Allergen sensitization profile in a cohort of children with asthma and allergic rhinitis in Tamilnadu – Hospital based study

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Abstract:

Introduction*: Allergic disorders are on the rise in India. The data on sensitization patternof allergens in children with asthma and allergic rhinitis in India has been varied in different regions. However, there is paucity of data especially from Tamilnadu and Vellore in Southern India which has unique climatic conditions. Hence, the study was planned to find the sensitization pattern of allergens in the population of Vellore.*

Materials and methods*: 207 children attending the allergy and asthma clinic of Nalam Medical Centre, Vellore for the first time, during the study period from January 2018 to September 2020were included in the prospective study. Basic demographic data was collected and children were subjected*

to testing by skin prick method for a panel of allergens selected based on previous pilot study. Statistical analysis was done using R software version 4.1.1.

***Results**: The mean age of the population was 7 years and most of the population were male (64%). Anthropometric measurements were normal and most of them had significant family history of asthma. Most of the children had sensitization to multiple allergens (64.7%). Dust mite (60.3%) was the predominant aeroallergen seen followed by cockroach (45.67%) and pollens especially Prosopis(50.79%). Food sensitization was less than 25% compared to the aeroallergens. Milk (24.86%) and egg white (24.86%) were the predominant food allergens.*

***Discussion:** Comparison of the study results with other Indian studies shows that sensitization to dust mite is relatively high in Vellore.Prosopis Juliflora is a unique aeroallergen observed in Vellore region*

Key words: Allergen sensitization in children, dust mite sensitivity, food allergens, aeroallergens

Introduction:

The incidence of allergic disorders in India is on the rise. Overall, 40-50% of the pediatric asthma cases are uncontrolled and there is a sub-optimal treatment of the same in Indian population. (1). Asthma and allergic rhinitis contribute to significant health care burden and morbidity. Treatment of allergic disorders in India is still mainly directed on symptom control and allergen avoidance. Due to the vast geographical distribution, the pattern of allergen sensitization is varied in India and is unique to every region. The allergen sensitization profile in each places is further influenced by the local climatic condition, and urbanization effect. The climatic effect due to global warming, carbon dioxide emissions and rainfall patterns have had a significant effect on the pollen sensitization in various parts of the world.(2)

Studies have been published on common aeroallergens from several parts of India. The commonest aeroallergens in India includes house dust mite, cockroach, pollen and mold spores. However, there has been a vast difference in the rate of sensitization pattern noticed among various studies in India. Also there are two pollen season in India, one in February and the other between September and December which also determines the sensitization to the predominant pollen based on which season the region comes under. (1) The Europrevall- INCO study which revealed food allergen sensitization in India was restricted to only two Indian centers namely Mysore and Bengaluru. (3). The pattern of food sensitization studied in India has been scant. The above factors clearly indicate that it is highly imperative to understand the regional allergen sensitization pattern in each part of India.

Vellore is in the Southern part of India and has a unique climatic condition with a wet season which is hot and oppressive and dry season being sweltering and humid. The temperature also varies from 62*F to 104*F. As air pollution and climatic change are the main reason for increased prevalence of respiratory disorders by contributing to release of allergenic pollens, mite growth and spore formation we expect that pattern of sensitization will be different in our region

(4). The studies from Tamilnadu regarding sensitization pattern is still scanty. With this background, we planned the study to analyze the allergen sensitization pattern of children with asthma and allergic rhinitis from Vellore.

Methods

Study design and data collection

The study was designed as a prospective study and enrolled children who attended the asthma and allergy clinic of Nalam Medical Centre and Hospital, which is a secondary level care hospital in Vellore. The study was approved by the ethical committee of the hospital. (No NMCHE0005) and VIT University. Informed consent was obtained from the parents or guardians of the children included in the

study. The study was performed from time period -January 2018 to September 2020. Children who attended the clinic for the first time with symptoms suggestive of asthma and allergic rhinitis, aged between one to 18 years were included in the study.

The basic demographic characteristics of the study population including age, anthropometry, comorbid conditions, symptoms and severity of asthma, vaccination status, family history of asthma, and tobacco exposure was collected using a standard data collection sheet. Those who had acute respiratory infections and chronic conditions like congenital heart disease, cystic fibrosis and those children whose parents did not give consent were excluded from the study.

Methodology

After careful analysis of previous pilot study done in India and the pollen pattern of our region we selected a fixed panel of allergens which included mixed dust mite allergen, cockroach, pollens - prosopisjulliflora, partheniumhysterophus, alternaria, cat dander and food allergens which included milk, egg white, peanut, chicken and fish.(5) The children were subjected to skin prick test for the above allergen extracts (Credisol, Mumbai, India). Histamine (10mg/ml of histamine phosphate) and 0.9% no saline wereused as positive and negative controls. Skin prick test(SPT) was performed and allergens were evaluated 15minutes after application and considered positive if the mean wheal diameter was >or= to 3mm above the negative control.

Statistical analysis

Data was analyzed using R software version 4.1.1, All categorical data was presented using frequency and percentages, and all continuous measurements was described using Mean±Std.Deviation or Median (inter quartile range) based on the distribution.

Results:

Around 207 children participated in the study and the mean age was 7(4,11). Most of the population were males (64%). The population had a normal distribution of the anthropometric measurements with no abnormal nutritional status. 48% of the children had family history of asthma with the paternal and maternal incidence being 14%, Interestingly 29% of their grandparents had asthma. The severity of asthma was graded using the GINA guidelines and 70%(145) of the children had partly controlled asthma with either 1 or 2 of the symptoms being present and around 23.19% (48) had uncontrolled symptoms. 6.76% (14) of them had well controlled asthma.around 98% of the children had both asthma and allergic rhinitis, 11% (23) had associated urticaria and 31.4% (46) had allergic conjunctivitis. (Table1)

Around 8.6% (18) of them did not demonstrate any sensitization to the tested allergens. Among 188 of the tested children,20 (9.6%)of them had mono sensitization, 35 (16.9%)had sensitization to two antigens and 134 (64.7%)had multiple sensitizations to the tested allergens as shown in Table 2

Most of the children had aeroallergen sensitivity with 114(60.3%)children having sensitization to dust mite. Sensitization to cockroach was high (45.67%). The sensitization to pollens was also equal to that of cockroach. Most of the children had sensitization to prosopis (50.79%)which was even higher than the cockroach and the sensitivity to parthenium was 40.2% (76). Only 34(18%)children showed sensitization to cat dander. (Table 3)

The incidence of food sensitization was less than 25% compared to the high aeroallergen sensitization. Among the food allergens the children showed maximum sensitization to milk (24.86%) and egg white (24.86%). The incidence of sensitization to fish was 21.163% (40) which was higher than sensitization to peanut (18%) (Table 4)

Table 1: Characteristics of children studied

Characteristics	Number (%)
Mean Age	7yrs (4,11)
Gender Male	132(64%)
Gender Female	75(36%)
BMI <=-2	6 (3%)
BMI -1 to -1.99	33 (16%)
BMI 0 to -0.99	64 (31%)
BMI 0.1 to 2	98 (47%)
BMI >2	6 (3%)
Neonatal admission	30 (14%)
Atopic dermatitis	21 (10%)
Flu vaccinations	43 (21%)
BCG vaccination	203 (98%)
Family history of asthma	99 (48%)
Father with h/0 asthma	29 (14%)
Mother with h/0 asthma	28 (14%)
Siblings with h/0 asthma	21 (10%)
Grand parents with h/0 asthma	60 (29%)

Control of asthma - Control	14(7%)
Control of asthma -Partly controlled	145 (70%)
Control of asthma Uncontrolled	48 (23%)
Comorbidities Allergic rhinitis	201
Comorbidities - Urticaria	23
Comorbidities – Allergic conjunctivitis	46
Age of onset of symptoms 0-1 yr	50 (24.2%)
Age of onset of symptoms 1-5 yrs	87 (42.2%)
Age of onset of symptoms 5- 10yrs	48 (23.3%)
Age of onset of symptoms >10yrs	21(10.2%)

Table 2 :Number of antigen children were sensitized

Sensitization	Male	Female	Total
No sensitization	11	7	18 (8.6%)
Mono sensitization	12	8	20 (9.6%)
Sensitization to two antigen	25	10	35 (16.9%)
Multiple sensitization	84	50	134 (64.7%)

Table 3: Sensitization to aeroallergens

Sensitization	Male	Female	Total(%)
Dust mite	77	37	114(60.3)
Cockroach	64	31	95 (50.26)
Prosopis	61	35	96 (50.79)
Parthenium	50	26	76(40.2)
Alternaria	31	22	53(28.04)
Cat dander	20	14	34(18)

Table 4: Sensitization to food allergens

Sensitization	Male	Female	Total(%)
Milk	28	19	47(24.86)
Egg white	32	15	47 (24.86)
Chicken	26	17	43 (25.09)
Fish	28	12	40 (21.163)
Peanut	18	16	34 (18)

Discussion

The present study shows that children who present with asthma and allergic symptoms are predominantly atopic and have sensitization to the tested allergens. Most of them had a normal BMI with significant association of allergy and asthma symptoms with family history. Aeroallergen especially dust mite is the predominant antigen with milk and egg being the predominant food allergen.

Generally, it has been noted that early onset of asthma is associated with risk of obesity.(6) Study done in UK had also shown that irrespective of ethnicity asthma was associated with obesity.(7). A systematic review had also noted that there is a bidirectional association of asthma and obesity where in early onset of asthma can contribute to obesity and childhood obesity drives an increased onset of asthma.(8) Similar observation has also been made by Salvi et al in a study done among Delhi school children in India where overweight and obesity was the only risk factor strongly associated with asthma.(9) This is in contrast to our study where we have noticed normal BMI in children with asthma. Similar pattern of association of normal or near normal BMI was noticed in studies done in Ernakulam, India and in Spain. (10,11). The study population characteristics probably can explain the differences and also the interregional differences show that region specific large sample studies will be needed to find out the association between BMI and asthma.

The present study has also showed significant association with family history with incidence more among the grand parents. Such an association has also been documented by studies done by Jain et al and Trivedi et al in India. (12,13) The transgenerational inheritance has been noticed in a study done by Yu et al.(14). Hence, it is imperative that family history must be enquired and recorded in all children brought for evaluation of asthma.

The present study has shown sensitization to dust mite to be 60.3%. The results were similar to that done in Mysuru by Mahesh et al who showed a prevalence of up to 65% which did not vary with the type of residence(15). However, another study done from Mysore had showed a lower sensitization of upto 27.7% (16).The percentage of prevalence of dust mite from West India is also about 41.8% (17). However, study from North India had shown very low sensitivity to dust mite which is only 7.8%(18). Hence it can be assumed that there is an interregional variation even within India in sensitization pattern to dust mites. Similar pattern of high dust mite sensitivity has been reported from other Asian countries like Singapore (70-90%) and Taiwan (85-90%)(2). The incidence of dust mite sensitization is

also high in a study done in Cincinnati, USA (60%) which had been analyzed in a cohort of patients admitted for asthma(19)

Sensitization upto 45.7% to other common indoor allergen, cockroach was observed in the present study. However, the sensitization pattern of 21% noticed by Savitha et al in their study from Mysuruand by Raj et al (18%) from North India has been lower for cockroach. (16,18).

Incidence among pollen sensitization is close to 50%. Tham et al also has noted 40-70% prevalence of pollen sensitization in South and East India compared to 10-14% prevalence in North India which has been reflected in the present study.(2)Among the pollens prosopis which is a shrub was the commonest aeroallergen noted in the study. This was a unique sensitization pattern found in Vellore region. Savitha et al had noted Parthenium which is a grass to be the commonest aeroallergen among pollens. Studies from North and Eastern India has noted Cynodonas the commonest pollen.(16,18,20). Western India differed from the rest and Amaranthusspinosus was the commonest pollen sensitization as noted by Lavina et al (17).

53% of children in the study population were sensitized to Alternaria which is almost similar to that found in the study by Mahesh et al (48%) but higher than what has been observed in North India by Raj et al (10%) and in West Bengal by Dey et al (26.1%). (15,18,20) Interestingly, most of the patients showed sensitization to Candida in Western India(17)

Milk and egg white was the predominant food allergen seen in the present study followed by chicken. This was in contrast to what was observed by Mahesh et al (3)as a part of Europrevallmulticentricanalysis where sensitization to milk and egg was low. However, Lavina et al in a study done in Mumbai had showed similar sensitivity pattern to milk (24.19%) and egg (29.23%) (17) In a study conducted by ICMR on prevalence of food allergy in adults was predominantly to chick pea(6.3%)(21) The apparent difference could be explained by the age included as usually nut

sensitization is most commonly seen in adults compared to milk and egg which children tend to outgrow.

The present study has shown that most of the children had multiple sensitizations (64.7%) compared to the study done in Mysore by Savitha et al where the study population predominantly had mono sensitization (57%)(16)

In conclusion, the findings of the present study clearly reveals that

1. The study population had normal BMI and also had significant family history with incidence more among grandparents.
2. There is a significant inter regional variation in the allergen sensitization pattern among India
3. In contrast to the West, where grass and tree pollen play a major role dust mites are the major cause of allergic rhinitis and asthma probably due to the unique climatic condition. (2)
4. Cockroach is another major indoor allergen
5. Prosopisjullifora appears to be a unique allergen to this part of the country and has to be included in the allergy panel
6. Fungal panel also needs to be selective to the region where it is being done.

The limitation of the study was the limited number of allergens tested. Probably inclusion of wider range of allergens would have helped us to compare the inter regional differences. However, the decision to include these allergens was based on a previous pilot study.

Highlights of the study

1. The present study has showed children were sensitized to multiple allergens in contrast to mono sensitization seen in certain parts of India
2. Children in study population were associated with normal BMI in contrast to several studies
3. Inter regional variations exist within India and each region required its own allergen panel.

4. House dust mites in varying percentages is the predominant allergen in India
5. Prosopis appears to be unique allergen in Tamilnadu
6. Milk and egg are the predominant food allergen in this part of the country.

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