



Study of Allergen Patterns in Cases of Moderate to Severe Persistent Allergic Rhinitis in Central India

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Abstract The prevalence of Allergic rhinitis (AR) is associated with a variety of environmental allergens and the level of exposure is through inhalation, or ingestion. It is clear from several studies and guidelines that screening and identification of various allergens in a particular region can facilitate in diagnosing, treating and formulating preventive strategies against AR. To study the allergen patterns in patients with Moderate to severe persistent allergic rhinitis from Central India. Male/female of 6 to 63 years age group, presenting with itching of the nose, sneezing, rhinorrhoea, nasal congestion and nasal obstruction. Patients suffering from infective pathology of nose and sinuses. The study group comprised of 1350 male/female of the age group between 6 and 63 years. Modified skin prick test was performed according to the method of Pepys and Bernstein. The ratio of allergen wheal and histamine wheal was used to evaluate the results. The reactions with wheal diameter 3 mm or greater than the reading in the negative control were considered as positive reaction.

Results of the study indicate that in Central India, the common allergens are pollens (78.5%), insects (64.5%), dust (38.5%), dust mites (18%) and food (10%) causing moderate to severe persistent allergic rhinitis. The study provided an insight and identified the allergen pattern in Central India. The results were of great help in counseling for avoidance therapy and for deciding allergen specific immunotherapy which is the standard treatment protocol to modify natural course of allergic rhinitis at this point of time.

Keywords Moderate to severe persistent allergic rhinitis · Allergens · Modified skin prick test

Introduction

About 20–30% of the Indian population suffers from allergic rhinitis, affecting physical, psychological and social aspects and impact work productivity due to repeated blowing of nose and the need to rub eyes and nose [1, 2]. The environmental allergens and the level of exposure through direct contact, inhalation, or ingestion have been attributed to be the causative factor of allergic rhinitis [3]. It is clear from several studies and guidelines that screening and identification of various allergens in a particular region can facilitate in diagnosing, treating and formulating preventive strategies against AR [3]. The bio-particulates implicated to cause AR are pollen, fungal spores, insect debris, house dust mites, animal dander, foods, etc. [4].

Since the preventive strategy and treatment of AR depends on correct identification of clinically relevant allergens in a particular region. This study was undertaken to evaluate the allergen patterns in patients with moderate

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severe persistent allergic rhinitis from Central India. In addition, data on the prevalence of sensitization to common allergens among AR patients particularly from Central India remains scarce [5]. Also these results were utilized in deciding allergen specific immunotherapy against specific allergens which is the only treatment which modifies natural course of allergic rhinitis at this point of time.

Aims and Objective

To study the allergen pattern in patients with moderate to severe persistent allergic rhinitis in Central India.

Materials and Methods

This observational study was conducted at Dr. Subir Jain's ENT centre Indore on Patients with moderate to severe persistent allergic rhinitis assessed as per ARIA (Allergic Rhinitis and its Impact on Asthma) guidelines, i.e. if the patient had two or more symptoms out of itching in nose, sneezing, watery discharge from nose, or nasal obstruction lasting for more than 4 days per week and also for more than 4 weeks in past 12 months were enrolled in the study [6]. The inclusion criterion was male/female of 6 to 63 years of age groups presenting with nasal itching, sneezing, watery rhinorrhoea and/or nasal obstruction. Exclusion criterion was patients suffering from infective pathology of nose and sinuses. All subjects underwent ENT examination, complete haemogram and total serum IgE estimation. They were subjected to Modified Skin Prick Test (MSPT); the test included 127 common allergens

(Fig. 1) like 2 type of mite, 46 types of pollens, 9 types of Fungi 6 types of insects, 8 types of dusts, 6 types of dander, 3 types of fabrics, 45 types of food and 2 types of miscellaneous antigens. Participants were requested to stop antihistaminic medication for minimum of 7 days prior to MSPT.

Modified Skin Prick Test

The modified skin prick test was performed according to the method of Pepys and Bernstein after taking a detailed informed consent of allergy testing. Volar aspect of both forearms was prepared, cleaned with methylated spirit dried naturally and marked and numbered at a distance of 1.25 to 1.5 cm apart. A drop of glycerinated histamine acid-phosphate and other drop of glycerinated buffer saline were used as positive and negative control respectively. A small drop of each test allergen extract was placed in the marked area as per numbering on Volar aspect of forearm. A blood lancet 3 mm length was passed through the drop and inserted into the epidermal surface at a 45 degree angle facing away from the skin surface. The blood lancet was then gently lifted to elevate a small portion of the epidermis without inducing bleeding (Tenting) which allows the solution to penetrate. After 15 to 20 min of prick, reading of wheal formation was recorded in mms. Comparison with both positive (histamine solution) and a negative control (saline solution) done. The ratio of allergen wheal and histamine wheal was used to evaluate the results (Fig. 1). The wheal was measured as the average length of the perpendicular line across its middle point and the longest diameter. The reactions with wheal diameter that was

Fig. 1 Showing the procedure of modified skin prick test



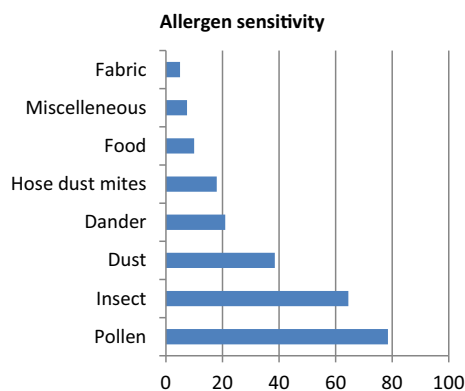


Fig. 2 Sensitivity pattern of various allergens in Allergic Rhinitis

3 mm or greater than the readings in the negative control were considered as a positive reaction [7]. The test allergens used in the study were obtained from a licensed allergen manufacturer.

Results

The study group of 1350 patients underwent MSPT with a total of 127 allergens, of which 5% patients had no reaction at all from MSPT, whereas 95% patients had a MSPT positive response (positive with one or more than one allergens). The test results were compiled and the data obtained exhibited that, pollen was most common trigger (78.5%) (Fig. 2), followed by insects (64.5%), dust (38.5%), dander (21%), dust mites (18%), food antigens (10%), miscellaneous (7.5%) and fabric (5%) among the study population (Table 1).

The study data also inferred that among 46 pollen tested *Prosopis Juliflora* was most frequently positive i.e. 15.5% of total 78.5% positive for pollen. Cockroach female was positive in 35.5% patients out of 64.5% showing sensitivity to insect allergens. Milk was the common food allergen being 7% among the 45 food allergens tested. Rice grain dust came positive in 22% out of total 38.5% dust allergen positive individuals. Human dander was 6.5% out of 21% positive for dander. The entire 18% positive for dust mites showed sensitivity to *D. Farinae*. *Parthenium* leaves was positive in 4% among miscellaneous and 2% exhibited sensitivity to silk among total of 5% positive for fabric (Fig. 3).

Discussion

The present study revealed that, overall incidence of allergy to various allergens was found to be significant. The subjects with AR, exhibited that MSPT was majorly

Table 1 Showing sensitivity for various allergens in the study group

MSPT sensitivity to common allergens in AR	
Type of allergen tested	Individuals' positive (%)
Pollens	78.5
Insects	64.5
Foods	10
Dusts	38.5
Dander	21
House dust mite	18
Miscellaneous	7.5
Fabrics	5

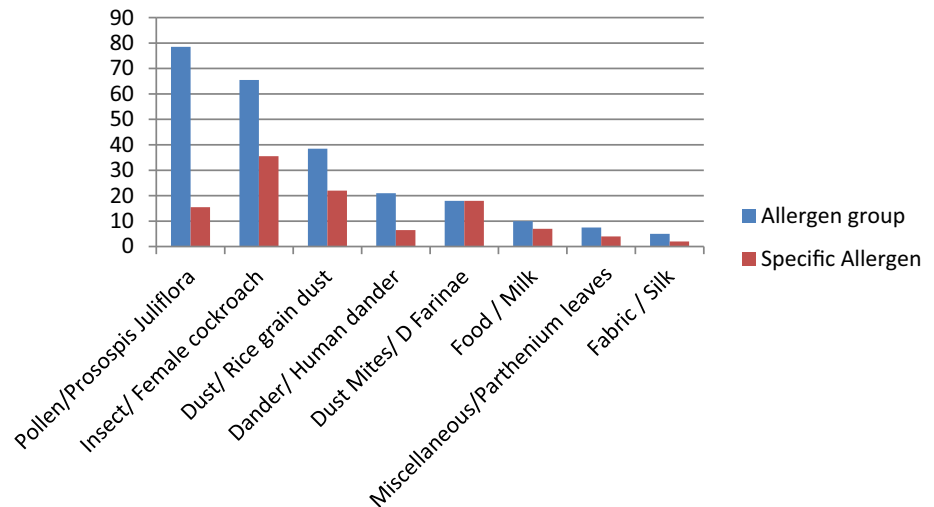
positive for pollens (78.5%), followed by insects (64.5%), dust (38.5%), dander (21%), dust mites (18%), food (10%), and fabric (5%). According to the insect panel testing, allergy to female cockroach (35.5%) was most frequent. Among food allergens, milk (5%) was the most common trigger. Among dusts allergens, grain dust rice (22%) was found to be most significant allergen. Among dust mites tested, *D. Farinae* (18%) was the most common mite causing AR symptoms. Human dander, *Parthenium* leaves and Silk caused about 6.5%, 4% and 2% MSPT positive response, respectively.

On comparing these observations with previous studies it was found that Arbat et al. reported from Nagpur, the most common allergens were mite (49%), followed by pollen (21.8%), dust (15.4%), insect (10.6%), fungus (3%), and animal epithelia (0%) in AR patients. *Parthenium hysterophorus* (7.7%) was the most common pollen found. According to the insect panel testing by Arbat, et al. Grasshopper 17 (3.4%) was the most frequent allergen followed by rice weevil (1.8%), ant (1.8%), mosquito (1.8%), cockroach (0.6%), honey bee (1.39%) and housefly (0.4%) [8]. Kumar et al. concluded in their study, insects (39.17%) were the most common aeroallergens followed by various types of house dust mites (11.99%), weed pollens (11.61%), dust (10.51), fungal spores (6.17%), tree pollen (6.12%), grass pollens (4.8%), kapok cotton (2.23%), silk (1.97%), and wool (0.42%) were the offending allergens [9].

Sensitization pattern to various aero-allergens by skin prick test in patients of united airway disease by Dave et al., demonstrated pollen as a dominant allergen followed by fungi, insects, dust, dander, fabric and feathers. The three dominant pollen allergens were *Cynodon dactylon* (53.93%), *Cenchrus ciliaris* (47.19%) and *Carica papaya* (40.44%) [10]. The results of present study are in accordance with this study carried out in Central India (Bhopal).

A study from North India by Gill et al., also showed markedly positive skin reactions to antigenic extracts of 13 pollens, varying from 2.4 to 16.9% with an average of

Fig. 3 Distribution of specific allergen among the group of allergens tested in the study



9.65%. The overall incidence of SPT reactivity was highest against the antigenic extract of pollen belonging to family Asteraceae and Moraceae [11]. However in the current study, MSPT reactivity was highest against the antigenic extract of pollen from *Prosopis Juliflora*. Singh et al. also observed *Prosopis juliflora* as a major cause of pollinosis with 12% patients from Delhi showing a positive skin reaction [12].

Rao et al. from South India recorded allergenicity to Parthenium hysterophorus pollen extracts in 34% of allergic rhinitis patients [13]. Similarly, Agashe and Soucenadin recorded high skin reactivity to *Casuarina equisetifolia* in patients from Bangalore [14]. The other clinically important aero-allergens in studies by Acharya et al. and Agashe et al. from south India observed sensitivity to *Cassia*, *Ageratum*, *Salvadora*, *Ricinus*, *Albizia lebbek* and *Artemisia scoparia* [15, 16].

It is widely known that cockroach is a source of inhalant allergens in AR, which was also observed in our study, similar results were reported by Sohan et al. [17]. Kumar et al. observed cockroach (85%) as an important aeroallergen that is frequently implicated responsible for AR symptoms in India [18].

Food allergy is estimated to be 4.5% in AR patients, however in our study 10% of patients tested positive to food allergens. According to Kumar et al., allergic reactions were frequently reported after consumption of curd in 48.1%, rice in 43.9%, citrus fruits in 35.2%, banana in 27.0%, milk in 11.9% and black gram in 9.7% cases of patients from Delhi. However in our study, milk (5%) was the most significant food trigger in AR patients from Central India [19]. Sinha et al. reported dust to be independent risk factor significantly associated with AR [20]. Clinical profile of allergic rhinitis in Haryana studied by Yadav et al. showed house dust (40%) as a major factor, which caused AR symptoms. Earlier reported incidence of

allergy to house dust varies from 46 to 73% [21]. In the current study, dust did cause significant allergy, particularly the rice grain dust (22%) due to an increased rice consumption in central India.

Prasad et al. in a study at Lucknow observed animal dander (3.1%) as major allergens in patients of nasobronchial allergy; among animal dander common offending allergens were cow dander (4.16%) and dog dander (4.16%) [6]. Dave et al. had also observed dander to be an important cause of AR with, cat dander (19.10%) and dog dander (19.10%) being the most common sensitizers [10]. In a study by Nitin et al., carried out in South India, contact with animals was found to precipitate allergic symptoms in 2.8% individuals [22]. However, according to Arbat et al., none of AR patients from Nagpur showed positive reaction to animal epithelia [8]. Similarly, Rasool et al., did not notice any positive results in skin prick test for dog epithelia in AR patients from Kashmir [23]. In the current study, human dander (6.5%) caused positive allergen test reaction, which has not been reported in other studies from Central India. The study by Deb et al., showed that both blockers and sneeze runners had significantly more sensitization to house dust mites (28.7% vs. 16.3%) [24]. Arbat et al., showed that 49% of patients were positive for mites. *Dermatophagoides pteronyssinus* (56.6%) was the most common causing symptoms. *Dermatophagoides faraei* (49%) and *Blomia* species (50.4%) were the other two types of mites [8]. Gill et al., in their study carried out in Patiala also found *D. farinae* (52.12%) to be the most significant dust mite [11]. In the current study, *Dermatophagoides faraei* was an important allergy causing dust mite (18%).

As noticed in various studies from India, Parthenium is one of major allergy causing factor. In the current study, SPT reactivity with Parthenium leaves was noticed in 4% of AR patients. Arbat et al., recorded 7.7% allergenicity to

Parthenium hysterophorus in patients from Central India [8]. However, Dave et al. noticed a higher percentage of patients allergic to Parthenium hysterophorus (15.73%) from Bhopal [10]. Awasthi et al., found that SPT positivity to Parthenium was statistically significantly higher in the urban population as compared to the rural population (40% vs. 17.31%; $p = 0.01$) [25]. Rao et al. Recorded allergenicity to Parthenium hysterophorus pollen extracts in 34% of allergic rhinitis patients from Bangalore [13].

Sheep wool (5.61%) was the most common sensitizer in fabric antigens. No other fabric and feathers were significant sensitizers as reported by Dave et al. [10]. Rasool et al. also recorded allergenicity to sheep wool in AR patients from Kashmir [23]. Skin prick test done with 58 different types of aeroallergens in India by Kumar et al., kapok cotton was significantly positive in 2.23% patients, silk in 1.97% patients, and wool in 0.42% AR patients [9]. However, in the current study silk fabric (2%) was the most common sensitizer in fabric antigens.

Conclusion

The study results gave an insight into the common allergen pattern in Central India in cases of moderate to severe persistent allergic rhinitis; the common allergens were pollens (78.5%), insects (64.5%), dust (38.5%) Mites (18%) and food (10%). The study also helped to identify specific allergens like female cockroach (35.5%), milk (5%), grain dust rice (22%), dust mites tested, *D. Farinae* (18%), Human dander (6.5%), Parthenium leaves (4%), and Silk (2%) which were found to be responsible in causing symptoms of AR in Central India. Thus giving a clue to the direction of avoidance therapy, allergen specific immunotherapy and scope of future research, to give the best possible treatment, to patients suffering from moderate to severe persistent allergic AR.

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Compliance with Ethical Standards

Conflict of interest All authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in study involving human participants were in accordance with ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable standard.

Informed Consent Informed written consent was obtained from all individual participants included in the study.

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