RESEARCH ARTICLE

Prevalence of Allergic Disorders and Allergen Sensitization Patterns in a Tertiary Care Corporate Hospital in North India

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Abstract

Aim: To study the prevalence and pattern of allergic disorders and sensitization patterns in North India.

Materials and methods: This observational cross-sectional study was conducted in a pediatric and allergy clinic at a tertiary care corporate hospital in Punjab, India. Data were collected using a structured questionnaire and patients presenting with signs and symptoms of allergy were tested using the skin prick test. The allergens were identified and sensitization patterns were compared across age-groups, gender, type of disorder, and states. Mean (SD) and proportions were reported for continuous and categorical data, respectively.

Results: A total of 256 patients were analyzed. The mean age was 16.8 years and the majority were males (65.2%). The most common allergic disorders were allergic rhinitis [211 (82.4%)], atopic dermatitis [127 (49.6%)], and allergic asthma [120 (46.9%)]. Allergic rhinitis was significantly more prevalent in males compared to females ($p < 0.001$). The majority of the patients had ≥3 allergic disorders at a time [175 (68.4%)]. The most common triggers for allergic symptoms were consumption of a particular food item [102 (39.8%)] and dust or dusty atmosphere [80 (31.3%)]. Sensitization was most commonly observed with *Dermatophagoides farina* and *D. pteronyssinus* but there was variation in the number and types of allergens across age-groups, states, and allergic disorders.

Conclusion: The burden of allergic disorders is high in the northern states of India with variation across states and age-groups given the different types of allergens. There is a need for advanced diagnostic and therapeutic interventions for these disorders.

Clinical significance: Understanding the prevalence, patterns, and triggers of allergies will help clinicians provide appropriate preventive counseling and treatment to the patient.

Keywords: Adenoid, Allergy, Allergic rhinitis, Asthma, Immunoglobulin E, Levocetrizine, Montelukast, Nasal obstruction, Pediatric, Sinusitis.

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Introduction

Allergic disorders are highly prevalent across all age-groups and settings globally. The Indian subcontinent is home to several forms of allergic disorders owing to the wide range and distribution of flora and fauna in the country. Estimates state that more than 25% of the Indian population is sensitized to different forms of allergens.[1] Major sources of allergen in India are pollen grains, fungal spores, animal epithelia, food items, insects, and dust mites.[2–4] A multi-centric population-based study (IN-SEARCH) in India reported that the prevalence of asthma, chronic bronchitis, and allergic rhinitis were 2.05, 3.5, and 3.3%, respectively.[5] Data on the pediatric population revealed that 3.3% of children aged 6–7 years and 5.6% of children aged 13–14 years were diagnosed with allergic rhino-conjunctivitis. It has been observed that 20–30% of the population suffers from allergic rhinitis and 15% of them developed atopic asthma.[6] In addition to asthma, the other forms of allergy, such as atopic rhinitis, anaphylaxis, drug, food and insect allergy, hypersensitive pneumonitis, atopic dermatitis, contact dermatitis, eczema, urticaria, angioedema, rhino-conjunctivitis, serum sickness, vasculitis, and granulomatous reactions were also on a rising trend in terms of prevalence as well as severity in India.[7]

The specific diagnosis of immunoglobulin E (IgE) mediated allergy is usually based on the correlation between the clinical history and signs and symptoms and is endorsed by diagnostic tests. Skin prick tests are the gold standard for demonstrating an IgE-mediated mechanism behind the allergic symptoms but their efficacy totally depends on the use of standardized skin prick test solutions. Data from hospital-based studies has shown a sharp increase in the prevalence of IgE-mediated allergic disorders in the past few years.[8] Prosopis juliflora among pollen allergens and Alternaria alternata among fungal allergens were common sensitizers reported in allergic patients with skin positivity of 34.7 and 17.7%, respectively.[8] In Western countries, recombinant allergen-based advanced diagnostic tools like Immuno-CAP and allergen microarray have revolutionized molecular diagnosis, which are sparsely available facilities in the Indian settings.[9,10] Accurate diagnosis and therapeutic intervention of allergy is difficult in India due to dependence on skin prick test using crude allergen extracts.[11,12] Therapeutic measures viz immunotherapy with

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hypoallergenic variants, allergen-derived peptides/fragments, and genetically engineered allergen derivatives are widely used in the Western world while sparsely available in India.[13] Economic constraints, lack of prioritization, and legal requirements for company licensing are primary deterrents to the availability of such diagnostic and therapeutic services in India.

It is necessary to understand the spectrum of key allergens and their determinants so as to strengthen the evidence base for prioritizing the availability of diagnostic and therapeutic interventions for this set of disorders in the country. The present study aims to understand the prevalence, clinical presentation, and determinants of allergic disorders at a tertiary care hospital in North India. Additionally, we strive to study the spectrum of allergens contributing to the broad dimension of IgE-mediated disorders and the sensitization pattern in Northern India.

Materials and Methods

Settings

This observational cross-sectional hospital-based study was conducted at a tertiary care corporate hospital in Mohali, Punjab, India. This is a 300-bed hospital primarily catering to patients from the northern states of India. Patients from Punjab and the neighboring states, Haryana, and Himachal Pradesh, commonly avail of the services at this hospital. All specialist and super-specialized diagnostic and therapeutic services are available at this hospital. The study was conducted in the pediatrics and allergy clinic of the hospital. On average, 10–15 patients with allergy present to this clinic daily. Information from all patients is recorded on the case record form and the physician prescribes tests and treatment based on the allergy profile of the patient. The data collection for this study was done from year 2017 to 2020.

Study Population

All patients presenting to the pediatric and allergy clinic with self-reported symptoms or with signs of allergy as per the physician's judgment were included in the study. Those who gave consent to the study were tested for the type of sensitization using skin prick test (SPT). The standard testing protocol was used.[14] Patients with a positive SPT at the first visit were enrolled in the study. Patients with an uncertain diagnosis of allergy or those with the presence of any systemic disease that would interfere with evaluation were excluded from the study.

Sample Size Calculation

Sample size estimation was based on the number of subjects visiting the pediatric and allergy clinic department of the hospital. The estimated number of participants visiting the study clinic during the study period was 765. Assuming a response rate of 50% and a confidence level of 95% and a margin of error at 5%, the estimated sample size was 256 patients. Sample size estimation was done using Raosoft, Inc.

Data Collection

Patient details were recorded on a pretested, structured questionnaire. Data on sociodemographic profile, signs and symptoms of allergy, precipitating factors, and triggers were recorded. Past history, family history of allergies, and the medication history were also recorded on the form. Those with signs and symptoms of allergy, who consented to the study underwent the skin prick test. A drop of commercially available allergen solution was introduced into the epidermis of the patients by pricking the skin with a 1 mm guarded lancet at an angle of 45 degrees. Appearance of wheal and redness within 15 minutes was noted. The testing process was conducted as per standard protocol.[14] Both positive histamine control and negative saline control were tested. The wheel diameter was recorded for the positive control, negative control, and allergen. Fifty Allergo SPT Prick test solutions (including powdered gluten) were used for testing allergy. The solution contained standard concentrations of grass pollens (50000 BU/mL), weed pollens (50000 BU/mL), mite solution (50000 BU/mL), mold solutions (10000 BU/mL), cat dander (50000 BU/mL), cow dander (10000 BU/mL), orange (1000 PNU/mL), banana (500 PNU/mL), aniseed (25000 PNU/mL), spinach (1000 PNU/mL), and asparagus (2500 PNU/mL), rest all food items (5000 PNU/mL) histamine (positive control) 1.7 mg/mL and physiological saline (negative control). The allergens were listed on the questionnaire and after the skin prick test, appropriate allergens were marked based on the findings.

Statistical Analysis

All data was entered in Microsoft Excel. Data was analyzed using STATA v16. Mean (SD) was calculated for continuous outcomes while proportions were calculated for categorical outcomes. Proportions were calculated and tables were constructed for all the allergens based on the gender, residence, and diagnosis of the patients.

Ethical and Human Considerations

Ethical approval was obtained from the Hospital Ethics Committee vide letter number IEC/2022/SPO/006. Written informed consent was obtained from the patients prior to enrollment in the study and confidentiality was maintained throughout the study process. In the case of children, consent was obtained from the parents/guardians and assent was taken from children. The test results of the SPT were discussed with the patients/guardians and appropriate treatment was provided according to standard treatment guidelines. The treatment was discontinued after the allergy resolved.

Results

Sociodemographic Profile

A total of 267 patients were enrolled during the study period. Of them, 256 (95.9%) patients completed the study, and their data was analyzed. Eleven patients (4.1%) were lost to follow-up. More than half of the patients were males [167 (65.2%)]. The mean age was 16.8 (15.5) years and more than half of the patients belonged to the age-group of 6–18 years [140 (54.7%)]. Most patients belonged to the states of Punjab [128 (50.0%)], Haryana [47 (18.4%)], Chandigarh [31 (12.1%)], and Himachal Pradesh [28 (10.9%)] (Table 1).

Spectrum and Determinants of Allergic Disorders

The most common allergic disorders were allergic rhinitis [211 (82.4%)], atopic dermatitis [127 (49.6%)], allergic asthma [120 (46.9%)], allergic conjunctivitis [113 (44.1%)], recurrent abdominal pain [44 (17.2%)], gastritis [36 (14.1%)], and urticaria [33 (12.9%)]. The proportion of male and female patients with allergic disorders was comparable for all allergic disorders in the study except for allergic rhinitis which was significantly more prevalent in males [145 (86.8%)] as compared to females [66 (74.2%); $p < 0.001$]. The majority of the patients had ≥3 allergic disorders at a time [175 (68.4%)]. The most common combinations of three allergic disorders at a time were allergic rhinitis + asthma + conjunctivitis [15 (8.6%)], allergic rhinitis +

Table 1: Demographic profile of study participants (*N* = 256)

Characteristic	*N = 256 n (%)*
Gender	
Male	167 (65.2)
Female	89 (34.8)
Age (years)	
Mean (SD)	16.8 (15.5)
Age-groups	
≤5 years	46 (18.0)
6–18 years	140 (54.7)
>18 years	70 (27.3)
Country of residence	
India	244 (95.3)
Punjab	128 (50.0)
Haryana	47 (18.4)
Chandigarh	31 (12.1)
Himachal Pradesh	28 (10.9)
Others[a]	10 (3.9)
Outside India[b]	11 (4.3)

[a]Others included Uttarakhand (3), Uttar Pradesh (2), Bihar (2), and one each from Delhi, Rajasthan, and Jammu. [b]Patients from outside India were from Canada (4) and one each from Afghanistan, Australia, China, New Zealand, Singapore, Spain, and USA

atopic dermatitis + conjunctivitis [15 (8.6%)], and allergic rhinitis + asthma + atopic dermatitis [11 (6.3%)]. Among the relatives of the patients, asthma was most commonly observed in grandparents [46 (18.0%)] and allergic rhinitis in father [43 (16.8%)] and mother [39 (15.2%)]. The allergic symptoms worsened in the morning [104 (40.6%) patients] and at night [98 (38.3%)] and most of the patients had perennial allergy with seasonal exacerbations [127 (49.6%)]. The majority of the patients experienced worsening of the symptoms while remaining indoors [151 (59.0%)]. The most common triggers for allergic symptoms were consumption of a particular food item [102 (39.8%)] and dust or dusty atmosphere [80 (31.3%)] (Table 2).

Sensitization to Allergens

The most common allergens identified were mites followed by pollens and molds. Sensitization, reported as wheal diameter ≥3 mm, was most commonly observed with *D. farinae* [173 (67.6%)], *D. pteronyssinus* [174 (68.0%)], Acarus siro [93 (36.3%)], Lepidoglyphus destructor [96 (37.5%)], Plantago lanceolata [Engl. Plantain; 81 (31.6%)], and Artemisia vulgaris (Mugwort) [81 (31.6%)]. The complete list of allergens is given in supplementary Table 1. The majority of patients had sensitization to ≥3 allergens at a time [181 (70.7%)]. In Punjab and Haryana, majority of the patients were sensitized to *D. farinae* [83 (64.8%) and 32 (68.1%), respectively] and *D. pteronyssinus* [87 (68.0%) and 32 (68.1%), respectively]. In Himachal Pradesh, the majority of the patients were sensitized to *D. farinae* [20 (71.4%)], *D. pteronyssinus* [19 (67.9%)], and Mugwort [14 (50.0%)]. In Uttar Pradesh [2 (100.0%)], majority of the patients were sensitized to *D. farinae*, *D. pteronyssinus*, Acarus siro, corn, and milk. In the case of patients residing outside India, the majority of the patients were sensitized to *D. farinae* [9 (81.8%)], *D. pteronyssinus* [8 (72.7%)], Helminthosporium halodes [6 (54.5%)], Timothy Grass [7 (63.6%)], Engl. Plantain [7 (63.6%)], Mugwort [7 (63.6%)], and Corn [6 (54.5%)] (Table 3).

Table 2: Spectrum and determinants of allergic disorders among study participants

Characteristic	*N = 256 n (%)*
Type of disorder	
Allergic rhinitis	211 (82.4)
Atopic dermatitis	127 (49.6)
Allergic asthma	120 (46.9)
Allergic conjunctivitis	113 (44.1)
Recurrent abdominal pain	44 (17.2)
Gastritis	36 (14.1)
Urticaria	33 (12.9)
Constipation	14 (5.5)
Sinusitis	13 (5.1)
Adenotonsillitis	16 (6.6)
Others	–
Time of the day	
Morning	104 (40.6)
Night	98 (38.3)
Evening	41 (16.0)
All day long	32 (12.5)
Afternoon	3 (1.2)
Effect of seasons	
Perennial with seasonal exacerbations	127 (49.6)
Perennial	68 (26.6)
Seasonal	61 (23.8)
Location	
Indoor	151 (59.0)
Outdoor	5 (2.0)
Both	96 (37.5)
None	4 (1.6)
Triggers	
After eating a particular food item	102 (39.8)
Dust or dusty atmosphere	80 (31.3)
Sleeping or lying on a bed	37 (14.5)
Smog or pollution	20 (7.8)
Physical exertion or exercise	20 (7.8)
Garden walk	15 (5.9)
Soaps, detergents, or cosmetics	15 (5.9)
Damp areas	14 (5.5)
Exposure to animals	4 (1.6)

Others included migraine (4), food allergy (3), refractory error (3), and two each of esophagitis seizure disorder, gastroenteritis, vitiligo, urinary tract infection, seborrhea capitis, drug allergy, and celiac disease

The number of allergens causing sensitization increased with an increase in age. The patients in age-groups of ≤5 years, 6–18 years, and >18 years were observed to be affected by 40 (80.0%), 48 (96.0%), and 49 (98.0%) allergens, respectively. In the age-groups of ≤5 years, the majority of the patients were sensitized to *D. farinae* [23 (50.0%)] and *D. pteronyssinus* [23 (50.0%)]. In the

Table 3: Sensitization to allergens by place of residence (*N* = 256)

SPT positive allergens	*Haryana (N = 47)*	*Himachal Pradesh (N = 28)*	*Punjab (N = 128)*	*Chandigarh (N = 31)*	*Delhi (N = 1)*	*Jammu (N = 1)*	*Rajasthan (N = 1)*	*Uttar Pradesh (N = 2)*	*Uttarakhand (N = 3)*	*Bihar (N = 2)*	*NRI (N = 11)*
Mites	–	–	–	–	–	–	–	–	–	–	–
Dermatophagoides farina	32 (68.1)	20 (71.4)	83 (64.8)	20 (64.5)	1 (100.0)	1 (100.0)	1 (100.0)	2 (100.0)	1 (33.3)	2 (100.0)	9 (81.8)
Dermatophagoides pteronyssinus	32 (68.1)	19 (67.9)	87 (68.0)	21 (67.7)	1 (100.0)	1 (100.0)	1 (100.0)	2 (100.0)	1 (33.3)	0	8 (72.7)
Acarus siro	14 (29.8)	13 (46.4)	45 (35.2)	12 (38.7)	0	0	1 (100.0)	2 (100.0)	1 (33.3)	0	5 (45.5)
Lepidoglyphus destructor	16 (34.0)	13 (46.4)	50 (39.1)	11 (35.5)	0	0	0	1 (50.0)	0	0	5 (45.5)
Mold	–	–	–	–	–	–	–	–	–	–	–
Aspergillus fumigatus	12 (25.5)	3 (10.7)	40 (31.3)	4 (12.9)	0	0	1 (100.0)	0	0	0	5 (45.5)
Alternaria alternata (Alternaria tenuis)	11 (23.4)	7 (25.0)	39 (30.5)	6 (19.4)	0	0	1 (100.0)	1 (50.0)	0	0	5 (45.5)
Helminthosporium halodes	7 (14.9)	3 (10.7)	27 (21.1)	3 (9.7)	0	0	0	0	0	0	6 (54.5)
Penicillum notatum	5 (10.6)	1 (3.6)	19 (14.8)	2 (6.5)	0	0	0	0	0	0	2 (18.2)
Cladosporium herbarum	9 (19.1)	3 (10.7)	33 (25.8)	5 (16.1)	0	0	1 (100.0)	0	1 (33.3)	0	2 (18.2)
Rhizopus nigricans	6 (12.8)	3 (10.7)	20 (15.6)	5 (16.1)	0	0	0	0	0	0	3 (27.3)
Fusarium moniliforme	6 (12.8)	0	18 (14.1)	3 (9.7)	0	0	0	1 (50.0)	0	0	3 (27.3)
Botrytis cinerea	7 (14.9)	2 (7.1)	25 (19.5)	7 (22.6)	0	0	0	1 (50.0)	1 (33.3)	0	3 (27.3)
Pollen (Grasses)	–	–	–	–	–	–	–	–	–	–	–
Bermuda grass (Cynodon dactylon)	6 (12.8)	10 (35.7)	39 (30.5)	12 (38.7)	0	0	1 (100.0)	0	1 (33.3)	0	5 (45.5)
Barley (Hordeum vulgare)	2 (4.3)	1 (3.6)	5 (3.9)	0	0	0	0	0	0	0	0
Orchard grass (Dactylis glomerata)	6 (12.8)	6 (21.4)	27 (21.1)	6 (19.4)	0	0	0	1 (50.0)	0	0	5 (45.5)
Timothy grass (Phleum pratense)	8 (17.0)	7 (25.0)	35 (27.3)	6 (19.4)	0	0	0	0	1 (33.3)	0	7 (63.6)
Rye grass (Lolium perenne)	5 (10.6)	6 (21.4)	36 (28.1)	5 (16.1)	0	0	0	1 (50.0)	0	0	4 (36.4)
Kentucky blue grass (Poa pratensis)	6 (12.8)	6 (21.4)	31 (24.2)	4 (12.9)	0	0	0	0	0	0	5 (45.5)
Rye (Secale cereale)	7 (14.9)	5 (17.9)	27 (21.1)	8 (25.8)	0	0	0	1 (50.0)	0	0	3 (27.3)

(Contd...)

Table 3: *(Contd...)*

SPT positive allergens	*Haryana (N = 47)*	*Himachal Pradesh (N = 28)*	*Punjab (N = 128)*	*Chandigarh (N = 31)*	*Delhi (N = 1)*	*Jammu (N = 1)*	*Rajasthan (N = 1)*	*Uttar Pradesh (N = 2)*	*Uttarakhand (N = 3)*	*Bihar (N = 2)*	*NRI (N = 11)*
Wheat (Triticum sativum)	5 (10.6)	6 (21.4)	17 (13.3)	2 (6.5)	0	0	0	0	0	0	4 (36.4)
Zea mays (Corn)	5 (10.6)	4 (14.3)	16 (12.5)	3 (9.7)	0	0	0	1 (50.0)	0	0	3 (27.3)
Holcus lanatus (Velvet grass)	2 (4.3)	3 (10.7)	8 (6.3)	0	0	0	0	0	0	0	1 (9.1)
Pollen (Weeds)	–	–	–	–	–	–	–	–	–	–	–
Lambs Quarter (Chenopodium album)	13 (27.7)	8 (28.6)	35 (27.3)	5 (16.1)	0	0	0	1 (50.0)	0	0	3 (27.3)
Ragweed (Ambrosia artemisiifolia)	9 (19.1)	7 (25.0)	34 (26.6)	3 (9.7)	0	0	0	2 (100.0)	0	0	3 (27.3)
Engl. Plantain (Plantago lanceolata)	10 (21.3)	9 (32.1)	46 (35.9)	8 (25.8)	0	0	0	1 (50.0)	0	0	7 (63.6)
Nettle (Urtica dioica)	7 (14.9)	4 (14.3)	24 (18.8)	4 (12.9)	0	0	0	1 (50.0)	0	0	4 (36.4)
Mugwort (Artemisia vulgaris)	9 (19.1)	14 (50.0)	44 (34.4)	5 (16.1)	0	0	0	1 (50.0)	1 (33.3)	0	7 (63.6)
Taraxacum vulgare (Dandelion)	3 (6.4)	0	5 (3.9)	3 (9.7)	0	0	0	0	0	0	1 (9.1)
Pollen (Trees)	–	–	–	–	–	–	–	–	–	–	–
Locust black (Robinia pseudoacacia)	4 (8.5)	7 (25.0)	29 (22.7)	7 (22.6)	0	0	0	1 (50.0)	0	0	2 (18.2)
Mountainous Pollen (Trees)	–	–	–	–	–	–	–	–	–	–	–
Alder (Alnus glutinosa)	3 (6.4)	6 (21.4)	20 (15.6)	5 (16.1)	0	0	0	0	0	0	1 (9.1)
Birch (Betula alba)	6 (12.8)	3 (10.7)	30 (23.4)	3 (9.7)	0	0	0	1 (50.0)	0	0	3 (27.3)
Poplar (Populus alba)	6 (12.8)	4 (14.3)	29 (22.7)	6 (19.4)	0	0	0	1 (50.0)	0	0	4 (36.4)
Salix capera (Willow)	2 (4.3)	3 (10.7)	8 (6.3)	0	0	0	0	0	0	0	1 (9.1)
Quercus robur (Oak)	2 (4.3)	2 (7.1)	8 (6.3)	0	0	0	0	0	0	0	0
Cottonwood (Populas deltoids)	0	0	1 (0.8)	0	0	0	0	0	0	0	0
Animal epithelia	–	–	–	–	–	–	–	–	–	–	–
Cow epithelia	10 (21.3)	4 (14.3)	13 (10.2)	1 (3.2)	0	0	0	0	0	0	1 (9.1)
Cat epithelia	4 (8.5)	3 (10.7)	10 (7.8)	3 (9.7)	0	0	0	0	0	0	1 (9.1)

(Contd...)

Table 3: *(Contd...)*

SPT positive allergens	*Haryana (N = 47)*	*Himachal Pradesh (N = 28)*	*Punjab (N = 128)*	*Chandigarh (N = 31)*	*Delhi (N = 1)*	*Jammu (N = 1)*	*Rajasthan (N = 1)*	*Uttar Pradesh (N = 2)*	*Uttarakhand (N = 3)*	*Bihar (N = 2)*	*NRI (N = 11)*
Fruits	–	–	–	–	–	–	–	–	–	–	–
Banana	5 (10.6)	5 (17.9)	22 (17.2)	3 (9.7)	0	0	0	1 (50.0)	0	0	3 (27.3)
Orange	6 (12.8)	4 (14.3)	24 (18.8)	4 (12.9)	0	0	0	0	1 (33.3)	0	5 (45.5)
Food—Flours and seeds	–	–	–	–	–	–	–	–	–	–	–
Corn	9 (19.1)	9 (32.1)	37 (28.9)	5 (16.1)	0	0	0	2 (100.0)	0	0	6 (54.5)
Wheat	10 (21.3)	7 (25.0)	24 (18.8)	5 (16.1)	0	0	0	1 (50.0)	1 (33.3)	0	3 (27.3)
Gluten	5 (10.6)	4 (14.3)	13 (10.2)	2 (6.5)	0	0	0	1 (50.0)	0	0	2 (18.2)
Food—Nuts	–	–	–	–	–	–	–	–	–	–	–
Ground nut	4 (8.5)	3 (10.7)	23 (18.0)	1 (3.2)	0	0	0	1 (50.0)	1 (33.3)	0	4 (36.4)
Walnut	7 (14.9)	5 (17.9)	21 (16.4)	3 (9.7)	0	0	0	0	0	0	5 (45.5)
Hazelnut	0	0	1 (0.8)	0	0	0	0	0	0	0	0
Vegetables	–	–	–	–	–	–	–	–	–	–	–
Spinach	2 (4.3)	1 (3.6)	6 (4.7)	0	0	0	0	0	0	0	0
Asparagus	3 (6.4)	2 (7.1)	7 (5.5)	0	0	0	0	0	0	0	1 (9.1)
Spices and pulses	–	–	–	–	–	–	–	–	–	–	–
Aniseed	1 (2.1)	0	6 (4.7)	0	0	0	0	0	0	0	0
Milk/Egg	–	–	–	–	–	–	–	–	–	–	–
Milk	6 (12.8)	2 (7.1)	18 (14.1)	4 (12.9)	0	0	0	2 (100.0)	0	0	2 (18.2)
Egg	6 (12.5)	4 (14.3)	13 (10.2)	4 (12.9)	0	0	0	1 (50.0)	0	0	3 (27.3)

age-groups of 6–18 years, majority of the patients were sensitized to *D. pteronyssinus* [99 (70.7%) patients], *D. farinae* [97 (69.3%) patients], Lepidoglyphus destructor [50 (35.7%) patients], Acarus siro [47 (33.6%) patients], and Alternaria alternata [47 (33.6%) patients]. In the age-group of >18 years, the majority of the patients were sensitized to *D. farinae* [53 (75.7%) patients], *D. pteronyssinus* [52 (74.3%)], Acarus siro [42 (60.0%)], and Lepidoglyphus destructor [44 (62.9%)] (Table 4).

Most patients with recurrent abdominal pain, asthma, atopic dermatitis, allergic rhinitis, gastritis, sinusitis, urticaria, and constipation were sensitized to *D. farinae* [27 (61.4%), 79 (65.8%), 96 (75.6%), 142 (69.3%), 28 (77.8%), 10 (76.9%), 25 (75.8%), and 12 (85.7%), respectively] and *D. pteronyssinus* [26 (59.1%), 85 (70.8%), 95 (74.8%), 150 (71.1%), 30 (83.3%), 10 (76.9%), 25 (75.8%), and 10 (71.4%), respectively]. Most patients with conjunctivitis were

Table 4: Sensitization to allergens by age ($N = 256$)

	Age-groups Number of patients, n (%)		
SPT positive allergens	*≤5 years (N = 46)*	*6–18 years (N = 140)*	*>18 years (N = 70)*
Mites	–	–	–
D. farinae	23 (50.0)	97 (69.3)	53 (75.7)
D. pteronyssinus	23 (50.0)	99 (70.7)	52 (74.3)
Acarus siro	4 (8.7)	47 (33.6)	42 (60.0)
Lepidoglyphus destructor	2 (4.3)	50 (35.7)	44 (62.9)
Mold	–	–	–
Aspergillus fumigatus	7 (15.2)	40 (28.6)	19 (27.1)
Alternaria alternata (Alternaria tenuis)	10 (21.7)	47 (33.6)	13 (18.6)
Helminthosporium halodes	1 (2.2)	26 (18.6)	19 (27.1)
Penicillum notatum	2 (4.3)	17 (12.1)	10 (14.3)
Cladosporium herbarum	3 (6.5)	33 (23.6)	18 (25.7)
Rhizopus nigricans	2 (4.3)	19 (13.6)	16 (22.9)
Fusarium moniliforme	0	18 (12.9)	13 (18.6)
Botrytis cinerea	2 (4.3)	25 (17.9)	19 (27.1)
Pollen (grasses)	–	–	–
Bermuda grass (Cynodon dactylon)	5 (10.9)	42 (30.0)	27 (38.6)
Barley (Hordeum vulgare)	0	3 (2.1)	5 (7.1)
Orchard grass (Dactylis glomerata)	1 (2.2)	24 (17.1)	26 (37.1)
Timothy grass (Phleum pratense)	3 (6.5)	31 (22.2)	31 (44.3)
Rye grass (Lolium perenne)	4 (8.7)	32 (22.9)	21 (30.0)
Kentucky blue grass (Poa pratensis)	3 (6.5)	27 (19.3)	22 (31.4)
Rye (Secale cereale)	3 (6.5)	26 (18.6)	22 (31.4)
Wheat (Triticum sativum)	1 (2.2)	20 (14.3)	13 (18.6)
Zea mays (Corn)	1 (2.2)	19 (13.6)	12 (17.1)
Holcus lanatus (Velvet grass)	0	5 (3.6)	9 (12.9)
Pollen (weeds)	–	–	–
Lambs quarter (Chenopodium album)	4 (8.7)	39 (27.9)	22 (31.4)
Ragweed (Ambrosia artemisiifolia)	4 (8.7)	32 (22.9)	22 (31.4)
Engl. Plantain (Plantago lanceolata)	5 (10.9)	44 (31.4)	32 (45.7)
Nettle (Urtica dioica)	2 (4.3)	21 (15.0)	21 (30.0)
Mugwort (Artemisia vulgaris)	5 (10.9)	46 (32.9)	30 (42.9)
Taraxacum vulgare (Dandelion)	0	8 (5.7)	4 (5.7)
Pollen (trees)	–	–	–
Locust black (Robinia pseudoacacia)	3 (6.5)	28 (20.0)	19 (27.1)
Mountainous pollen (trees)	–	–	–
Alder (Alnus glutinosa)	1 (2.2)	18 (12.9)	16 (22.9)
Birch (Betula alba)	2 (4.3)	24 (17.1)	20 (28.6)
Poplar (Populus alba)	4 (8.7)	24 (17.1)	22 (31.4)
Salix capera (Willow)	1 (2.2)	5 (3.6)	8 (11.4)
Quercus robur (Oak)	0	9 (6.4)	3 (4.3)
Cottonwood (Populas deltoids)	1 (2.2)	0	0
Animal epithelia	–	–	–
Cow epithelia	1 (2.2)	19 (13.6)	9 (12.9)
Cat epithelia	0	11 (7.9)	10 (14.3)
Fruits	–	–	–
Banana	0	22 (15.7)	17 (24.3)
Orange	4 (8.7)	22 (15.7)	18 (25.7)
Food–Flours and seeds	–	–	–
Corn	4 (8.7)	31 (22.1)	33 (47.1)
Wheat	2 (4.3)	27 (19.3)	22 (31.4)
Gluten	2 (4.3)	14 (10.0)	11 (15.7)
Food—Nuts	–	–	–
Ground nut	3 (6.5)	17 (12.1)	17 (24.3)
Walnut	2 (4.3)	16 (11.4)	23 (32.9)
Hazelnut	0	0	1 (1.4)
Vegetables	–	–	–
Spinach	0	4 (2.9)	5 (7.1)
Asparagus	1 (2.2)	7 (5.0)	5 (7.1)
Spices and pulses	–	–	–
Aniseed	0	5 (3.6)	2 (2.9)
Milk/Egg	–	–	–
Milk	3 (6.5)	18 (12.9)	13 (18.6)
Egg	2 (4.3)	13 (9.3)	16 (22.9)

sensitized to *D. farinae* [83 (73.5%)], *D. pteronyssinus* [83 (73.5%)], Acarus siro [58 (51.3%)], and Lepidoglyphus destructor [61 (54.0%)]. Patients with adenotonsillitis were sensitized to *D. pteronyssinus* [8 (50.0%)]. Patients with migraine were sensitized to *D. farinae* [4 (100.0%)], *D. pteronyssinus* [3 (75.0%)], Lepidoglyphus destructor [3 (75.0%)], Alternaria alternata [2 (50.0%)], Helminthosporium halodes [2 (50.0%)], Botrytis cinerea [2 (50.0%)], Bermuda grass [2 (50.0%)], Timothy grass [2 (50.0%)], Alder [2 (50.0%)], Corn [2 (50.0%)], and Egg [2 (50.0%)] (Table 5).

Discussion

The most common allergy diagnoses in the present study were allergic rhinitis (82.4%), atopic dermatitis (49.6%), and allergic asthma (46.9%). Allergic rhinitis was significantly more prevalent in males (86.8%) while other disorders were in similar proportions across the genders. Majority of the patients had ≥3 allergic disorders at a time (68.4%). Nearly half of the patients had perennial allergy with seasonal exacerbations (49.6%) and most allergies occurred indoors (59.0%). The most common triggers for allergic symptoms were consumption of a particular food item [102 (39.8%)] and dust or dusty atmosphere [80 (31.3%)]. The most common allergens identified were mites followed by pollens and molds. Sensitization, was most commonly observed with *D. farinae* (67.6%) and *D. pteronyssinus* (68.0) which were also the most commonly implicated allergens across Punjab, Haryana, and Himachal Pradesh. Patients residing outside were also most commonly sensitized to *D. farinae* (81.8%) and *D. pteronyssinus* (72.7%). The number of allergens causing sensitization increased with increasing age. The major allergens were *D. farinae* [23 (50.0%)] and *D. pteronyssinus* [23 (50.0%)] across all age-groups.

There might be a possibility of selection bias in the study as the patients were recruited from the allergic clinic of a tertiary hospital. However, we had a representation from four major northern states/union territories of India. The response rate in the study was high as only 4.1% of participants withdrew from the study. We used standardized solutions for skin prick test and the determination of allergens, thereby reducing the possibility of measurement bias in the study. We cannot completely rule out the possibility of recall bias as the participants may have forgotten the possible triggers, given the fact that allergies might have been triggered due to multiple exposures. Overall, the results are likely to be reliable and representative of the target population given the relatively low risk of bias.

Respiratory diseases represent 25% of all outpatient visits to a general physician and about 80% of patients with recurrent presentations are later diagnosed allergic.[15] A study by Yoo et al. reported that the common presentations of allergic disorders are eczema, rhinitis, urticaria, atopic dermatitis, conjunctivitis, angioedema, asthma, anaphylaxis, affecting >40% of the population.[16] Our findings are in line with these findings showing allergic rhinitis (82.4%), atopic dermatitis (49.6%), and allergic asthma (46.9%) as the most common presentations. Simpson et al. reported that co-existence of multiple allergic disorders has increased with time.[17] Similarly, a study by Kumar et al. in 2012, showed polysensitization to more than two aeroallergens.[18] Our findings also report sensitization to ≥3 allergens at a time in most patients. Previous studies done in different settings across countries have reported house dust mite as the most frequently reacting allergen in skin prick test.[19–21] Also, in our study, a majority of the patients were sensitized to *D. farinae* and *D. pteronyssinus* dust mites and the pattern was similar across all states. There was predominant sensitization to dust mite in all geographical areas with certain kinds of allergens being more common than others in some states. This points toward the geoclimatic and vegetation variation across these agricultural states. This changing environment has changed the profile of allergens as well as intensity of exposure in the country. It was observed that elevated temperatures and higher CO_2 levels resulted in an increase in the pollination cycle of weeds, thereby increasing the pollen load in the air.[22] In a study done at Vallabhbhai Patel Chest Institute in New Delhi, the age-group most commonly affected by allergic disorders was 20–30 years. In contrast, our study reported 6–18 years as the most common age-group affected by allergic disorders. This may be due to the differences in the study population enrolled as the present study was done in a pediatric allergy clinic while the other study was done in an adult allergy clinic. We also found that the number of allergens causing sensitization increased with an increase in age possibly due to body's susceptibility and increase in exposure to environmental allergens. Another reason could be increasing sensitizations starting from the early age-group due to lifestyle, dietary changes, and increasing chemical exposure.

Our study has certain limitations. The patients who had access to the hospital in terms of location and socioeconomic factors only were recruited, thereby reducing the generalizability of the findings. Serum specific IgE levels could not be tested in all patients due to financial constraints. Additionally, due to non-availability of molecular tests, we could not characterize the allergens in detail.

It has been found that low levels of sanitation, rapid urbanization, and deforestation are important factors contributing to the allergen distributions in the ambient environment.[23] Allergic disorders not only lead to poor quality of life but also pose a significant socioeconomic burden. Despite the availability of data on the high prevalence of allergic disorders in India and awareness regarding the diversity of allergens across states, the country still lacks well-equipped allergy centers. It is important to make advanced molecular diagnostics for allergies widely available so as to describe allergen characteristics and sensitization patterns more accurately. For designing successful therapeutic interventions, the identification of the specific offending allergen in a particular patient is the first step. This can be extremely difficult in India, given the cross-reactivity between allergens and diverse soil and environmental conditions that affect the protein content as well as the antigenicity of the allergens. Apart from diagnostics, the poor availability of therapeutic interventions in the Indian sub-continent is also an important issue. Modified allergen immunotherapy has been widely used in Western countries for the past two decades.[24–27] It is the process of causing immunomodulation in IgE-mediated diseases and is considered the only effective therapy against allergic diseases so far. There are sufficient numbers of clinical trials worldwide to prove its effectiveness and safety. In India, however, this therapy is still under development. Research on these diagnostic and therapeutic interventions needs to be prioritized in India. It is necessary to promote the availability of these interventions on a large scale, to combat allergic disorders in a more timely and efficient manner.

Conclusion

The burden of allergic disorders is high in the northern states of India with variation across states and age-groups given the different types of allergens. Methods for early identification are warranted

Table 5: Sensitization to allergens by allergic disorder (*N* = 256)

	Number of Patients, n (%)										
SPT positive allergens	*Migraine (N = 4)*	*RAP* (N = 44)*	*Asthma (N = 120)*	*Atopic dermatitis (N = 127)*	*Conjunctivitis (N = 113)*	*Allergic rhinitis (N = 211)*	*Gastritis (N = 36)*	*Sinusitis (N = 13)*	*Urticaria (N = 33)*	*Constipation (N = 14)*	*Adeno–tonsillitis (N = 16)*
Mites	–	–	–	–	–	–	–	–	–	–	–
D. farinae	4 (100.0)	27 (61.4)	79 (65.8)	96 (75.6)	83 (73.5)	142 (69.3)	28 (77.8)	10 (76.9)	25 (75.8)	12 (85.7)	7 (43.8)
D. pteronyssinus	3 (75.0)	26 (59.1)	85 (70.8)	95 (74.8)	83 (73.5)	150 (71.1)	30 (83.3)	10 (76.9)	25 (75.8)	10 (71.4)	8 (50.0)
Acarus siro	1 (25.0)	15 (34.1)	41 (34.2)	54 (42.5)	58 (51.3)	81 (38.4)	17 (47.2)	4 (30.8)	13 (39.4)	6 (42.9)	4 (25.0)
Lepidoglyphus destructor	3 (75.0)	15 (34.1)	45 (37.5)	59 (46.5)	61 (54.0)	85 (40.3)	17 (47.2)	4 (30.8)	10 (30.3)	5 (35.7)	2 (12.5)
Mold	–	–	–	–	–	–	–	–	–	–	–
Aspergillus fumigatus	0	14 (31.8)	34 (28.3)	38 (29.9)	36 (31.9)	60 (28.4)	10 (27.8)	4 (30.8)	6 (18.2)	5 (35.7)	3 (18.8)
Alternaria alternata (Alternaria tenuis)	2 (50.0)	17 (38.6)	40 (33.3)	36 (28.3)	35 (31.0)	63 (29.9)	9 (25.0)	4 (30.8)	5 (15.2)	2 (14.3)	4 (25.0)
Helminthosporium halodes	2 (50.0)	8 (18.2)	23 (19.2)	26 (20.5)	26 (23.0)	42 (19.9)	4 (11.1)	4 (30.8)	6 (18.2)	3 (21.4)	1 (6.3)
Penicillum notatum	0	5 (11.4)	20 (16.7)	15 (11.8)	17 (15.0)	24 (11.4)	4 (11.1)	2 (15.4)	5 (15.2)	1 (7.1)	0
Cladosporium herbarum	0	10 (22.7)	30 (25.0)	31 (24.4)	32 (28.3)	50 (23.7)	9 (25.0)	2 (15.4)	5 (15.2)	2 (14.3)	2 (12.5)
Rhizopus nigricans	1 (25.0)	7 (15.9)	16 (13.3)	24 (18.9)	22 (19.5)	32 (15.2)	5 (13.9)	1 (7.7)	6 (18.2)	3 (21.4)	2 (12.5)
Fusarium moniliforme	0	9 (20.5)	16 (13.3)	20 (15.7)	20 (17.7)	27 (12.8)	5 (13.9)	0	5 (15.2)	1 (7.1)	2 (12.5)
Botrytis cinerea	2 (50.0)	7 (15.9)	22 (18.3)	30 (23.6)	29 (25.7)	42 (19.9)	6 (16.7)	4 (30.8)	5 (15.2)	2 (14.3)	2 (12.5)
Pollen (grasses)	–	–	–	–	–	–	–	–	–	–	–
Bermuda grass (Cynodon dactylon)	2 (50.0)	13 (29.5)	35 (29.2)	38 (29.9)	43 (38.1)	57 (27.0)	7 (19.0)	6 (46.2)	17 (51.5)	2 (14.3)	3 (18.8)
Barley (Hordeum vulgare)	0	1 (2.3)	4 (3.3)	3 (2.4)	4 (3.5)	6 (2.8)	0	0	1 (3.0)	1 (7.1)	0
Orchard grass (Dactylis glomerata)	1 (25.0)	8 (18.2)	24 (20.0)	27 (21.3)	34 (30.1)	42 (19.9)	9 (25.0)	3 (23.1)	8 (24.2)	3 (21.4)	2 (12.5)
Timothy grass (Phleum pratense)	2 (50.0)	9 (20.5)	33 (27.5)	37 (29.1)	36 (31.9)	55 (26.1)	10 (27.8)	5 (38.5)	10 (30.3)	2 (14.3)	3 (18.8)
Rye grass (Lolium perenne)	0	11 (25.0)	24 (20.0)	30 (23.6)	36 (31.9)	51 (24.2)	3 (8.3)	3 (23.1)	7 (21.2)	1 (7.1)	4 (25.0)
Kentucky blue grass (Poa pratensis)	0	8 (18.2)	28 (23.3)	27 (21.3)	33 (29.2)	44 (20.9)	6 (16.7)	3 (23.1)	8 (24.2)	2 (14.3)	2 (12.5)
Rye (Secale cereale)	1 (25.0)	6 (13.6)	27 (22.5)	29 (22.8)	31 (28.3)	43 (20.4)	5 (13.9)	4 (30.8)	8 (24.2)	2 (14.3)	2 (12.5)
Wheat (Triticum sativum)	0	7 (15.9)	22 (18.3)	15 (1.8)	21 (19.5)	28 (13.3)	4 (11.1)	3 (23.1)	5 (15.2)	2 (14.3)	3 (18.8)
Zea mays (Corn)	0	6 (13.6)	19 (15.8)	14 (11.0)	19 (17.7)	29 (13.7)	1 (2.8)	1 (7.7)	1 (3.0)	2 (14.3)	1 (6.3)
Holcus lanatus (Velvet grass)	0	2 (4.5)	5 (4.2)	6 (4.7)	10 (8.8)	12 (5.7)	0	0	2 (6.1)	0	0
Pollen (weeds)	–	–	–	–	–	–	–	–	–	–	–
Lambs Quarter (Chenopodium album)	1 (25.0)	12 (27.3)	30 (25.0)	36 (28.3)	39 (34.5)	53 (25.1)	9 (25.0)	4 (30.8)	8 (24.2)	4 (28.6)	6 (37.5)
Ragweed (Ambrosia artemisiifolia)	1 (25.0)	12 (27.3)	27 (22.5)	33 (26.0)	35 (31.0)	49 (23.2)	8 (22.2)	2 (15.4)	7 (21.2)	0	3 (18.8)
Engl. Plantain (Plantago lanceolata)	0	13 (29.5)	35 (29.2)	46 (36.2)	52 (46.0)	68 (32.2)	9 (25.0)	3 (23.1)	11 (33.3)	3 (21.4)	5 (31.3)
Nettle (Urtica dioica)	0	8 (18.2)	21 (17.5)	22 (17.3)	26 (23.0)	39 (18.5)	6 (16.7)	1 (7.7)	6 (18.2)	2 (14.3)	1 (6.3)

(Contd...)

Table 5: *(Contd...)*

	Number of Patients, n (%)										
SPT positive allergens	*Migraine (N = 4)*	*RAP* (N = 44)*	*Asthma (N = 120)*	*Atopic dermatitis (N = 127)*	*Conjunctivitis (N = 113)*	*Allergic rhinitis (N = 211)*	*Gastritis (N = 36)*	*Sinusitis (N = 13)*	*Urticaria (N = 33)*	*Constipation (N = 14)*	*Adeno–tonsillitis (N = 16)*
Mugwort (Artemisia vulgaris)	1 (25.0)	18 (40.9)	39 (32.5)	42 (33.1)	49 (43.4)	69 (32.7)	11 (30.6)	4 (30.8)	8 (24.2)	3 (21.4)	4 (25.0)
Taraxacum vulgare (Dandelion)	1 (25.0)	1 (2.3)	5 (4.2)	6 (4.7)	8 (7.1)	10 (4.7)	0	0	3 (9.1)	1 (7.1)	0
Pollen (trees)	–	–	–	–	–	–	–	–	–	–	–
Locust Black (Robinia pseudoacacia)	1 (25.0)	11 (25.0)	22 (18.3)	33 (26.0)	28 (24.8)	42 (19.9)	7 (19.4)	4 (30.8)	6 (18.2)	1 (7.1)	1 (6.3)
Mountainous pollen (trees)	–	–	–	–	–	–	–	–	–	–	–
Alder (Alnus glutinosa)	2 (50.0)	7 (15.9)	17 (14.2)	23 (18.1)	24 (21.2)	29 (13.7)	6 (16.7)	1 (7.7)	5 (15.2)	1 (7.1)	1 (6.3)
Birch (Betula alba)	1 (25.0)	8 (18.2)	24 (20.0)	27 (21.3)	27 (23.9)	39 (18.5)	6 (16.7)	4 (30.8)	6 (18.2)	2 (14.3)	2 (12.5)
Poplar (Populus alba)	1 (25.0)	10 (22.7)	25 (20.8)	27 (21.3)	28 (24.8)	40 (19.0)	10 (27.8)	4 (30.8)	8 (24.2)	3 (21.4)	3 (18.8)
Salix capera (Willow)	0	1 (2.3)	7 (5.8)	5 (3.9)	7 (6.2)	10 (4.7)	0	1 (7.7)	3 (9.1)	1 (7.1)	0
Quercus robur (Oak)	0	2 (4.5)	5 (4.2)	3 (2.4)	6 (5.3)	10 (4.7)	0	0	3 (9.1)	1 (7.1)	0
Cottonwood (Populas deltoids)	0	1 (2.3)	0	1 (0.8)	1 (0.9)	1 (0.5)	0	0	0	0	1 (6.3)
Animal epithelia	–	–	–	–	–	–	–	–	–	–	–
Cow epithelia	0	7 (15.9)	15 (12.5)	19 (15.0)	22 (19.5)	24 (11.4)	0	2 (15.4)	1 (3.0)	1 (7.1)	1 (6.3)
Cat epithelia	1 (25.0)	2 (4.5)	12 (10.0)	13 (10.2)	15 (13.3)	19 (9.0)	4 (11.1)	3 (23.1)	2 (6.1)	3 (21.4)	0
Fruits	–	–	–	–	–						
Banana	1 (25.0)	7 (15.9)	12 (10.0)	25 (19.7)	27 (23.9)	35 (16.6)	5 (13.9)	2 (15.4)	4 (12.1)	4 (28.6)	1 (6.3)
Orange	1 (25.0)	7 (15.9)	19 (15.8)	25 (19.7)	24 (21.2)	38 (18.0)	7 (19.4)	2 (15.4)	6 (18.2)	3 (21.4)	1 (6.3)
Food—Flours and Seeds	–	–	–	–	–	–	–	–	–	–	–
Corn	2 (50.0)	10 (22.7)	32 (26.7)	35 (27.6)	41 (36.3)	65 (30.8)	12 (33.3)	4 (30.8)	13 (39.4)	4 (28.6)	3 (18.8)
Wheat	1 (25.0)	9 (20.5)	27 (22.5)	32 (25.2)	31 (27.4)	48 (22.7)	6 (16.7)	4 (30.8)	5 (15.2)	3 (21.4)	2 (12.5)
Gluten	1 (25.0)	3 (6.8)	15 (12.5)	13 (10.2)	18 (15.9)	24 (11.4)	5 (13.9)	2 (15.4)	1 (3.0)	1 (7.1)	2 (12.5)
Food—Nuts	–	–	–	–	–	–	–	–	–	–	–
Ground nut	0	8 (18.2)	15 (12.5)	18 (14.2)	18 (15.9)	33 (15.6)	7 (19.4)	0	8 (24.2)	3 (21.4)	2 (12.5)
Walnut	0	8 (18.2)	20 (16.7)	22 (17.3)	24 (21.2)	35 (16.6)	5 (13.9)	2 (15.4)	5 (15.2)	3 (21.4)	2 (12.5)
Hazelnut	0	0	1 (0.8)	0	1 (0.9)	1 (0.5)	0	0	0	0	0
Vegetables	–	–	–	–	–	–	–	–	–	–	–
Spinach	0	1 (2.3)	4 (3.3)	1 (0.8)	4 (3.5)	7 (3.3)	0	0	1 (3.0)	1 (7.1)	0
Asparagus	0	1 (2.3)	9 (7.5)	5 (3.9)	8 (7.1)	12 (5.7)	4	2 (15.4)	1 (3.0)	1 (7.1)	0
Spices and Pulses	–	–	–	–	–						
Aniseed	0	1 (2.3)	3 (2.5)	3 (2.4)	4 (3.5)	7 (3.3)	0	0	0	0	0
Milk/Egg	–	–	–	–	–	–	–	–	–	–	–
Milk	1 (25.0)	9 (20.5)	12 (10.0)	22 (17.3)	21 (18.6)	31 (14.7)	8 (22.2)	2 (15.4)	5 (15.2)	3 (21.4)	2 (12.5)
Egg	2 (50.0)	1 (2.3)	16 (13.3)	17 (13.4)	16 (14.2)	27 (12.8)	4 (11.1)	2 (15.4)	6 (18.2)	4 (28.6)	3 (18.8)

*RAP, recurrent abdominal pain; SPT, skin pick test

to plan preventive and curative interventions and to potentially reduce the burden of allergic disorders in the country.

Clinical Significance

It is clinically important to know the prevalence, patterns, and triggers of allergies in the practice area of a physician. This will help clinicians to provide appropriate preventive counseling and treatment to the patient as per the population exposure.

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