ORIGINAL RESEARCH PAPER

Immunology

KEY WORDS: Aeroallergen Sensitization, Amaranthus Spinosus, Skin Prick Test, Asymptomatic Sensitization, Polysensitization, Allergic Rhinitis, Asthma

PRECLINICAL SENSITIZATION TO AMARANTHUS SPINOSUS IN AN URBAN MEDICAL STUDENT POPULATION: A BLINDED CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Aeroallergens, including mites, cockroach, molds, and pollens, are important environmental triggers for allergic airway diseases such as allergic rhinitis and bronchial asthma. Sensitization may precede the development of clinically apparent disease, and asymptomatic sensitization has increasingly gained attention in allergy research. Skin prick testing (SPT) remains the standard in vivo method for detecting IgE-mediated sensitization. European Academy of Allergy and Clinical Immunology and World Allergy Organization guidelines recommend standardized SPT methodology for aeroallergen evaluation. **Objective:** To evaluate the prevalence, co-sensitization profile, and clinical correlates of Amaranthus spinosus sensitization among asymptomatic urban medical students using blinded SPT methodology. **Methods:** This observational single-center study included 110 medically healthy MBBS students recruited without prior allergy history screening. Participants underwent blinded SPT using 12 aeroallergens supplied by ALLVAC Pharmaceuticals along with histamine and saline controls. A wheal ≥3 mm above saline was considered positive according to international recommendations. Pseudopodia and flare reactions were documented. Clinical questionnaire data were correlated with sensitization findings. **Results:** Sixteen of 110 subjects (14.5%) demonstrated sensitization to Amaranthus spinosus. Only two subjects (12.5%) showed isolated sensitization, while the remainder demonstrated polysensitization. The most common co-sensitizations were Dermatophagoides farinae (75%), Dermatophagoides pteronyssinus (75%), Prosopis juliflora (56.25%), Parthenium hysterophorus (56.25%), and cockroach allergen (56.25%). Pseudopod formation was observed in 43.75% of reactions. Clinical questionnaire correlation showed that most sensitized individuals did not report overt allergic disease despite evidence of immunologic sensitization. **Conclusion:** Amaranthus spinosus sensitization was relatively common among asymptomatic urban medical students and was predominantly associated with polysensitization rather than isolated reactivity. The findings support the concept of latent atopy in apparently healthy populations.

INTRODUCTION

Allergic airway diseases such as allergic rhinitis and bronchial asthma are increasingly prevalent worldwide and are strongly associated with sensitization to environmental aeroallergens including mites, molds, cockroach allergens, and pollens.[1-3] Urbanization, industrialization, and environmental pollution have contributed significantly to the rising burden of allergic disorders globally, particularly in developing countries such as India.[6-8]

Skin prick testing (SPT) is considered the gold standard in vivo method for identifying IgE-mediated sensitization and is recommended by both European Academy of Allergy and Clinical Immunology and World Allergy Organization for aeroallergen assessment.[1-4] Standardized SPT metho-dology improves reproducibility and diagnostic reliability across allergy studies.[1-3]

Most published studies evaluating aeroallergen sensitization focus on symptomatic individuals presenting with allergic rhinitis or asthma. However, sensitization may exist in asymptomatic individuals prior to development of clinically evident allergic disease. Early identification of latent sensitization may help recognize populations at risk for future allergic airway disease and facilitate preventive interventions.[5-8]

Weed pollens are important contributors to respiratory allergy in tropical countries. Amaranthus spinosus, a common weed pollen widely distributed across India, has been identified as a significant aeroallergen in sensitized populations.[14] However, data regarding asymptomatic sensitization to Amaranthus in healthy urban populations remain limited.

The present study aimed to evaluate the prevalence and co-sensitization pattern of Amaranthus spinosus among asymptomatic urban medical students using blinded SPT methodology and to correlate sensitization findings with clinical questionnaire data.

MATERIALS AND METHODS

Study Design and Setting

This observational single-center skin prick test study was conducted over five consecutive days in an urban tertiary medical institution.

Study Population

A total of 110 medically healthy MBBS students were recruited randomly without prior screening for allergy history.

Inclusion Criteria

- Apparently healthy MBBS students
- Voluntary participation

- Written informed consent

Exclusion Criteria

- Basal hyperreactivity
- Invalid histamine or saline controls
- Recent antihistamine intake
- Dermatographism
- Urticarial skin response

Participation was voluntary and free of cost.

Allergen Panel

Twelve aeroallergens supplied by ALLVAC Pharmaceuticals were tested using blinded methodology. Allergen identities were revealed only after completion of data collection.

The allergens included:

1. Dermatophagoides farinae (Df)
2. Dermatophagoides pteronyssinus (Dp)
3. Prosopis juliflora
4. Cynodon dactylon
5. Amaranthus spinosus
6. Artemesia species
7. Chenopodium species
8. Parthenium hysterophorus
9. Ricinus communis
10. Alternaria species
11. Aspergillus fumigatus
12. Cockroach allergen

Positive (histamine) and negative (saline) controls were included in accordance with EAACI-recommended SPT methodology.[1-4]

Validation Criteria

- Saline wheal ≤3 mm
- Histamine wheal ≥4 mm
- Minimum 3 mm difference between positive and negative controls

These criteria were based on established international SPT standards.[1-4]

Skin Prick Testing Procedure

SPT was performed on the volar aspect of the forearm using standardized lancets. A wheal diameter ≥3 mm greater than saline control was considered positive, in accordance with international recommendations.[1-4] Presence of flare response and pseudopodia was documented.

Data Collection and Statistical Analysis

Subjects positive for Amaranthus spinosus sensitization were identified after allergen unblinding. Clinical questionnaire data were correlated with sensitization findings.

Categorical variables were expressed as percentages. Due to lack of a complete allergen-negative comparison dataset, inferential statistical testing for significant associations could not be performed.

RESULTS

Prevalence of Amaranthus spinosus Sensitization

Among 110 asymptomatic medical students, 16 subjects demonstrated sensitization to Amaranthus spinosus, yielding a prevalence of 14.5%.

Only two subjects (12.5%) demonstrated isolated Amaranthus sensitization, whereas most exhibited polysensitization patterns.

Isolated Amaranthus Sensitization

- Sample 77
- Sample 103

Pseudopod Formation

Pseudopodia were observed in 7 of 16 Amaranthus-positive reactions (43.75%), suggesting relatively strong cutaneous hypersensitivity responses.

Samples with Pseudopodia
1, 16, 40, 53, 54, 58, and 64

Co-Sensitization Pattern
The most frequent associated aeroallergens among Amaranthus-positive subjects were house dust mites followed by weed pollens and cockroach allergen.

Table 1. Co-sensitization Profile Among Amaranthus-Positive Subjects

Associated Allergen	Positive (n=16)	Percentage
Df	12	75.0%
Dp	12	75.0%
Prosopis	9	56.25%
Cockroach	9	56.25%
Parthenium	9	56.25%
Cynodon	8	50.0%
Ricinus	6	37.5%
Chenopodium	4	25.0%
Artemisia	3	18.75%
Alternaria	2	12.5%
Aspergillus	0	0%

Most Common Co-Sensitizations

1. Df and Dp — 75% each
2. Prosopis, Parthenium, and Cockroach — 56.25% each
3. Cynodon — 50%

These findings suggest that Amaranthus sensitization in this cohort behaves predominantly as part of a broader atopic polysensitization profile rather than isolated sensitization.[14-18]

Clinical Correlation

Questionnaire correlation data were available for 14 of 16 Amaranthus-positive subjects.

Matched Samples
16, 23, 53, 54, 58, 64, 67, 77, 91, 95, 103, 104, 106, and 109

Table 2. Clinical Characteristics of Amaranthus-Sensitized Subjects

Clinical Parameter	Positive / Total	Percentage
History of allergies	5/14	35.7%
Nasal symptoms	5/14	35.7%
Asthma	1/14	7.1%
Wheeze/SOB on exposure	3/14	21.4%
Skin symptoms	4/14	28.6%
Eye symptoms	4/14	28.6%
Food allergy	1/14	7.1%
Multiple allergies	1/14	7.1%
Indoor environmental trigger	4/14	28.6%
Outdoor environmental trigger	2/14	14.3%
Sleep disturbance	4/14	28.6%
Daily pet exposure	4/14	28.6%
Family history of allergy	3/14	21.4%
Dermographism	1/14	7.1%

DISCUSSION

This study demonstrated a notable prevalence of Amaranthus spinosus sensitization among asymptomatic urban medical students despite absence of clinically overt allergic disease.

A major observation was the predominance of polysensitization. Only 12.5% of sensitized subjects exhibited isolated Amaranthus sensitization, whereas most showed concurrent sensitization to house dust mites, weed pollens, and cockroach allergen. Similar polysensitization patterns have been described in previous aeroallergen studies among

atopic populations.[14-18]

House dust mite sensitization was especially prominent, with Df and Dp positivity observed in 75% of Amaranthus-positive subjects. This coexistence of perennial indoor allergens and seasonal pollens reflects a broader atopic predisposition and has been observed in prior allergy epidemiology studies.[14-18]

Interestingly, most sensitized individuals denied known allergy history. Although nasal symptoms were reported in 35.7%, only one participant had physician-reported asthma. These findings support the concept that asymptomatic sensitization may precede clinically manifest allergic airway disease.[5-9]

Pseudopodia were observed in nearly half of positive reactions. While pseudopod formation has historically been considered suggestive of stronger IgE-mediated reactivity, its prognostic significance remains uncertain and requires further investigation.[1-4]

The relatively low frequency of outdoor trigger reporting despite sensitization to weed pollen may indicate subclinical sensitization or reduced awareness of environmental allergen exposure among participants.

The blinded methodology used in this study minimized observer bias and improved objectivity of allergen interpretation.

Limitations

1. Single-center study with relatively small sample size
2. Study population limited to medical students and may not represent the general population
3. Lack of serum-specific IgE correlation
4. Cross-sectional design preventing longitudinal outcome assessment
5. Inability to compute valid p-values due to absence of complete allergen-negative comparison dataset

CONCLUSION

Amaranthus spinosus sensitization was relatively common among asymptomatic urban medical students and was predominantly associated with polysensitization, particularly to house dust mites and other weed pollens. Many sensitized individuals lacked overt allergic symptoms, suggesting latent atopy in apparently healthy populations. Early identification of asymptomatic sensitization patterns may help recognize individuals at risk for future allergic airway disease and guide preventive strategies.

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