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Research Article

Aeroallergen Profile in Patients of Nasobronchial Allergy in Gangetic Plains

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Received: June 15, 2023; **Published:** August 17, 2023

Abstract

Background: Identification of aeroallergens causing nasobronchial allergy, is important in management of these patients. This study was conducted by skin prick test (SPT) in patients of naso-bronchial allergy, in Northern Gangetic plains of India, near confluence of River Ganga and Yamuna.

Materials and Methods: Skin prick tests were performed on 80 respiratory allergy patients (allergic rhinitis, asthma or both), to identify common aeroallergens. The testing kit contained 66 allergen extracts including pollens, fungi, insects, danders, dusts and miscellaneous type triggers.

Results: Major sensitizers among pollens were, *Cynodon dactylon*, *Sorghum vulgare, Pennisetum typhoides, Brassica campestris, Putranjiva roxburghii, Albizia lebbeck*. Among fungal sensitizers, there were *Aspergillus fumigatus, Candida albicans* and *Aspergillus niger*. The insect allergen extracts showing markedly positive skin reactions were Cockroach (female) and Cockroach (male) in most of cases. House dust and Paper dust among dusts, Kapok cotton among group of fabric and feathers and Dust Mite and *Parthenium* leaves among miscellaneous group were the dominant types, eliciting markedly positive skin reactions.

Conclusion: We gathered knowledge about common allergens, present in our area of study, which could be used for treating patients by immunotherapy or avoidance strategy.

Keywords: *Aeroallergens; Gangetic Plains; Nasobronchial Allergy; Skin Prick Test*

Introduction

Worldwide, allergic rhinitis affects about 10% to 30% of the population [1] and sensitization (IgE antibodies) to foreign protein in the environment is present in up to 40% of the population [1]. The rise in prevalence of allergic disease has continued in the industrialized world for more than 50 years [1]. In India, the prevalence of asthma in children below 9 years of age was found to be 0.8% in 1966, which is now increased to about, 5.6% to 23.4% in different parts of the country [2], thus showing a rising trend. In one study, up to 80% of asthmatics were found to have allergic rhinitis and likewise up to 40% of allergic rhinitis patients were found to have asthma, thus leading to the concept of united airway disease [3]. There appears to be a strong association between bioparticulate matters in the atmosphere

and their effect on human health. The bioparticulates mostly responsible for allergic symptoms are pollens, fungal spores, pest debris, household dust mite, animals dander, chemical compounds, and foodstuffs [4-6]. Airborne biopollutants pose an important problem worldwide due to their allergic properties. Aeroallergens play an important role in the pathogenesis of respiratory disorder like, allergic rhinitis and asthma. Pollens and other aeroallergens are variable in different ecozones, and it is important to identify them for diagnosis and immunotherapy of allergy sufferers.

Few previously done studies have identified aeroallergens and other bioparticles responsible for respiratory allergies in different parts of Gangetic plains of Uttar Pradesh [7,8].

Aim of the Study

The present study was undertaken to find out the causative aeroallergens among patients of naso-bronchial allergy, in and around the area situated at confluence of river Ganga and Yamuna.

Materials and Methods

The present observational study was conducted for one year, from October 2019 to October 2020, in Gangetic plains, near confluence of River Ganga and Yamuna. A total of 80 adult patients with naso-bronchial allergy having raised total serum IgE level were included in the present study. The clinical diagnosis of allergic rhinitis and/or bronchial asthma was made according to ARIA guidelines [9] and GINA guidelines [10], respectively. All the patients underwent spirometry, to ensure remission. Skin prick tests were performed on all patients with 66 allergen extracts. The extracts included 46 types of pollens, 12 species of fungi, 4 types of insects, 10 types of dusts, 10 types of danders, 5 types of fabrics and feathers, dust mite and miscellaneous group. For performing skin prick test (SPT), a drop of the allergen extract of 1:10 concentration was kept on the volar aspect of the forearm, following which 26G hypodermic needle was inserted about 0.5 mm through the extract and then lifted slightly to allow adequate entry of antigen beneath the stratum corneum of epidermis. The skin reactions were graded after 15 minutes according to criteria proposed by Agarwal., *et al* [11]. The tests were done considering all the prerequisites and 2+, 3+ and 4+ reactions were labeled as markedly positive skin reactions, while 1+ was taken as weakly positive skin reaction.

Patients excluded from recruitment were, pregnant women, patients with uncontrolled asthma, patients on steroids, patients with autoimmune disorders, HIV, diabetes mellitus, liver disease, psychiatric disorders and hypothyroidism. Patients unable to perform spirometry, or having addiction of alcohol or smoking were also excluded.

Descriptive data were elaborated in the form of percentage of patients tested positive or markedly positive, for various allergens on skin prick test.

Results

Among 80 patients recruited in our study, 48 were males and 32 were females. All the patients were between 18 to 60 years of age. Out of these 80 patients, we saw that 18 patients had allergic rhinitis, 22 patients had asthma and 40 patients had united airway disease. Majority of 45.5% asthma, 66.7% allergic rhinitis, 75% united airways disease were less than 30 years of age.

We found that all our patients were allergic to some or the other test allergen. In the present study, a total of 5,280 tests were performed with 66 allergens, which included pollen, fungi, insects, dusts, danders, fabrics and feathers, dust mite and miscellaneous group, on 80 patients of nasobronchial allergy (Table 1-7) Positive result was found for all the allergens tested, except 3 of them, which included tobacco among miscellaneous group (Table 7) and fungi like *Aspergillus niger* and *Trichoderma* spp (Table 2). Mild positivity of 1+ grading

was found for Jute and Kapock cotton (Table 6). Remaining all 61 allergens evoked markedly positive skin reactions (2+, 3+, 4+), in at least one participant of the study. The results of skin reactivity to various allergen extracts, are shown in tables below.

SN	Allergens	Total test	Total positive	% positive	+1	+2	+3	+4	Marked positive	% marked positive
1	*Albizia lebbeck* (siras)	80	19	23.75	5	14	0	0	14	17.5
2	*Amaranthus hybridus* (chaulia)	80	7	8.75	2	5	0	0	5	6.25
3	*Amaranthus spinosus* (kateli chaulia)	80	19	23.75	8	8	3	0	11	13.75
4	*Argemone mexicana* (peeli kateli)	80	15	18.75	2	11	2	0	13	16.25
5	*Artemisia scoparia* (banota barna)	80	8	10.00	4	4	0	0	4	5
6	*Asphodelus tenuifolius* (piazi)	80	7	8.75	3	3	1	0	4	5
7	*Azadirachta indica* (neem)	80	5	6.25	1	3	1	0	4	5
8	*Brassica campestris* (sarson)	80	14	17.5	7	6	1	0	7	8.75
9	*Cannabis sativa* (bhang)	80	12	15.00	3	7	2	0	9	11.25
10	*Carica papaya* (papita)	80	18	22.5	7	10	1	0	11	13.75
11	*Cassia fistula* (amaltas)	80	8	10.00	6	2	0	0	2	2.5
12	*Cassia siamea* (cassia)	80	6	7.5	1	5	0	0	5	6.25
13	*Chenopodium album* (bathua)	80	7	8.75	1	5	1	0	6	7.5
14	*Chenopodium murale* (khar bathua)	80	14	17.5	6	7	1	0	8	10
15	*Cynodon dactylon* (doob ghas)	80	31	38.75	7	18	6	0	24	30
16	*Cyperus rotundus* (motha ghas)	80	5	6.25	3	1	1	0	2	2.5
17	*Eucalyptus tereticornis* (safeda)	80	12	15.00	5	7	0	0	7	8.75
18	*Holoptelea integrifolia* (papri)	80	14	17.5	8	4	1	1	6	7.5
19	*Melia azadirach* (bakain)	80	11	13.75	4	6	1	0	7	8.75
20	*Morus alba* (shahtoot)	80	10	12.5	4	4	2	0	6	7.5
21	*Parthenium hysterophorus* (congress grass)	80	14	17.5	5	7	2	0	8	10
22	*Pennisetum typhoides* (bajra)	80	9	11.25	4	4	1	0	5	6.25
23	*Prosopis juliflora* (vilayati keekar)	80	20	25.00	5	11	4	0	15	18.75
24	*Putranjiva roxburghii* (putranjiva)	80	9	11.25	2	5	2	0	7	8.75
25	*Ricinus communis* (arandi)	80	13	16.25	3	8	2	0	10	12.5
26	*Rumex dentatus* (jangli palak)	80	3	3.75	2	0	1	0	1	1.25
27	*Sorghum vulgaris* (jowar)	80	10	12.5	4	4	2	0	6	7.5
28	*Typha angustifolia* (patera)	80	7	8.75	4	3	0	0	3	3.75
29	*Xanthium strumarium* (chota gokhu-ru churchuta)	80	6	7.5	1	4	1	0	5	6.25
30	*Zea mays* (macca)	80	17	21.25	4	10	3	0	13	16.25

Table 1: *Results of skin prick test with pollen allergens.*

SN	Allergens	Total test	Total positive	% positive	+1	+2	+3	+4	Marked positive	% marked positive
1	*Aspergillus flavus*	80	14	17.5	2	2	0	0	2	2.5
2	*Aspergillus fumigatus*	80	3	3.75	0	2	1	0	3	3.75
3	*Aspergillus niger*	80	0	0	0	0	0	0	0	0
4	*Aspergillus tamarii*	80	3	3.75	1	2	0	0	2	2.5
5	*Candida albicans*	80	4	5.00	1	1	2	0	3	3.75
6	*Trichoderma spp*	80	0	0	0	0	0	0	0	0

Table 2: *Results of skin prick test with fungi allergens.*

SN	Allergens	Total test	Total positive	% positive	+1	+2	+3	+4	Marked positive	% marked positive
1	Cockroach Female	80	45	56.25	8	22	13	2	37	46.25
2	Cockroach Male	80	36	45.00	6	22	7	1	30	37.5

Table 3: *Results of skin prick test with insects allergens.*

SN	Allergens	Total test	Total positive	% positive	+1	+2	+3	+4	Marked positive	% marked positive
1	Cotton mill dust	80	12	15.00	2	7	3	0	10	12.5
2	Flex fiber dust	80	2	2.5	1	0	1	0	1	1.25
3	Grain dust bajra	80	14	17.5	3	8	2	1	11	13.75
4	Grain dust jowar	80	9	11.25	3	6	0	0	6	7.5
5	Grain dust wheat	80	19	23.75	6	9	4	0	13	16.25
6	Grain dust rice	80	13	16.25	3	5	4	1	10	12.5
7	Hay dust	80	3	3.75	2	1	0	0	1	1.25
8	House dust mites	80	15	18.75	4	8	1	2	11	13.75
9	Paper dust	80	9	11.25	2	5	0	0	5	6.25
10	Thrushing dust bajra	80	1	1.25	0	1	0	0	1	1.25
11	Thrushing dust wheat	80	3	3.75	0	3	0	0	3	3.75
12	Straw dust	80	6	7.5	3	1	1	1	3	3.75

Table 4: *Results of skin prick test with dust allergens.*

SN	Allergens	Total test	Total positive	% positive	+1	+2	+3	+4	Marked positive	% marked positive
1	Cat dander	80	9	11.25	3	5	1	0	6	7.5
2	Cow dander	80	2	2.5	0	2	0	0	2	2.5
3	Dog dander	80	7	8.75	4	3	0	0	3	3.75
4	Human dander	80	5	6.25	1	4	0	0	4	5
5	Horse dander	80	3	3.75	1	2	0	0	3	3.75
6	Buffalo dander	80	5	6.25	3	2	0	0	2	2.5

Table 5: *Results of skin prick test with dander allergens.*

SN	Allergens	Total test	Total positive	% positive	+1	+2	+3	+4	Marked positive	% marked positive
1	Silk raw	80	5	6.25	3	2	0	0	2	2.5
2	Sheep wool	80	1	1.25	0	0	1	0	1	1.25
3	Wool mixed	80	4	5.00	1	3	0	0	3	3.75
4	Chicken feather	80	3	3.75	2	1	0	0	1	1.25
5	Jute	80	1	1.25	1	0	0	0	0	0
6	Kapock cotton	80	1	1.25	1	0	0	0	0	0
7	Pigeon feather	80	4	5.00	1	3	0	0	3	3.75

Table 6: *Results of skin prick test with fabrics and feathers allergens.*

SN	Allergens	Total test	Total positive	% positive	+1	+2	+3	+4	Marked positive	% marked positive
1	Brewer yeast	80	2	2.5	1	1	0	0	1	1.25
2	Tobacco	80	0	0	0	0	0	0	0	0
3	Parthenium leaves	80	6	7.5	2	4	0	0	4	5

Table 7: *Results of skin prick test with miscellaneous allergens.*

Discussion

Asthma and Rhinitis are chronic conditions that impose a substantial economic burden on not just the affected individual but also on his family, the healthcare system and the society as a whole. Epidemiological studies, done worldwide have consistently shown asthma and rhinitis to be coexistent in the same individual [12-16].

In our study we have found that out of 80 patients of nasobronchial allergy, in whom skin prick test for aeroallergens was performed, the positive skin reactions were quite common for the various allergens tested. The common offending allergens found in the study (Fig-

ure 1) were Insects [Cockroach female (56.2%), Cockroach male (45.0%)] followed by, Pollens [*Cynodon dactylon* (doob ghas) 38.8%, *Prosopis juliflora* (Vilayati keekar) 25.0%, *Amaranthus spinosus* (Kateli Chaulia) 23.8%, *Albizia lebbeck* (siras) 22.8%, *Carica papaya* 22.5%], Dusts [Grain dust wheat (23.8%) House dust mites (18.8), Grain dust bajara (17.5%)], Danders [Cat dander (11.2%), Dog dander (8.8%)], Fabric and feathers [Pigeon feather (7.5%)]and Fungi [*Aspergillus flavus* (5.0%), *Candida albicans* (5.0%), *Aspergillus fumigatus* (3.8%)]. None of my patient in study population was found negative for all aeroallergen tested.

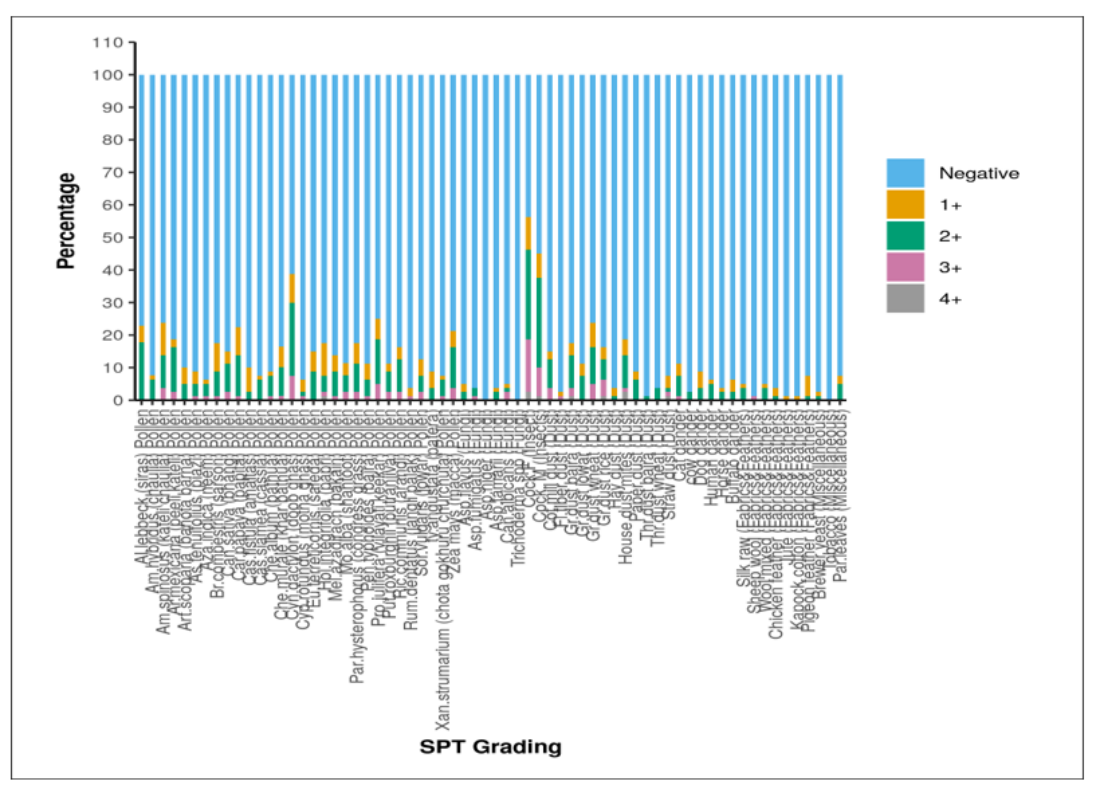

Figure 1: *Positivity percentage for different allergen extracts.*

V.D. Mishra., *et al*. (2016) [17] conducted the same study few years ago reported a maximum number of positivity among pollens by *Parthenium* leaves (45%), but we found it to be with *Cynodon dactylon* (38.8%). After these, the various groups of allergens responsible for respiratory allergy were as insects (18.75%), dust allergens (8.51%), fabrics (8.33%), fungi (5.66%), and finally, animal dander (5%). Unlike the present study, which found insect allergy to cockroach, as most prevalent, previous study reported house dust mite (HDM) as most prevalent (60%). Regarding house dust mite present study found only 18.8% patients of nasobronchial allergy, sensitive to HDM. This difference could be explained by the fact, that both studies were conducted, about 10 years apart, which is enough time for flora and fauna of an area to get altered.

R.L. Agrawal., *et al*. (2008) [18] also conducted the same study at the same centre a few years ago on 50 patients, for 87 different aeroallergens. They considered (2+ to 4+) skin reactions as markedly positive. They reported that thirty nine patients (78%) were positive

with dust mite, 22 patients (44%) were positive with insects, 33 patients (66%) were positive with dusts, 21 patients (42%) were positive with fungi, 10 patients (20%) were positive with danders, 17 patients (34%) were positive with fabrics and feathers and 29 patients (58%) were positive with *Parthenium* leaves. Again the difference in findings with present study, could be explained by same fact, which is of difference in time of about 12 years, between both studies.

In similar but smaller study done by R. Prasad., *et al*. (2009) [19], on 48 patients of nasobronchial allergy, in whom skin prick test was performed, 10.4% of the patients showed negative reaction to all antigens tested, while the remaining 89.6% showed positive reactions of various grades. This is contrary to our finding, where none of the patients was negative to all aeroallergens tested. Markedly, the positive skin reactions (2+ to 4+) were quite common for the various allergens tested. The common offending allergens found in the study were insects (21.8%), followed by dusts (11.9%), pollens (7.8%), dander (3.1%), and fungi (1.3%). Difference in proportion of sensitivity to different aeroallergen, could well be explained by the difference in size of study population, and area of study.

Fungi which are considered to be one of the most common allergens worldwide, were also found to be prevalent in present study population. In present study it was found that, among fungal aeroallergen, SPT was markedly positive for *Aspergillus flavus* (5.0%), *Candida albicans* (5.0%), *Aspergillus fumigatus* (3.8%) *Aspergillus tamarii* (3.8%).

BP Singh., *et al*. [20] conducted a study in Lucknow in 1980 to know the common fungal spores prevalent in the city and to find out their allergenicity in allergic patients. Comparision with this study revealed that, fungal aeroallergens such as *Aspergillus* were common in our study also, but contrary to previous study, in the present study *Candida albicans* was also markedly positive in 5% cases.

Agashe SN [21] found mold spores of *Cladosporium, Periconium, Nigrospora, Alternaria, Helminthosporium, Smut* spores, *Aspergillus*, and *Penicillium* to be the common aeroallergens. High rates of markedly positive skin reaction were also shown by insects (21.2%), female locust (33.3%), male locust (25%), grasshopper (20.8%), cricket (16.7%), female cockroach (16.7%), and male cockroach (14.6%) which is similar to present study. In present study cockroach allergy was found in overwhelmingly higher percentage among patients of nasobronchial allergy.

Gaur., *et al.* [22] in their study on insect allergy, found allergy to moth, mosquito, locust (male), locust (female), dragonfly, jassids, housefly, cockroach grasshopper, wasp, beetle, ant, cricket and honeybee, to be common in patients of nasobronchial allergy. In our study we found allergy to cockroach (male) among 45% patients and to cockroach (female) among 56.2% patients of nasobronchial allergy.

In our study, 12% patients of nasobronchial allergy showed markedly positive skin reaction to various dusts. Most common dusts were house dust (25%), followed by wheat dust (12.5%), cotton dust (6.3%), and paper dust (4.2%). Previous studies [18,19], done about 10 years back in Prayagraj and Lucknow, reported varied results about prevalence of dust allergy, among patients of nasobronchial allergy, which ranged from 8.5 to 66%. This difference could be due to change in flora and fauna induced by time.

Acharya., *et al.* [23] found house dust followed by wheat dust, cotton dust and paper dust to be common among patients of nasobronchial allergy. The differences in incidence of markedly positive reactions in various studies may be due to different flora in different geographical areas and change of flora over a successive time period.

In present study we have found that most common dander cat dander (11.2%) followed by dog dander (8.85%), buffalo dander (4.3%), human dander (4.3%), horse dander (3.8%). Similar previous studies also found cat dander as most common, while they could not find any case of buffalo dander, or it was much lesser than found in present study [17,18].

In our study we found that predominant allergens in patients of allergic rhinitis (AR) is cockroach female (Insect) 10 (55.6%) followed by cockroach male (Insects) 8 (44.4%), *Carica papaya* (papita) Pollen 7 (38.9%), *Cynodon dactylon* (doob ghas) Pollen 7 (38.9%), Grain

dust wheat (Dust) 6 (33.3%). While previous study done in Eastern part of India, found pollen allergy as most common among patients of allergic rhinitis.

We also found that predominant allergens in asthma (BA) is cockroach female (Insect) 13 (59.1%) followed by cockroach male (Insects) 9 (40.9%), *Cynodon dactylon* (doobghas) Pollen 7 (31.8%), *Eucalyptus tereticornis* (safeda) Pollen 7 (31.8%), *Canbis sativa* (bhang) Pollen 6 (27.3%). Contrary to our study similar study done in South India, found pollen allergy as most common among patients of asthma.

Present study found that the predominant allergens in united airway disease (UAD) in order of decreasing proportion, were cockroach female (Insect) 22 (55.0%) and followed by cockroach male (Insects) 19 (47.5%), *Cynodon dactylon* (doob ghas) Pollen 17 (42.5%), *Amaranthus spinosus* (kateli chaulia) Pollen 12 (30.0%), *Prosopis juliflora* (vilayati keekar) Pollen 12 (30.0%). Contrary to our finding, previous study done at same place, about 10 years back reported that pollen allergy is most common among these patients. Although they also reported *Cynodon dactylon* (doob grass) as most common pollen allergen responsible for allergy among these patients.

In present study although insect allergy to female and male cockroach was most common in both urban and rural population, but when other allergens were analysed it was found that allergy to dust grain rice was significantly more common in rural population, while allergy to pigeon feather was significantly more common among urban patients of nasobronchial allergy. It appeared from our study that nasobronchial allergy to various allergens groups including pollen, fungus, insect, dust, dander, fibre, etc. were more common among patients of rural population, but this difference was not found to be statistically significant, except for above mentioned allergens.

Conclusion

In conclusion, it is suggested that such studies should be conducted from time to time to know the changing trend of prevalence of causative allergens in Gangetic plain, near confluence of Ganga and Yamuna rivers, and other regions of Uttar Pradesh that can help clinicians in management of patients, particularly in context of climate change, where possibility of changes in flora and fauna causing aerobronchial allergy is high.

Conflict of Interest

None to declare.

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