshr.2025.9109

Received: Jan 19, 2025 Accepted: Feb 11, 2025 Online Published: Feb 26, 2025

Abstract

Allergic Rhinitis (AR) is one of the commonest allergic disorders. It is defined as the inflammatory disorder of the mucosal lining of the nose caused by exposure to allergens such as pollen, dust, feathers etc. AR leads to impaired quality of life and hinders social and professional life. In this study, we analysed the pattern of allergen sensitivity among the patients presenting with allergic rhinitis across Telangana. India is a vast country with a wide variety of geographical landscapes; hence the pattern of allergen sensitivity may differ from place to place and with changing climatic conditions. Skin prick test and IgE are the gold standard and were used to diagnose the offending allergens that play a key role in the management of AR. Pollen, dust, insects, feathers are common causes of allergy worldwide, it was found that the prevalence and distribution of allergens varied with geographical variations and also with climate changes and pollution.

Our study analyzed 100 consecutive medical records of patients with allergic rhinitis, with a female predominance (63 females and 37 males). The mean age was 34.52 years (SD = 12.70). Notably, 62% of patients were in the age group of 20-40 years.

The majority of patients were from Hyderabad (53%) and Rangareddy (11%) districts, likely due to the hospital's location in Hyderabad. Pollen was the most common allergen, affecting 75 % of patients. Allergy to insects was also significant (72%) patients, with mosquitoes, moths, and cockroaches being the primary insect allergens. Other allergens included house dust mite, cotton dust, and house dust, with a few patients reacting to fruits (3%) and feathers (4%). Serum IgE levels of patients, showed a mean level of 241.10 IU/ml (SD = 173.49). IgE levels were slightly higher in males (Mean = 262.57 IU/ml, SD = 198.79) compared to females (Mean = 229.13 IU/ml, SD = 158.45). Pollen grains contain proteins and glycoproteins that act as allergens,

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triggering an immune response in sensitive individuals. These allergens stimulate the production of IgE antibodies, leading to the release of histamine and other inflammatory mediators, which cause the symptoms of allergic rhinitis.

Keywords: Allergic rhinitis; aeroallergens, Allergy, mapping of allergens, IgE levels, Pollen, house dust mites.

Introduction

Allergic rhinitis, often characterized by symptoms such as sneezing, nasal congestion, and itching, is a prevalent condition affecting a significant portion of the population.[1,2] The condition, primarily triggered by aeroallergens, has seen a noticeable rise in incidence in various regions, including Telangana, India.[3] Though not lethal, the disease is associated with significant disability and socioeconomic burden.[4] The mainstay of treatment is avoidance of allergens along with pharmacological treatment or immunotherapy.[1] Rising temperatures and increasing pollution often increase the incidence of allergic disorders and the profile of allergens may also be altered with such changes. The pattern of allergens may also change depending on the geographical location, diet patterns, genetic and environmental factors.[5]

The identification of key aeroallergens responsible for allergic rhinitis in the Telangana region is crucial for developing targeted intervention strategies and improving the quality of life for affected individuals. A number of studies have shown that house dust mites and pollen to be the predominant aeroallergens in patients with allergic rhinitis. House dust mite is most common agent in all of Asia except Japan where Pollen is more predominant.[6,7] This study aims to systematically identify and analyze the predominant aeroallergens contributing to allergic rhinitis in Telangana, thereby providing a foundation for effective management and prevention measures.

The Telangana region, with its diverse climatic conditions and rapid urbanization, presents a unique set of environmental factors that can influence the prevalence and distribution of aeroallergens. Despite the growing burden of allergic rhinitis, there is a lack of comprehensive studies focusing on the specific aeroallergens prevalent in this region. Understanding the key allergens responsible for allergic rhinitis can lead to more accurate diagnosis, tailored treatment plans, and effective public health policies. Moreover, such insights can aid in raising awareness among healthcare providers and the general public about the importance of allergen avoidance and management strategies.[5] Very few reports of patterns of allergy sensitivity among patients with AR have been published from various parts of India.[3,8–10] This study aims to provide valuable insights into the aeroallergens responsible for allergic rhinitis in the Telangana region and contribute to the development of effective prevention and management strategies.

Specific objectives of this investigation have been to identify and catalog the common aeroallergens affecting individuals present in the Telangana region using allergen identification diagnosis and correlate it with the identified aeroallergens. Further, to analyze sensitization

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patterns among allergic rhinitis patients through skin prick tests and specific IgE testing. By addressing these objectives, the study aims to contribute valuable knowledge to the field of allergy research and improve healthcare outcomes for individuals suffering from allergic rhinitis in the Telangana region. Also to develop educational programs aimed at increasing public awareness about allergic rhinitis for effective management practices.

Methodology

The methodology includes identifying key aeroallergens responsible for allergic rhinitis in the Telangana region which involves a multi-step approach, using individual sampling methods, clinical assessment, and data analysis.

Study Design and Population

The study included 100 individuals suffering from AR and their data of confirmed diagnoses with allergic rhinitis, recruited from individuals visiting Mahavir hospital, and Research Centre. Informed consent for Skin prick test was taken from the patients. The diagnosis of Allergic Rhinitis was based on ARIA guidelines.[11,12] Individuals with asthma only, food allergy and other atopic disorders were excluded. Patients with incomplete data were excluded.

Allergy Testing

Skin Prick Tests (SPT): Participants underwent skin prick tests using a panel of common aeroallergens to identify sensitization patterns. The wheal and flare responses were measured and recorded. Histamine and Saline were used as positive and negative controls. A wheal response which is 3 mm more than the negative control is taken as positive.

ELISA Assay for IgE levels: Blood samples were collected from participants to measure specific IgE levels against identified aeroallergens using enzyme-linked immunosorbent assay (ELISA) techniques.

Data Collection and Analysis

Demographic details, clinical history, Blood tests (IgE levels) and Skin prick tests were tabulated in a CDC Epi Info (Version 7) software.

Statistical Analysis: Data was analyzed using statistical software (CDC EPiInfo version 7) to identify significant correlations between aeroallergen exposure and allergic rhinitis symptoms. Descriptive statistics, regression analysis, and other relevant statistical methods were employed. Categorical variables were defined in terms of frequency and interquartile range. Continuous variables were described in terms of mean and standard deviation. Datawrapper (online application) was used to map the patient's distribution.

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Results

A total of 100 consecutive medical records of patients with allergic rhinitis were included among which 63 were female and 37 were male (Figure-1). The mean average age was 34.52 years with a standard deviation of 12.70 (Figure 2).

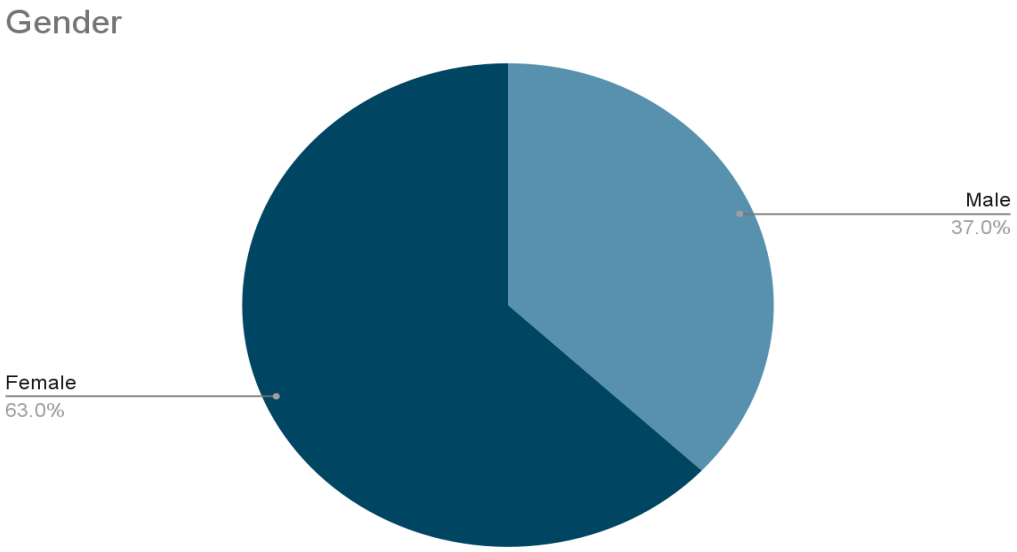

Figure1: Gender wise distribution of Allergic Rhinitis patients

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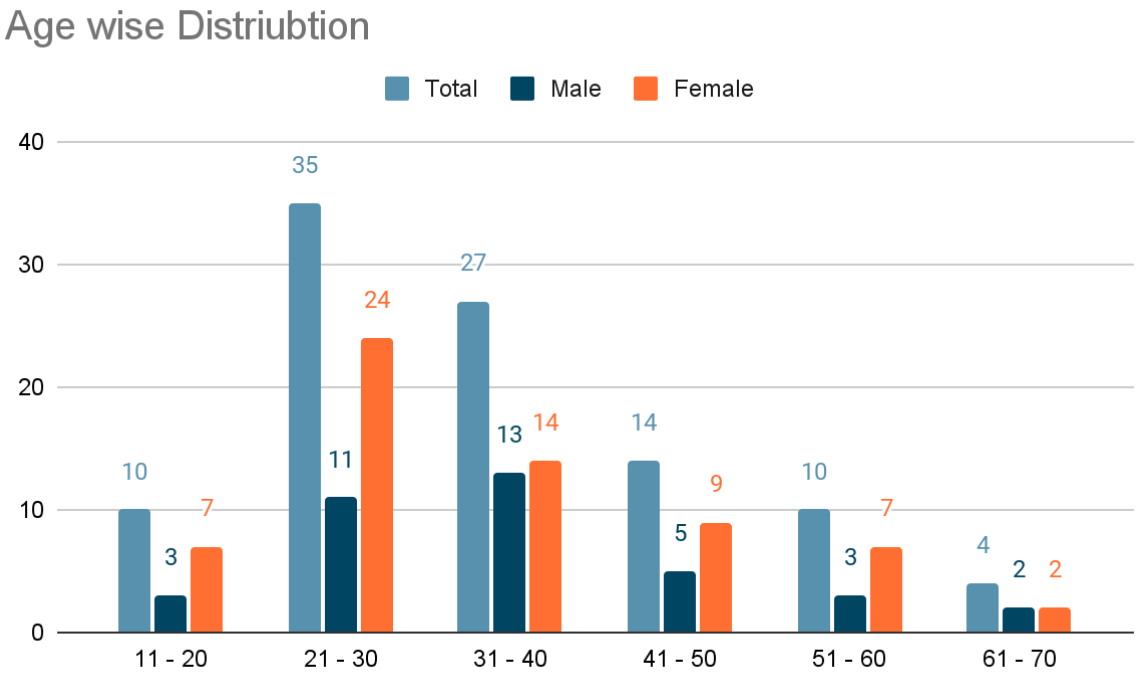

Figure -2 Grouping the number of patients Age-wise

It is seen from the above graph that 62% of the patients were in the age group 20-40 years. The number of females were at peak in the 21-30 age group (n=24) while the number of males were highest in the 31-40 age group (n=13).

Occupation of the AR patients:

46% of these patients were housewives while the rest of the 54% were either employed or were business personnel. The data on season of presentation was available in 87 patients. Most of these patients presented in Winter season (59.78%) while 9.2% of these patients presented during summer, 12.64% of patients presented during rainy season and 18.39 % of patients presented in Autumn.

District wise Distribution:

Majority of the patients were from Hyderabad and Rangareddy districts as the hospital is located within the Hyderabad districts. The Table-1 shows geographical distribution of cases.

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Table-1: District-wise distribution of patients in Telangana State

Districts of Telangana	Number of patients
Hyderabad	53
Rangareddy	11
Nalgonda	6
Karimnagar	4
MedchalMalkajgiri	4
Mancheriyal	3
Sangareddy	3
Medak	2
Nagarkurnool	2
Nizamabad	2
Hanmakonda	1
Kamareddy	1
Khammam	1
Mahabubnagar	1
Suryapet	1
YadadriBhuvanagiti	1

About 53% of patients were from Hyderabad district, whereas other districts represented include Nalgonda (6%), Karimnagar (4%), Medchal Malkajgiri (4%), and several others with 1-3% patients each district. The mapping of the allergens has been done using the software tools (Datawrapper- online tool) and shown in figure -3.

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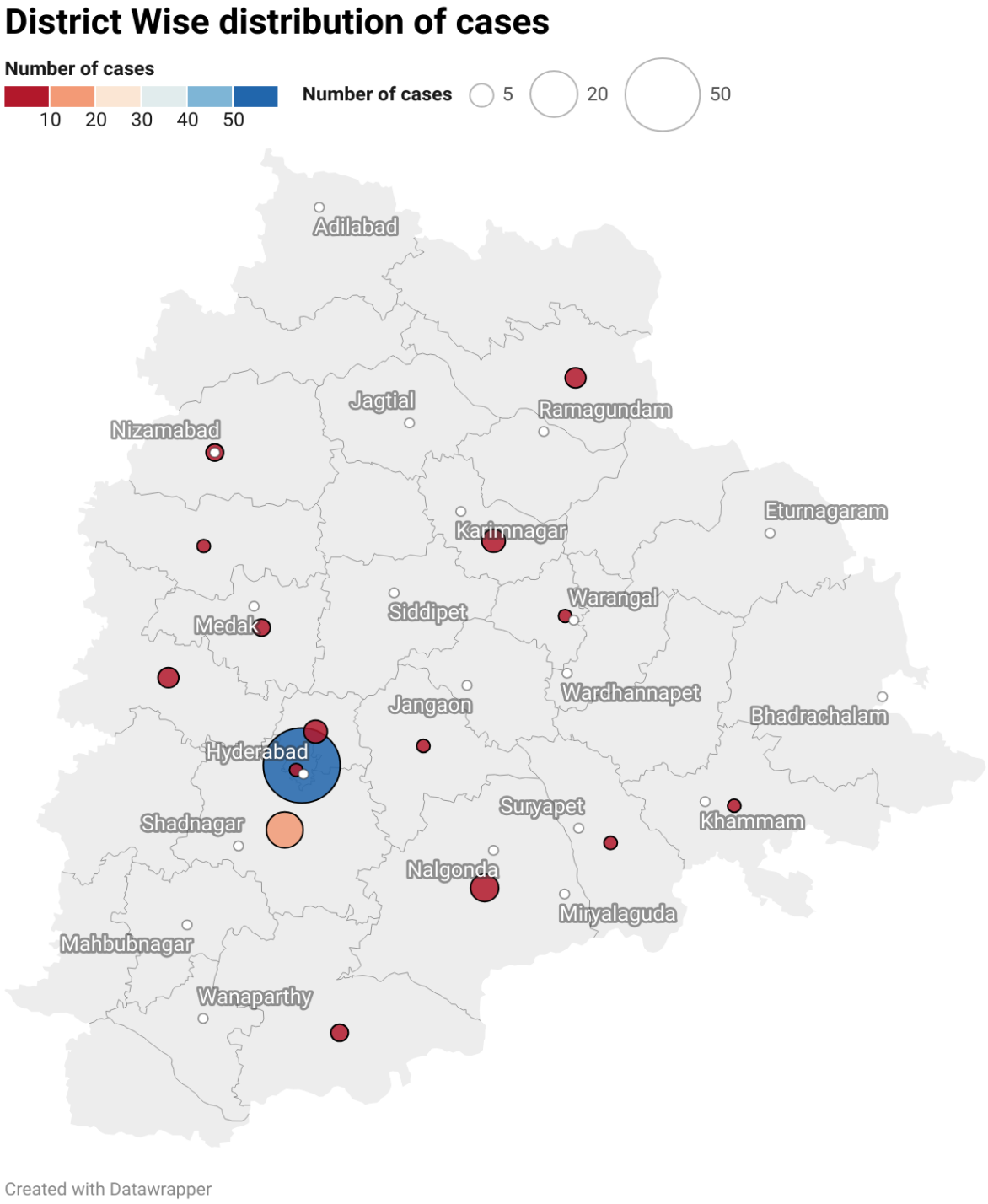

Figure-3: District wise distribution of allergy cases showing all the districts of Telangana State of India and the density of patients in each district.

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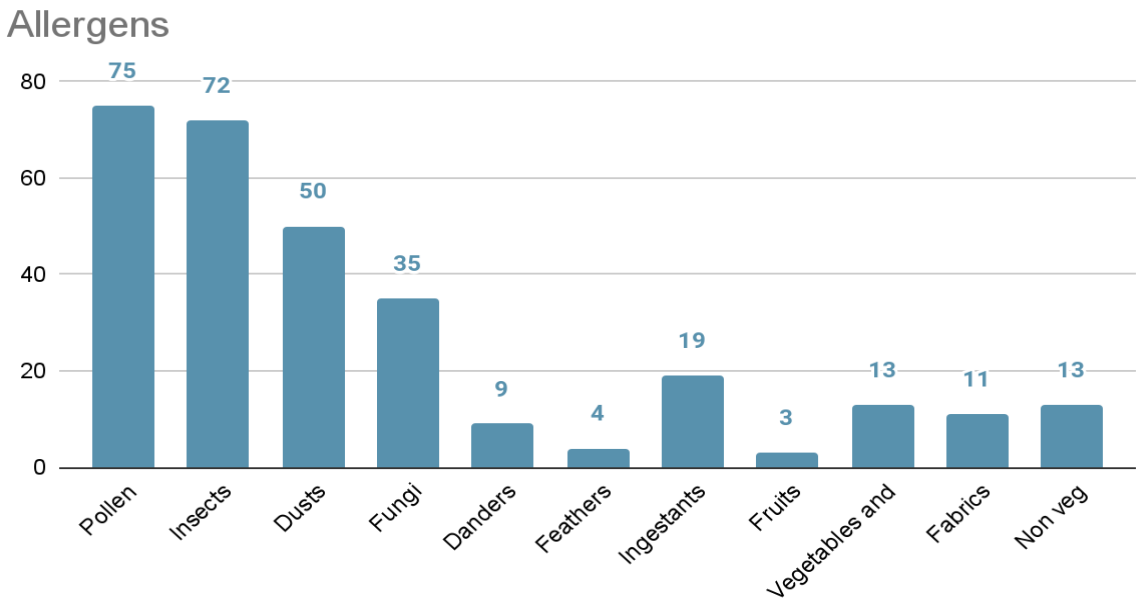
Allergens:

Pollen was the most common allergen in the study group with 75 patients having allergy to pollen followed by allergy to insects which was seen in 72 patients (figure-4). *ProsopisJuliflora* (n=46), *Amaranthusspinosus* (n= 41) and *Ageratum conyzoides* were the most common pollen allergens. Pollen grains are lightweight and small, often less than 50 micrometers in diameter, allowing them to remain airborne and travel long distances. Their small size enables them to penetrate the respiratory tract, reaching the nasal mucosa and triggering allergic reactions.

Mosquito, Moth and Cockroach were also very common insect allergens. House dust mite, Cotton dust and house dust were the most common allergens among the dusts category. Allergy to fruits and feathers were seen in 3 and 4 patients respectively (figure-4).



Fifure-4: Various Allergens widely spread among the patients – Allergens Verses number of Patients

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Serum IgE levels:

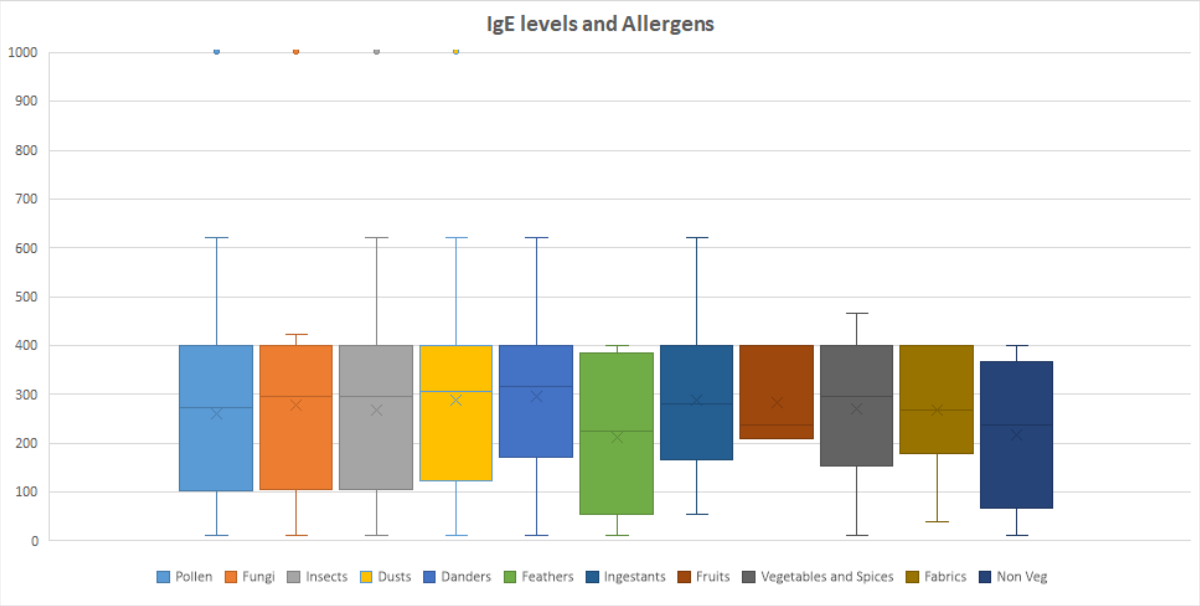

Figure-5: Serum IgE levels in patients with Various Allergens in cases with Allergic Rhinitis.

Serum IgE levels were available in 81 patients. Mean IgE was found 241.10 IU/ml with a standard deviation of 173.49. The IgE levels were slightly higher in males (Mean value = 262.57 IU/ml; SD198.79) compared to females (Mean value = 229.13 IU/ml; SD158.45) (figure-5).

Discussion

From our study it was seen that Pollen has emerged as the primary allergen for the Telangana people. Pollen is one of the most significant causes of allergic rhinitis due to its widespread distribution, allergenic properties, and seasonal abundance. Several studies highlight pollen from trees, grasses, and weeds as primary aeroallergens causing allergic rhinitis. Research often focuses on identifying specific pollens prevalent in different regions and seasons. Pollen was the most common allergen found in our study. This is in contrast to most of the previous studies published from different parts of India.[3,8–10,13,14] House dust mite is reported as the most common allergen from other studies. A study from Chennai analysed the SPT results of 52 patients and found that most patients were allergic to house dust mites (92.3%).[10]Pollen hypersensitivity was also very common (84.6%).[10] A cross sectional study from Bangalore reported that allergy to house dust mite was seen in 41 % of the patients. Sensitisation to pollen was seen only in 17.8% of the patients. 9 The scenario in Telangana region was different, as we found pollen is released by plants during specific times of the year, depending on the species and local climate. For example, in spring, tree pollen is abundant, followed by grass pollen in late spring to summer, and weed pollen is prevalent mostly in late summer to early fall, and winter time in this region. This seasonal release aligns with peak periods of allergic rhinitis, also known as "hay fever."

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Next important allergens were: House Dust Mites (HDM): HDM, particularly *Dermatophagoidespteronyssinus* and *Dermatophagoidesfarinae*, are significant indoor allergens. Studies suggest that HDM exposure is a major cause of perennial allergic rhinitis.

Among Fungi -*Alternaria*, *Cladosporium*, and *Aspergillus* produce airborne spores that are potent allergens. The prevalence of these spores can vary seasonally and with environmental conditions. Allergens from pets such as cats, dogs, and rodents are well-documented triggers for allergic rhinitis. Exposure is higher in households with pets, but dander can also be transported to pet-free environments. Particularly in urban areas, cockroach allergens (*Blattellagermanica* and *Periplanetaamericana*) are recognized as significant indoor allergens contributing to allergic rhinitis and asthma.

Studies emphasize the influence of environmental factors like temperature, humidity, and pollution on the concentration and distribution of aeroallergens. Climatic variations can affect pollen and mold spore levels. Geographical, climatic variations and urbanisation affect patterns of hypersensitivity to aeroallergens. The allergome of Asia differs quite significantly from the western countries where pollen is the dominant aeroallergen, whereas the house dust mite is more common in Asian countries.[6,15,16] Amongst the Asian countries, southern India and Taiwan ranks highest among house dust mite sensitisation (89.7%). However, even south India is a very wide region and has considerable variation in geography, climate, humidity and housing conditions. Hence, the allergen hypersensitivity pattern should be seen in the context of local patterns rather than large geographical areas. The allergen hypersensitivity pattern of the local areas should guide the preventive measures taken at the community level.

In our study, females were more common than males, which was consistent with the previous studies. A recent meta-analysis showed that there is female preponderance in cases of allergic rhinitis in adults, while there was male dominance in childhood. Our study consisted of mostly adults and was correlating with the previous studies. [17,18]Urbanization and climate change have contributed to the proliferation of allergenic plants, increasing pollen exposure in populated areas.

Epidemiological Patterns: Research often involves epidemiological studies to determine the prevalence and distribution of allergic rhinitis in different regions, correlating these findings with identified allergens. Multiple studies investigate how seasonal changes affect aeroallergen concentrations. For instance, pollen counts typically peak during specific seasons, correlating with increased allergic rhinitis cases. Our study can form the basis for further research on hypersensitivity patterns in our area and help in formulating prevention strategies at individual and community level.

Conclusion and further research:

Our findings suggest that the pollen was the most common allergen responsible for hypersensitivity in allergic rhinitis patients in Hyderabad and surrounding areas of Telangana.

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This highlights the importance of need for further research to identify the pattern of hypersensitivity according to geographical distributions and environmental conditions. Knowledge of prevalent pattern of hypersensitivity guides us to formulate programs to effectively prevent, treat and educate the patients with Allergic rhinitis. Addressing pollen as a cause of allergic rhinitis requires effective management strategies, such as monitoring pollen forecasts, using air filters, and seeking medical treatments like antihistamines, intranasal corticosteroids, or allergen immunotherapy. Genetic predisposition plays a crucial role in determining sensitivity to pollen allergens. Individuals with a family history of allergies are more likely to develop allergic rhinitis.

Public Awareness and Education

Based on the findings, educational programs and materials are being developed to raise awareness about allergic rhinitis and effective management practices among the general public. The study results will be disseminated through scientific publications, conferences, and community outreach programs to ensure broad access to the information. Articles often explore preventive measures such as environmental control strategies, use of air purifiers, and pharmacological treatments to manage allergic rhinitis effectively.

Declarations:

Acknowledgements: We are grateful to the participants of this study for their cooperation in forming the study group.**:** We are thankful to the Chairman of Mahavir Hospital and Research Centre and the Director of BMMRC for their encouragement,

Conflict of Interest: None

Funding: None

Ethics committee approval: Approval of the Ethics Committee of the Institute (Bhagwan Mahavir Medical Research Centre) was received for this study

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