Common Allergens Prevalent in and Around Ambala, Haryana: An Intradermal Study among Patients with Asthma and Allergic Rhinitis and Atopic Dermatitis

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What was known?
- Allergens are one of the many factors which can cause and trigger nasobronchial allergy, atopic dermatitis and bronchial asthma.
- Skin intradermal tests can help identify allergens in cases of asthma, allergic rhinitis and eczema.

Introduction
Worldwide, eczema affects 3%–20.5% of the population and allergic rhinitis affects between 10% and 30% of the population and sensitization (IgE antibodies) to a foreign protein in the environment is present in up to 40% of the population. The rise in the prevalence of allergic diseases has continued in the industrialized world for more than 50 years. Both outdoor and indoor aeroallergens sensitize and exacerbate allergic asthma. In 1921, Kern noted that a patient with asthma had a positive prick-puncture skin test to extracts obtained from her mattress. The patient’s asthma improved after she enclosed the mattress in heavy packing paper and thoroughly cleaned the room. In 1925, Storm van Leeuwen successfully treated individuals with asthma by moving them to high altitudes or enclosing them in an allergen-proof chamber.

In India alone, approximately 20% of the population suffer from allergic rhinitis, 6% from dermatitis, and 15% from bronchial asthma. The prevalence of atopic dermatitis (AD) has increased in the past two to three decades possibly due to change in indoor and outdoor environment. Allergens are one of the many factors which can cause and trigger nasobronchial allergy, AD, and bronchial asthma. There appears to be a strong association between bioparticulate matters in the...
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atmosphere and their effect on human health. The bioparticulates mostly responsible for allergic symptoms are pollens, fungal spores, pest debris, household dust mite, animal danders, chemical compounds, and foodstuffs.[6-9]

Aeroallergens have been found to have an important role in allergic disorders. The present study was conducted to find the different types of allergens responsible for allergy in the area around Ambala, Haryana, and the surrounding areas.

Materials and Methods

A total of 100 patients attending the outpatient department of Respiratory Medicine Department of Maharishi Markandeshwar Institute of Medical Sciences and Research (MMIMSR), Mullana, Ambala, Haryana, from 2010 to 2017 were included in this study. An institutional ethics committee clearance was taken. An informed consent from each patient was obtained before their participation in the study. The patients taken were confirmed cases of allergic rhinitis, AD, and bronchial asthma.[10,11] All the selected subjects were told to stop systemic steroid or other immunosuppressives at least for three days and antihistaminic at least for 7 days prior to the intradermal test.

Intradermal injection of 197 allergen extracts was given to all 100 patients. The allergen extract included 50 types of pollen, 19 fungi, 17 insects, 14 types of dusts, 6 types of animal dander, 7 types of fabric and feathers, 82 types of foods, dust mite, and parthenium. Intradermal injection has overall higher sensitivity and is more reproducible than skin prick test for testing with low potency extracts.[12] The intradermal test requires about 1000-fold less concentrated extract than those used for skin prick test to achieve a similar response.[13]

In this study, 197 allergens and positive control (histamine buffer) and negative control (saline buffer) concluded a total of 199 intradermal injections given to a patient [Figure 1]. All the allergens were given on the back with 4 cm distance between them. Injections were given using a 26 gauge needle up to 0.5 mm depth beneath the skin. The results were interpreted by wheal produced in relation to the negative control. Because of the high incidence of one plus reaction in nonallergic individuals, this group was excluded from the study, and only high positives were considered and analyzed [Figures 1 and 2]. The skin reactions were read after 15–30 min and were graded according to the criteria already published.[14] Care was taken not to do allergy testing in patients with eczema during an episode of exacerbation.

Results

In this study, the major allergens were pollens (51%) followed by foods (28.9%), insects (26.9%), fungus (12.6%), and dusts (6.7%). Among the various allergens tested, the dust mite allergy was found in 4% of cases, unlike western studies where dust mite was the most prevalent. Among pollen allergens, *Brassica campestris* (8%) was found as major allergen followed by *Ageratum conyzoides* (7%) and *Artemisia scoparia* (6%) *Cannabis sativa*, *Cynodon dactylon*, and *Maerua arenaria* (5%) [Table 1]. Among the fungal group, *Alternaria tenuis*, *Aspergillus flavus*, *Aspergillus fumigates*, *Candida albicans*, *Penicillium sp.*, and *Rhizopus nigricans* (3%) were the major allergens followed by *Fusarium solani* (2%) [Table 2]. In the insect group, mosquito (7%), ant (6%), grasshopper (5%), locust (male), moth, and house fly (4%) were the major allergens [Table 3]. Among the dust allergens, grain dust rice (3%), straw dust, house dust, and grain dust bajra (2%) were found [Table 4] to be the major agents responsible for allergic reactions. Among fabrics and feathers wool mix was found in 2% of cases [Table 6]. Among food allergens [Table 7], prawn (5%) was the major allergen. Other food allergens were almonds, baker’s yeast, Bengal gram (3%) and mushroom, mango ripe, rajma, cinnamon, chocolate, beans fresh, and areca nut (2%).
Aeroallergens are an important cause of allergic respiratory disease worldwide. In this study, the major allergens were pollen (51%) followed by food (28.9%), insect (26.9%), fungus (12.6%), and dust (6.7%).
Table 4: Results of intradermal test with dust allergens

| Allergen extract        | Total number of patients | Marked positive reaction (2+/3+) | Percentage |
|-------------------------|--------------------------|---------------------------------|------------|
| Cotton mill dust        | 100                      | 1                               | 1          |
| Flax fibre dust         | 100                      | 0                               | 0          |
| Grain dust bajra        | 100                      | 2                               | 2          |
| Grain dust jowar        | 100                      | 1                               | 1          |
| Grain dust Rice         | 100                      | 3                               | 3          |
| Grain dust mix          | 100                      | 0                               | 0          |
| Grain dust wheat        | 100                      | 0                               | 0          |
| Hay dust                | 100                      | 1                               | 1          |
| House dust              | 100                      | 2                               | 2          |
| Paper dust              | 100                      | 0                               | 0          |
| Straw dust              | 100                      | 2                               | 2          |
| Thrashing dust bajra    | 100                      | 1                               | 1          |
| Thrashing dust wheat    | 100                      | 0                               | 0          |
| Mouldy hay             | 100                      | 0                               | 0          |

Table 5: Results of intradermal test with dander allergens

| Allergen extract   | Total number of patients | Marked positive reaction (2+/3+) | Percentage |
|--------------------|--------------------------|---------------------------------|------------|
| Buffalo dander     | 100                      | 1                               | 1          |
| Cat dander         | 100                      | 0                               | 0          |
| Cow dander         | 100                      | 0                               | 0          |
| Dog dander         | 100                      | 0                               | 0          |
| Horse dander       | 100                      | 0                               | 0          |
| Human dander       | 100                      | 0                               | 0          |

Table 6: Results of intradermal test with fabric and feathers allergen

| Allergen extract   | Total number of patients | Marked positive reaction (2+/3+) | Percentage |
|--------------------|--------------------------|---------------------------------|------------|
| Jute               | 100                      | 0                               | 0          |
| Kapok cotton       | 100                      | 0                               | 0          |
| Silk (raw)         | 100                      | 0                               | 0          |
| Sheep              | 100                      | 0                               | 0          |
| Wool mix           | 100                      | 2                               | 2          |
| Chicken feather    | 100                      | 0                               | 0          |
| Pigeon feather     | 100                      | 0                               | 0          |

Shivpuri\(^6\) found *Curvularia*, *Alternaria*, *A. fumigates*, *Phoma*, *Neurospora*, *Aspergillus tamarii*, *Helminthosporium*, *Aspergillus niger*, *R. nigricans*, *Trichoderma*, and *Cladosporium*, to be the most common allergens in patients with nasobronchial allergy. Among the dust allergens, grain dust rice (3%), straw dust, house dust, and grain dust bajra (2%) were found to

Table 7: Results of intradermal test with food allergen extract

| Allergen extract | Total number of patients | Marked positive reaction (2+/3+) | Percentage |
|------------------|--------------------------|---------------------------------|------------|
| Almonds          | 100                      | 3                               | 3          |
| Apple            | 100                      | 0                               | 0          |
| Areca nut        | 100                      | 2                               | 2          |
| Arvi             | 100                      | 0                               | 0          |
| Bajra            | 100                      | 0                               | 0          |
| Baker’s yeast    | 100                      | 3                               | 3          |
| Banana ripe      | 100                      | 1                               | 1          |
| Beans fresh      | 100                      | 2                               | 2          |
| Bengal gram      | 100                      | 3                               | 3          |
| Black pepper     | 100                      | 1                               | 1          |
| Cabbage          | 100                      | 1                               | 1          |
| Cardamom large   | 100                      | 1                               | 1          |
| Cardamom small   | 100                      | 1                               | 1          |
| Cashew nut       | 100                      | 0                               | 0          |
| Cheeku           | 100                      | 0                               | 0          |
| Chocolate        | 100                      | 2                               | 2          |
| Cinnamon         | 100                      | 2                               | 2          |
| Clove (long)     | 100                      | 0                               | 0          |
| Coconuts         | 100                      | 1                               | 1          |
| Coriander        | 100                      | 0                               | 0          |
| Coffee beans     | 100                      | 0                               | 0          |
| Cumin (jeera)    | 100                      | 1                               | 1          |
| Dal arhar        | 100                      | 2                               | 2          |
| Dal masoor       | 100                      | 0                               | 0          |
| Dal moong        | 100                      | 1                               | 1          |
| Dal moth         | 100                      | 0                               | 0          |
| Dal urad         | 100                      | 0                               | 0          |
| Lobia            | 100                      | 0                               | 0          |
| Rajma            | 100                      | 2                               | 2          |
| Raungi           | 100                      | 1                               | 1          |
| Kabuli chana     | 100                      | 0                               | 0          |
| Drum stick       | 100                      | 0                               | 0          |
| Garlic           | 100                      | 0                               | 0          |
| Citrus (lemon)   | 100                      | 1                               | 1          |
| Cucurbis         | 100                      | 0                               | 0          |
| Dhania leaves    | 100                      | 0                               | 0          |
| Ginger           | 100                      | 0                               | 0          |
| Ground nut       | 100                      | 0                               | 0          |
| Gum acacia       | 100                      | 0                               | 0          |
| Jowar            | 100                      | 0                               | 0          |
| Katha            | 100                      | 1                               | 1          |
| Lady finger      | 100                      | 0                               | 0          |
| Licorice         | 100                      | 0                               | 0          |
| Mango ripe       | 100                      | 2                               | 2          |
| Mango unripe     | 100                      | 0                               | 0          |
| Milk buffalo     | 100                      | 1                               | 1          |
| Mushroom         | 100                      | 2                               | 2          |

Contd...
be the major agents responsible for allergic reactions. Acharya[15] found house dust followed by wheat dust, cotton dust, and paper dust to be common among patients with nasobronchial allergy. Among fabrics and feathers wool mix was found in 2% of cases [Table 5]. Among food allergens [Table 7], prawn (5%) was the major allergen even though Ambala is nowhere near the sea. Other food allergens were almond, baker’s yeast, Bengal gram (3%) and mushroom, mango ripe, rajma, cinnamon, chocolate, beans fresh, and areca nut (2%). However, 82 antigens were negative among all the cases. Total positive reactions were 255 comprised by a total of 115 antigens. Since non-AD is characterized by negative skin prick test, they were not a part of the present study.[6]

The variation in the prevalence of aeroallergen reactivities in a different region is due to different geo-climatic condition and adaptation of specific microbiological flora and fauna in a specific climate. The variation of skin reactivity may also be attributed to change in the specific pattern of vegetation over a period as a result of the changes in geo-climatic condition. One of the management protocols can be the avoidance of common aeroallergens prevalent in that part of the world although it is not so easy. Allergen‑specific immunotherapy is a viable option for these patients.[16] It can be used in combination with conventional therapy to maximize the outcome and in authors’ experience has proved effective in many treatment-resistant cases.

**Conclusion**

The present study was undertaken to find out the important allergens responsible for allergy in and around Ambala and Yamunanagar having various industries as metal and plywood industry. The difference in the markedly positive intradermal test results among various other studies may be attributed to the difference in the flora of the various geographical regions and to the change in flora over time and climatic conditions. The information from the study may be useful to clinicians managing patients suffering from allergies and help in building the prevalent allergenic antigens in this part of India. The identification of most prevalent and also the full spectrum of aeroallergens responsible for respiratory allergies has a very important role in the management of these conditions. The study may help in selecting the most specific and most cost-effective panel of aeroallergen antigens for the intradermal test as the appropriate diagnostic test, and hence will help in finding the best formulation of allergen‑specific immunotherapy as an effective treatment.

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**Conflicts of interest**

There are no conflicts of interest.

**What is new?**

- The antigens prevalent in this part of India are mapped which will help in selecting the most specific and most cost-effective panel for skin allergy testing in various parts of India.
- Incorporation of low cost immunotherapy will be possible to patients of asthma, allergic rhinitis and eczema.

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