

## Study of allergen patterns in patients of severe persistent allergic rhinitis in Central India based on Modified Skin Prick Test reactivity

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**Abstract:** Allergic rhinitis (AR) is a symptomatic disorder of the nose induced by perennial or seasonal allergen exposure causing inflammation of membranes lining the nose, characterized by nasal congestion, rhinorrhoea, sneezing, itching of the nose and/or post-nasal discharge. The prevalence of AR is associated with a variety of environmental allergens and the level of exposure through direct contact, 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. Since the preventive strategy and treatment of AR depends on correct identification of clinically relevant allergens in a particular region. This multi centric study was undertaken to evaluate the allergen patterns in patients with severe persistent allergic rhinitis from Central India. The inclusion criterion was male/female of all age groups presenting with nasal congestion, rhinorrhoea, sneezing, itching of the nose and/or post-nasal discharge. Exclusion criterion was patients suffering from infective pathology of nose and sinuses. The study group comprised of 810 male/female of the age group between 6 to 63 years. Results of the study indicate that in Central India, the common allergens are pollens (78.5%), insects (64.5%), food (50%) and dust (38.5%) causing severe persistent allergic rhinitis. Therefore avoidance of these allergens may results in improvement of symptoms. These results may also be helpful in immunotherapy of AR patients from Central India.

**Keywords:** Severe Persistent Allergic Rhinitis, Allergens, Modified Skin Prick Test

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### I. 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 multi centric study was undertaken to evaluate the allergen patterns in patients with 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].

### II. Aims and Objective

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

### III. Material and Methods

This observational study was conducted at ENT centre and ENT and Vertigo clinic in central India between January 2009 and December 2017 . Patients with severe persistent allergic rhinitis assessed as per ARIA (Allergic Rhinitis and its Impact on Asthma) guidelines i.e. if they had two or more symptoms out of watery runny nose, nasal itching, nasal obstruction or sneezing; lasting for at 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 all age groups presenting with nasal itching, sneezing, watery rhinorrhoea and/or post-nasal discharge. 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 140 common allergens like 1 type of mite, 50 types of pollens, 9 types of Fungi 6 types of insects, 9 types of dusts, 6 types of dander, 3 types of fabrics, 53 types of food and 3 types of miscellaneous antigens. Participants were requested to stop antihistaminic medication for minimum of seven days prior to MSPT.

**Modified skin prick test**

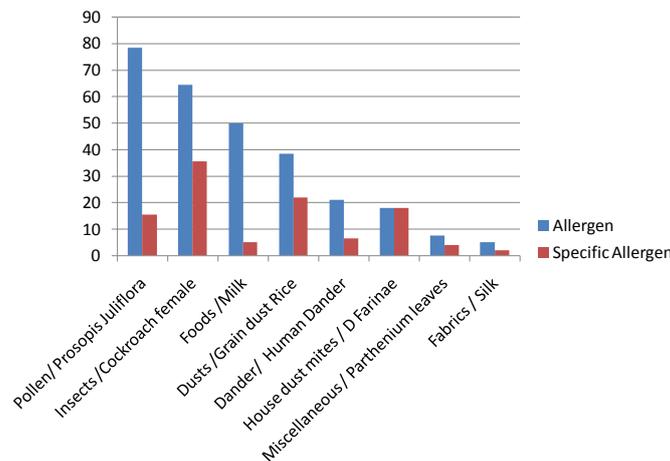
The modified skin prick test was performed according to the method of Pepys and Bernstein. A small drop of each test extract or a control solution was placed on patient's forearm . A blood lancet 3mm length was passed through the drop and inserted into the epidermal surface at a 45 degree angle with , facing away from the surface. The blood lancet was then gently lifted to elevate a small portion of the epidermis without inducing bleeding, which allows the solution to penetrate. The test solution was gently wiped away 15 to 20 minutes later just before reading. The peak reactivity of skin-prick testing was 15 to 20 minutes, at which time the wheal (hive) size was read in millimetres and compared with both a positive ( histamine solution) and a negative ( saline solution) control. The mean distance between two skin prick tests was 1.2 to 1.5 cms. The ratio of allergen wheal and histamine wheal was used to evaluate the results. 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 3 mm or greater than the reading in the negative control were considered as a “marked positive reaction” [8]. The negative control glycerinated buffered saline and the positive control Glycerinated Histamine acid phosphate were used. The test allergens used in the study were obtained from a licensed standard allergen manufacturer.

**IV. Observations and Results**

Eight hundred and ten patients with severe persistent allergic rhinitis aged between 6 to 63 years were included in the study. A total of 810 MSPT were performed with a total of 140 allergens on 810 patients, of which 5% patients had no reaction at all from MSPT, whereas 95% patients had a MSPT positive (positive only with 1+ allergen). The test results were compiled and the data obtained exhibited that, pollen was a common trigger (78.5%), insects were triggers in 64.5%, food was a trigger in 50%, dust was trigger in 38.5% and dander was trigger in 21%, dust mites in 18%, miscellaneous in 7.5% and fabric in 5% of study population (Table 1).

<b>MSPT positivity to common allergens in AR patients</b>	
Type of allergen Tested	Individuals positive (%)
Pollens	78.5
Insects	64.5
Foods	50
Dusts	38.5
Dander	21
House dust mite	18
Miscellaneous	7.5
Fabrics	5

**Table 1:** Showing Percentage of sensitivity of various allergens in the study group.



**Fig.1:** Showing the distribution of specific allergen among the group of allergens tested in the study.

The study data also inferred that among 50 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 5% among the 54 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. All the 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.1)

## V. Discussion

The overall incidence of allergy to various allergens in our study was found to be significant. In the present study, in subjects with AR, SPT was majorly positive for pollens (78.5%) followed by insects (64.5%), food (50%), dust (38.5%), dander (21%), dust mites (18%) and fabric (5%). According to the insect panel testing, allergy to female cockroach (35.5%) was the most frequent. Among food allergens, milk (5%) was the most common trigger. Among dusts allergens, grain dust rice (22%) was found 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% SPT positivity, respectively.

On comparing these findings with a study carried out in Central India (Nagpur); unlike the present study, 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 [9]. In Lucknow, the most common offending allergens were insects (21.2%), followed by dusts (12.0%), pollens (7.8%), animal dander (3.1%), and fungi (1.3%) [9]. According to a study including AR patients across India, 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[10]. Sensitisation pattern to various aero-allergens by skin prick test in patients of united airway disease in Bhopal, demonstrated pollen as a dominant allergen followed by fungi, insects, dust, dander, fabric and feathers[11].

The current results are in accordance with another study carried out in Central India (Bhopal), during April 2013 to March 2014, wherein pollens are one of the major risk factor for allergy, the three dominant pollen allergens were *Cynodon dactylon* (53.93%), *Cenchrus ciliaris* (47.19%) and *Carica papaya* (40.44%) [11]. 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 highest against the antigenic extract of pollen belonging to family Asteraceae and Moraceae [12]. However in the current study, SPT reactivity was highest against the antigenic extract of pollen from *Prosopis Juliflora*. Shivpuri et al., also observed *Prosopis juliflora* as a major cause of pollinosis with 12% patients from Delhi showing a positive skin reaction [13]. Studies from South India, recorded allergenicity to Parthenium hysterophorus pollen extracts in 34% of allergic rhinitis patients [14]. Similarly, Agashe and Soucenadin recorded high skin reactivity to *Casuarina equisetifolia* in patients from Bangalore [15]. The other clinically important aeroallergens from south India include *Cassia*, *Ageratum*, *Salvadora*, *Ricinus*, *Albizia lebbek* and *Artemisia scoparia* [16, 17].

It is widely known that the cockroach is a source of inhalant allergens in AR, which is also noticed in our study [18]. Kumar et al. observed cockroach (85%) as an important aeroallergen that is frequently implicated in driving AR symptoms in India [19]. 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%) in central India (Nagpur) [9].

Food allergy is estimated to be 4.5% in AR patients and in our study 50% 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 [20].

In several studies, dust is found to be independent risk factor significantly associated with AR [21]. Clinical profile of allergic rhinitis in Haryana showed house dust (40%) as a major factor, which caused AR symptoms. Earlier reported incidence to house dust varies from 46% to 73% [22]. In the current study, dust did cause significant allergy, particularly the rice grain dust (22%). Since the areas in Central India is increased rice consumption for rice grain dust

Prasad et al in a study at Lucknow observed animal dander (3.1%) as major allergens in patients of naso-bronchial allergy; among animal dander common offending allergens were cow dander (4.16%) and dog dander (4.16%) [23] among dander, cat dander (19.10%) and dog dander (19.10%) were most common sensitizers in UAD patients from Bhopal [11]. 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 [24]. However, according to Arbat et al., none of AR patients from Nagpur showed positive reaction to animal epithelia [9]. Similarly, Rasool et al., did

not notice any positive results in skin prick test for dog epithelia in AR patients from Kashmir [25]. 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%) [26]. Preview of allergens through skin test in Central India (Nagpur) by Arbat et al., showed that 49% of patients were positive for mites alone. *Dermatophagoides pteronyssinus* (56.6%) was the most common causing symptoms. *Dermatophagoides arina* (49%) and *Blomia* species (50.4%) were the other two types of mites [9]. Gill et al., in their study carried out in Patiala also found *D. arina* (52.12%) to be the most significant dust mite [12]. Similarly in the current study, *Dermatophagoides arina* 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 [9]. However, Dave et al noticed a higher percentage of patients allergic to Parthenium hysterophorus (15.73%) from Bhopal [11]. Awasti 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%;  $p=0.01$ ) [27]. Rao et al. Recorded allergenicity to Parthenium hysterophorus pollen extracts in 34% of allergic rhinitis patients from Bangalore [14].

Sheep wool (5.61%) was the most common sensitizer in fabric antigens. No other fabric and feathers were significant sensitizers in UAD patients from Bhopal [11]. Rasool et al. also recorded allergenicity to sheep wool in AR patients from Kashmir [25]. 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 [10]. However, in the current study silk fabric (2%) was the most common sensitizer in fabric antigens.

## VI. Conclusion

The study results gave an insight into the common allergen pattern in Central India in cases of severe persistent allergic rhinitis; the common allergens were pollens (78.5%), insects (64.5%), food (50%) and dust (38.5%). Therefore avoidance of these allergens may results in improvement of symptoms. More over it is evident by various studies conducted in different regions of India that the pattern of allergens is variable and more research is required to standardize the allergen patterns.

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**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 consent was obtained from all individual participants included in the study.

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