

Research Article

The Spectrum of Aeroallergen Sensitization in Children with Wheeze-At A Tertiary Care Centre

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Abstract: Introduction: Aeroallergens may trigger symptoms in sensitized children with asthma. Documentation of sensitization is crucial to enable effective implementation of measures to prevent asthma exacerbations. To document the sensitization patterns of very young children (≤ 2 years) with asthma. This study was conducted in view of the crucial importance of aeroallergens in childhood. The purpose of this study was to determine the prevalence of sensitization to common aeroallergens in children with residing in our region and to elucidate the association of aeroallergen sensitization with severity. Methods: This study was conducted at a tertiary care center in northern India. We are following a cohort of pediatric asthma patients (up to 18 yrs) from the Pediatric Chest Clinic since August 2009. Eligibility criteria were children with asthma who stayed in Delhi and nearby areas and willing to follow up 3 monthly regularly for at least 1 year. The diagnosis and treatment of asthma was based on the Global Initiative for Asthma (GINA) guidelines. At enrolment, baseline data was collected, spirometry was performed [6], and FENO measurement was done. Asthma was classified as per the NAEPP guidelines [8]. The patients were followed up every 3 months, symptom diary was maintained, and control was assessed as per GINA guidelines. The cohort included 243 asthmatic children. Results: Children with recurrent (4 or more episodes of wheezing in the past year) ages between 2yrs to 10 yrs. The total number of the patients included in the study was 120 patients, 60 (50%) male and 60 (50%) with Mean Age = 6.15 years. Out of the 60 male cases, 45 (75%) had positive SPT to at least one of the aeroallergens and 15 (25%) were negative for all aeroallergens tested. Out of the 60 female cases, 42(70%) had a positive SPT to at least one of the aeroallergens and 18(30%) were negative for all aeroallergens. Out of 120 children, 87 (87.5%) had positive SPT to at least one of the aeroallergens. The highest prevalence of positive skin reaction was recorded for mite allergens among them Dermatophytosis pteronyssinus (80.6%), *D. farinae* (80.7%), *Bloomia* (68.7%), among Fungi group, *Aspergillus fumigates* (11.9%) *Alternaria alternate* (10.5%), *Cladosporium herbarum* (2.8%) Cat, cockroach and pigeon showed positive in (19.5%) (14.9%) and (4.4%) of cases respectively. Among Pollen group *Cynodon dactyl* (8.9) & *Parthenium hysterophorus* (7.4) The frequency of positive tests to an individual allergen is depicted in the table (8). In the studied population, the highest a prevalence of positive skin reactions was documented for the *D. pteronyssinus* and *D. farinae* with a frequency of (80.5%) of cases, and the lowest for *Dog*. Conclusion: SPT is an effective way to determine aeroallergen with minimal expense & greater selection of antigen. Specific allergen identification helps in implementing specific allergen preventive measures. Dust mites are the most common aeroallergen in all age groups. Among Dust Mites *Dermatophagoides Farinae*, *Dermatophagoides pteronyssiuns* & *Blomia* are most common. Incidence of aero allergy in children with recurrent wheeze increases with age. Indoor allergens are more common than outdoor allergens.

Keywords: Allergens, Wheezing, Paediatric population, Dust mites.

INTRODUCTION

Determining sensitivity to allergens is essential in diagnosing and predicting children with allergic diseases. According to allergen type, sensitization to allergens could be different during a lifetime. Nowadays, sensitization to pollen is increasing in children globally, and pollen allergy is strongly associated with a significant number of hospital visits worldwide. Meanwhile, chronic cough is defined as a cough that lasts more than four weeks in children. Because chronic cough may be the sole presenting symptom of an underlying chronic respiratory illness in children, it is common reason parents visit respiratory specialists for evaluation for their children. Previous researches suggest that chronic cough in children may often be from allergic diseases, such as asthma and allergic rhinitis (AR), and almost 70% of children with a chronic cough had used asthma medications. [4]

Therefore, children with chronic cough may inappropriately use asthma medications if there is a misdiagnosis. Despite the significance of chronic cough as a possible indicator of allergic disease or chronic lung disease in children, most studies of children examined those who were under four years old or attended child care centers, not school-aged children. Therefore, chronic cough risk factors and etiology in school-aged children remain poorly understood with causative triggers. From these results, we postulate that sensitization to pollen may be related to chronic cough in children. [5,6] However, to our knowledge, no comprehensive studies to date have assessed a relationship between sensitization to aeroallergen and chronic cough in school-aged children from the general population. Therefore, the purpose of our study was to shed light on the relationship between sensitization to aeroallergens including pollen, house-dust mite (HDM),

and animal dander and chronic cough to use skin prick tests (SPTs) and questionnaires. Also, we identify the relationships to chronic cough with the demographic or environmental characteristics, including gender, allergic comorbidities, family history, and exposure to tobacco smoke and mold, and estimate the prevalence of chronic cough in school-aged children. Documentation of aeroallergen sensitization is important because of its role in pathogenesis and acute asthma exacerbation. Allergen Immunotherapy can also be instituted based on the allergy skin prick test results. This study was conducted in view of the crucial importance of aeroallergens in childhood. The purpose of this study was to determine the prevalence of sensitization to common aeroallergens in children with residing in our region and to elucidate the association of aeroallergen sensitization with severity.

METHODS

This study was conducted at a tertiary care center in northern India. We are following a cohort of pediatric asthma patients (up to 18 yrs) from the Pediatric Chest Clinic since August 2009. Eligibility criteria were children with asthma who stayed in

Delhi and nearby areas and willing to follow up 3 monthly regularly for at least 1 year. The diagnosis and treatment of asthma was based on the Global Initiative for Asthma (GINA) guidelines. At enrolment, baseline data was collected, spirometry was performed [6], and FENO measurement was done. Asthma was classified as per the NAEPP guidelines [8]. The patients were followed up every 3 months, symptom diary was maintained, and control was assessed as per GINA guidelines. The cohort included 243 asthmatic children.

As SPT needs cooperation of the child, we performed SPT on children who were above five years of age. Of the cohort of 243 children, 180 children were 5 or more years of age and gave consent to SPT.

SPT was done using 12 aeroallergens. Saline was taken as negative control and histamine was used for positive control. Patients were not on antihistamines for at least 48 hours preceding the test. The twelve allergens tested were rice grain dust, wheat threshing dust, housefly, dog dander, female cockroach, house dust mite (*Dermatophagoides farinae*), *Curvularia lunata*, *Aspergillus tamari*, *Alternaria tenius*, *Prosopis juliflora*, *Cynodon dactylon*, and *Holoptelea integrifolia*. Allergens were obtained from All Cure Pharma Pvt Ltd, Bahadurgarh, Haryana. As it was not feasible for us to use a large panel, we used aero-allergens which we suspected to be of relevance considering our patient population (urban, rural, urban slum) and other previous studies from our country. Test was considered positive if wheal in any of the allergens was 3 mm or more than the negative control. Child was considered atopic if he demonstrated positive result to one or more allergen, and non-atopic if he had a negative SPT. Study protocol was approved by Institutional Ethics committee of All India Institute of Medical Sciences. Statistical analysis: Data were entered using Microsoft Access. Statistical analysis was performed using Stata 9.0 statistical software (Stata Corp., College Station, TX, USA). Differences between normally distributed variables were tested using unpaired Student's t-test whereas non-normally distributed variables were tested with two – sample Wilcoxon rank-sum (Mann-Whitney) test. Chi-square test was used for testing difference in proportions for categorical variables. P value of <0.05 was considered significant.

RESULTS

The total number of the patients included in the study was 120 patients, of the 60 [50%] male and 60[50%] female. (Table-3) with Mean Age = 6.15 years and SD = 2.4.

Table 1: Sex Wise Distribution

	Frequency	Percent
Male	60	50
Female	60	50
Total	120	100.0

The study group is divided into three age groups, 2-4yrs., 5- 7yrs and 8-10 yrs. The frequency of each group is shown in table 2.

Table 2: Age Distribution

Age Groups	Frequency	Percent
2-4Yrs	39	32.5
5-7Yrs	38	31.6
8-10Yrs	43	35.9
Total	120	100.0

Out of 120 children in the study, 87 children were found sensitive to at least one aeroallergen and 33 were negative for all aeroallergens association between positive skin prick test and wheezing is shown in Graph 1.

Out of the 60 male cases, 45(75%) had positive SPT to at least one of the aeroallergens and 15(25%) were negative for all aeroallergens tested.

Table 3: Association of sex and allergen sensitization

SPT	Male	Female
Positive	45	42
Negative	15	18
P-Value	0.6711	

Out of 120 children, 87 (72.5%) had positive SPT to at least one of the aeroallergens. 29 (33.3%) of patients with positive tests were in the age group 5-7 years and 30 (34.4%) were in the age group of 8-10 Yrs. Only 15 (45.4%) were found in the age group 2-4 years (Table 4).

A statistically significant correlation is seen between age groups and sensitivity (p-value 0.025)

Table 4: Association of Skin Prick test with age group

Age	Sensitivity Present	No Sensitivity	Total
2-4Yrs	28(32.1%)	15(45.4%)	43(35.8%)
5-7Yrs	29(33.3%)	10(30.3%)	39(32.5%)
8-10Yrs	30(34.4%)	8(24.24%)	38(31.6%)
Total	87(72.5%)	33(27.5%)	120(100%)

The highest prevalence of positive skin reaction was recorded for mite allergens among them Dermatophytosis pteronyssinus (80.6%), D. farinae (80.7%), Bloomia (68.7%), among Fungi group, Aspergillus fumigates (11.9%) Alternaria alternate (10.5%), Cladosporium herbarum (2.8%) Cat, cockroach and pigeon showed positive in (19.5%) (14.9%) and (4.4%) of cases respectively. Among Pollen group Cynodon dactyl (8.9) & Parthenium hystrophorus (7.4) The frequency of positive tests to an individual allergen is depicted in the table (8). In the studied population, the highest a prevalence of positive skin reactions was documented for the D. pteronyssinus and D. farinae with a frequency of (80.5%) of cases, and the lowest for Dog (Canis familiaris) (0%) of cases respectively

Table 5: Skin sensitivity to allergens

No	Allergen Group	Allergens	No of Patients	Percent	Percent of Cases
1	Mites	D. Farinae	59	49.1	80.6%
2		D. Pteronyssinus	54	54	80.7%
3		D. Bloomia	46	46	68.7%
4	Fungi	Aspergillus Fumigatus	8	8	11.9%
5		Alternaria Alternate	7	7	10.5%
6		Cladosporium Herbarum	2	2	2.8%
7	Pollens	Cayanodon Dactylon	6	6	8.9%
8		Parthenium Hysterophorus	5	5	7.6%
9	Epithelia	Cat Epithelia	13	13	19.5%
10		Dog Epithelia	0	0	0%
11		Pigeon	3	3	4.6%
12	Insects	Cockroach	10	10	14.7%

Out of the 87 children with a positive skin prick test, 86 showed sensitivity to indoor allergens (dust mites, fungi, cockroach, cat) & 10 showed sensitivity to the outdoor allergen (pollen, pigeon). The association between indoor allergens and wheezing is statistically significant (P-value <0.0001).

Table 6: Association between indoor and outdoor allergens

Allergen	Positive	Negative
Indoor	86	1
Outdoor	10	77

Chi square value= 95.3 p value <0.0001

DISCUSSION

Aeroallergens are the prominent causes of allergic symptoms in patients with recurrent wheeze. Sensitivity to aeroallergens increased significantly with age. The

frequency of sensitization was 23.3% among children aged 2 years to 4 years, 45% in the age group of 5-7 years and 31.6% in the age group of 8-10 years. This is similar to the results of Sonnappa S et al.⁸ The study showed a prevalence of positive skin prick tests of 69.01% in males and 64.41% in females. Thus, it shows boys had a slightly greater prevalence of any positive skin-test (69.01% vs 64.41%). In this study, 66.9% of patients were sensitive to aeroallergen but 33.1% had negative skin prick tests. The negative reactions may be probably because of the patient's sensitization to other particular allergens. This high percent of sensitization was also shown by Mohammadi K et al.⁹ 81% of their patients had positive skin reactivity to aeroallergens, which were also comparable to 68% in Farhoudi A et al.¹⁰ Mites were the most common aeroallergen in patients with allergic diseases in the current study which is similar to studies of Spycher BD et al.¹¹ As against our study, pollens were the most common cause of sensitization in study by Sobel ME et al.¹² This difference also was expected since mites tend to require high humidity and moderate temperatures to thrive, whereas pollens require a dry climate and a high temperature. In many humid countries, dust mites were the most important cause of sensitization in allergic children because mites tend to thrive in high humidity.¹³ Surprisingly, mite allergens were also reported in hot and dry regions, like Kuwait.¹⁴ and Iran.¹⁵ It might be related to the wide use of air conditioners which make good conditions for mites to grow and increase susceptibility to indoor allergens. Among mites, *D. pteronyssinus* had the highest rate of sensitization and *D. farinae* were next in importance. In a similar study, house dust mites were reported to have the highest rate of sensitization among Malaysian asthmatic patients¹⁶ and patients with allergic rhinitis in Thailand.¹⁷ *Bloomia* also showed a significant reaction in many wheezers which is shown by studies of Martinez FD et al.¹⁸ Their study showed that there is a rising trend in the sensitization pattern of *Bloomia*. Among the fungi, in our study *Aspergillus fumigatus* (4.6%) being the most common sensitizer followed by *Alternaria* *Alternata* and (4.6%). Similarly, *Aspergillus fumigatus* had been identified as a major fungal allergen in the study of Prasad et al.¹⁹ Nelson HS studied the sensitivity of asthmatics to cockroach allergens in children from 6 months to 12 years old and reported a 29% rate of positive skin tests in these children.²⁰ Results of a study in northern Iran have also reported the prevalence of sensitivity to cockroach allergen in patients with asthma as 12.7 percent.²¹ This study result had shown that there is less sensitivity to animal dander. In contrast, Western and European countries²² show a higher percent of sensitization because of the incidence of domestic pets in their homes more than our country. In this study, according to the highest prevalence of allergies to mites, proper training of the patients about avoiding contact with these agents as the most important way to prevent the wheezing symptoms. Informing about allergy symptoms is effective in prevention and reduction of the

severity of symptoms in patients. Furthermore, using immunotherapy for desensitization to common allergens will have a significant effect on the symptoms to completely disappear. In our study, only 6 patients had positive pricks test to pollen extract. These results contrast with other studies in areas such as Virginia and the United States, where authors found high levels of sensitivity to pollen in young children. It showed a positive prick test in 29% of children aged 1 to 2 years, and it increases to 50% in those in the range of 3 to 4 years.²³ A greater number of pollinic seasons are required to sensitize to young children. The major indoor allergenic proteins that have been characterized are house dust mite allergens, cat antigens, dog dander antigens, mouse antigens, cockroach antigens, and certain fungal allergens

CONCLUSION

Our result confirmed that mites are the main sensitizing aero-allergens among patients with recurrent wheeze in and around Hyderabad. Among mites *Dermatophagoides Farinae*, *Dermatophagoides pteronyssinus* and *Bloomia* are the most common aeroallergens. The SPT is an important test to know the sensitization of aeroallergen, which has a high sensitivity, low specificity, less expensive with minimal equipment and a greater selection of antigen. The sensitivity to aeroallergens increases with age. In children, the sensitivity to indoor allergens is more prevalent than sensitivity to outdoor allergens. Sensitivity to pollen was found in older children more than 5 years of age. Furthermore, this study may also help control or avoid allergens causing allergic disease.

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