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Demographic Profile of Dust Mite Sensitization among Indian Children using Standardized Allergens: An Observational Study

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ABSTRACT

Among allergic diseases, house dust mites (HDM) are the major group of aeroallergens found in diverse habitats. Few studies were conducted in the adult Indian population regarding the prevalence of HDM sensitization using standardized allergens by skin prick tests (SPT). To evaluate the demographic profile of dust mite sensitization among Indian children by SPT using standardized allergens. An observational study was conducted among 937 children with IgE mediated allergic diseases. SPT test was performed using six different types of standardized dust mite allergens viz. *Dermatophagoides pteronyssinus* (DP), *Dermatophagoides farinae* (DF),*Blomia tropicalis* (BT), *Acarus siro* (AS), *Lepidoglyphus destructor* (LD),and *Tyrophagus putrescentiae* (TP) along with serum-specific IgE for DP, DF, and BT only. Relevant association and correlation statistics was applied using SPSS v 25 (IBM, New York, USA) and p-value < 0.05 was considered significant. The mean age of the participants was 7.8±3.8 years with a male predilection (male to female ratio = 1.9: 1). Most of the cases were from Tamilnadu (18.9%) followed by West Bengal (14.6%) and the majority were having perennial allergies with seasonal exacerbations (57.7%). Most of the children (36.1%) with HDM sensitizations were suffering from allergic rhinitis (AR) associated with asthma and DP was the most common (68.2%) HDM followed by DF (66.8%), and BT (32.4%). The association between categories of wheal in SPT and serum-specific IgE level among DP and DF was statistically significant ($p < 0.001$). Hence we conclude that *D. pteronyssinus* is the most common house dust mite sensitization seen in IgE mediated allergic diseases among children. Asthma associated with allergic rhinitis was found to be the most common IgE mediated disease among *D. pteronyssinus* sensitized children.

Keywords

House dust mites; Skin prick test; Standardized allergens; Serum Specific IgE; Pediatric population

Introduction

Allergic diseases such as asthma, rhinitis, and eczema have become a public health concern across the globe. The increasing prevalence of these diseases in the last 20-30 years makes it a healthcare burden. Even in India, more than 25% of the total population is sensitized to different forms of aeroallergens like house dust mite (HDM), pollen grains, fungal spores, and food, etc (Shaikh and Shaikh, 2008; Singh and Kumar, 2003). Among them, HDMs are the most versatile group of arthropods found in diverse habitats.

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Literature Review

The name "House dust mite" is reserved for the *Pyroglyphid* mites belonging to the order Astigmata. (Colloff, 1998). Of all HDMs, *Dermatophagoides pteronyssinus* and *Dermatophagoides farinae* are the most predominant species geographically; whereas, *Blomia tropicalis* is limited mainly to the tropical and subtropical regions of the world. The *Acarus siro, Glycyphagus domesticus, Lepidoglyphus destructor,* and *Tyrophagus putrescentiae* species come under the category of storage mites (Matricardi et al, 2016). The species *D. pteronyssinus* is the most common mite species (78.8%) found in humid regions including houses or indoor dwellings; whereas, *D. farinae* is often found in the dry areas of indoor places (Dhaliwal and Gill, 2020). The mites responsible for allergic diseases are mostly found in human inhabitation with beds and pillows (80%) as the most common places followed by sofas, kitchen floor,pillows, mattresses, carpets, soft toys, and upholstered furniture (Kader et al, 2018; Moingeon, 2014). The mite fecal particles, mite exoskeleton, and the mite body fragments are the common mite allergens (Miller, 2018).

The common allergic diseases caused due to mite sensitization are allergic rhinitis, asthma, atopic dermatitis, and conjunctivitis (Bergmann, Raulffs and Sander, 2014). Very rarely, mite-contaminated foods can also cause systemic allergic symptoms ((Miller, 2018; Bousquet et al, 2007).

Several studies, conducted all over India, have documented the presence of allergic dust mites. (Jogdand et al, 2013)from Pune reported the thermosensitive nature of dust mites and stated that the mites can't survive in relative humidity of 25% or less and high (more than 35^0C) as well as low temperature (less than 10^0C). Also, *dermatophagoides sp.* were found as the most common inhabitants of houses. Similarly, *Dermatophagoides sp.* followed by *Blomia* as the dominant species, and the load of the mites in the dust sample correlated with the severity of allergic symptoms (Sharma, Dutta and Singh, 2011). A cohort study, constituting of 1456 participants, followed the patients from the age of 4 years to 18 years and concluded that allergic sensitization continues to increase over childhood into adolescence with a 7% annual increase in the sensitivity of HDM (Roberts, 2012). A randomized controlled study of 197 patients with IgE-mediated allergic disorders was published with a result that Indian dust mite extracts have significantly lower potency compared to USFDA-approved extracts (Christopher et al, 2018).

Several studies were conducted in India among the adult population regarding the sensitization pattern of HDM; especially, *D. pteronyssinus* and*D. farinae.* Although early age is considered a risk factor for dust-mite sensitization (Shaaban, 2008), studies conducted on Indian children are scarce. Hence, the present observational study was conducted to evaluate the demographic profile of dust mite sensitization using standardized allergens among children.

Methods

The present observational cross-sectional study was conducted in the out-patient department of VN Allergy & Asthma Research Centre, Chennai between March 2018 and February 2019 after receiving institutional ethical approval from the Saveetha Medical College & Hospital, Chennai. All the patients aged ≥6 months to 18 years of either gender with signs and symptoms of allergy rhinitis, asthma, urticaria, food allergy, atopic dermatitis, and angioedema were eligible to be included in the study. Those having dermographism, acute asthma, and any other co-morbidities like chronic lung diseases, congenital anomalies, pregnancy, lactation, and malignancy were excluded from the study.

Sample size estimation was done by n master version 2.0 (BRTC, Vellore) by estimating confidence interval for single proportion (87.9%) (Moingeon P, 2014) and absolute precision

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(3%) using finite population correction factor method. Population size was assumed to be 1,000,000 and a design effect of 1.5 was taken. The following formula was used to calculate the sample size {n = [DEFF × Np (1-p)] / [($d^2/Z^2_{1-\alpha/2}$ × (N-1) +p × (1-p)]}. Out of 1897 patients, who visited our center during the study period from 23 different States and/or Union Territories (UTs) as per the predefined inclusion and exclusion criteria, 937 cases were selected by systematic random sampling method with a sampling interval of 2.

Methodology

Standardized allergen extracts kit obtained from Allergo SPT TM (Merck, Allergopharma, Mumbai, India) having 3 mL (color-coded) vial with dropper pipette containing the allergen dissolved in physiological saline solution with 50% glycerol and preserved with phenol. *B. tropicalis* was not used using this method; however, *B. tropicalis* antigen has obtained from immutek, Madrid, Spain. SPT was performed to identify sensitization using six different types of dust mite allergens like DP, DF, BT, AS, LD & TP. All the patients (n=937) were tested with these standardized allergens provided by Allergopharma and immutek. Positive and negative controls used were histamine hydrochloride (10 mg/mL) and normal physiological saline, respectively. Controls were used to avoid false-negative results. SPT was performed as per recommendations summarized in the position paper (Bousquet J et al, 2012) and the stoppage of relevant drugswas done as per recommendations (Heinzerling, 2013).

Statistical analysis: All the relevant data were recorded in a predesigned case report format. Data validation was done manually by two separate persons not involved in the study. Continuous data were expressed in mean (SD); categorical data were expressed in proportions. Data normalcy testing of continuous data was done by Shapiro Wilk test and no transformation was required. Analysis of variance (ANOVA) was used to compare among more than two independent groups for more than one variable. All the relevant statistics were done by SPSS v 25.0 (IBM, NY, USA). Pearson's Chi-square test was applied to calculate the strength of association in terms of Cramer's V. For all statistical purposes, p-value <0.05 was considered significant.

Results

In our study, 937 cases were selected with a male: female ratio of 1.9: 1. Most of the participants were in the age group of 6 to 13 years (54.2%) with a mean age of 7.8±3.8 years**.** Maximum dust mite sensitization was found among patients suffering from AR with asthma (36.1%). We had included data from 23 states of India; however, due to the limitation of the space, we mentioned only Tamilnadu, West Bengal, Punjab, and Telangana as most of the cases were from these areas. The common trigger was indoor (54.6%) allergens. Detailed demographic characteristics were mentioned inTable 1.

Table 1: Demographic characteristic of study population (N-937)

Variables	n (%)	Mean (SD)*	Median (IQR)#
Age (years)		7.8 (3.8)	

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Age Categories			
Less than 6 Years	215 (22.9)		
6 to 12 Years	508 (54.2)		
More than 12 Years	214 (22.8)		
Gender			
Male	618 (66)		
Female	319 (34)		
State			
Tamilnadu	177 (18.9)		
West Bengal	137 (14.6)		
Punjab	135 (14.4)		
Telangana	78 (8.3)		
Types of Disease			
AR with Asthma	338 (36.1)		
AR	259 (27.6)		
Others[#]	210 (22.4)		
Asthma	88 (9.4)		
Urticaria with Respiratory allergies	42 (4.5)		

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Seasonality Perennial Seasonal Perennial with Seasonal Exacerbations	220 (23.5) 176 (18.8) 541 (57.7)		
Site of Trigger: Indoor Outdoor Both	512 (54.6) 63 (6.7) 362 (38.6)		
DF	626 (66.8)		
SPT for DF (mm)			4 (0, 7)
Serum Specific IgE for DF (kUA/l)			5 (3, 6.2)
DP	639 (68.2)		
SPT for DP (mm)			4 (2, 6)
Serum Specific IgE for DP (kUA/l)			5 (3, 6)
BT	304 (32.4)		
SPT for BT (mm)			5 (2, 5)
Serum Specific IgE for		5.3 (2.6)	

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BT (kUA/l)			
AS	302 (32.2)		
SPT for AS (mm)			5 (3, 6)
LD	268 (28.6)		
SPT for LD (mm)			3 (2, 5)
TP	194 (20.7)		
SPT for TP (mm)			2 (1, 4)

*Standard Deviation; # Inter Quartile Range; DP: *Dermatophagoides pteronyssinus*; DF: *Dermatophagoides farinae*; BT: *Blomia tropicalis*; AS: *Acarus siro*; LD: *Lepidoglyphus destructor*; TP: *Tyrophagus putrescentiae;* [#] Atopic Dermatitis, Food allergy, urticaria, angioedema, allergic conjunctivitis and various combinations of these.

Out of 937 study subjects, SPT for *D. pteronyssinus* was found positive in 639 cases (68.2%), *D. farinae* in 626 (66.8%), *B. tropicalis* in 304 (32.4%), *A. siro* in 302 (32.2%), *L.destructor* in 268 (28.6%), and *T. putrescentiae*in 194 (20.7 %) cases. Most of the children were found sensitive to multiple dust mites in SPT. In patients with AR with asthma, *D. pteronyssinus* sensitized children were the most common (72.2%) followed by *D. farinae* (69.5%), and *A. siro* (31.1%). Out of those having perennial rhinitis with seasonal exacerbations (57.7%), most were sensitized to *D. pteronyssinus* (74.7%) followed by *D. farinae* (70%) and *B. tropicalis* (45.8%).

The detailed sensitization pattern of dust mites across the different zones of India was mentioned in Table 2.

Table 2: Area wise distribution of dust mite sensitisation (N-937)

States	**DP n (%)**	**DF n (%)**	**BT n (%)**	**AS n (%)**	**LD n (%)**	**TP** [n (%)]
North India	168 (26.3)	172 (27.5)	03 (1)	81 (26.8)	67 (25)	14 (7.2)
South India	236 (36.9)	230 (36.7)	117 (38.5)	120 (39.7)	111 (41.4)	104 (48.4)

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East India	80 (12.5)	80 (12.8)	87 (28.6)	45 (14.9)	39 (14.6)	43 (22.1)
West India	96 (15)	86 (13.7)	30 (9.9)	22 (7.3)	17 (6.3)	16 (8.3)
North East India	59 (9.2)	58 (9.3)	57 (18.8)	34 (10.4)	34 (12.6)	27 (13.8)
Total	639 (68.2)	626 (66.8)	304 (32.4)	302 (32.2)	268 (28.6)	194 (20.7)

DP: *Dermatophagoides pteronyssinus*; DF: *Dermatophagoides farinae*; BT: *Blomia tropicalis*; AS: *Acarus siro*; LD: *Lepidoglyphus destructor*; TP: *Tyrophagus putrescentiae*

D. farinae sensitized children were prevalent in North (27.5%) and West (13.7%) India, whereas in South India, *T. putrescentiae* sensitized children (48.4%) were seen commonly. *B. tropicalis* sensitized children were commonly found in East (28.6%) and North East (18.8%) India.

The distribution of five different types of dust mite sensitization among various diseases like AR, asthma, and AR with asthma, seasonality of symptoms has been depicted in Table 3.

Table 3: Distribution of dust mite sensitisation among IgE mediated diseases and seasonality of symptoms (N-937)

Variable n (%)	DP	DF	BT	AS	LD	TP
Types of Disease						
AR 259 (27.6)	166 (64.1)	179 (64.1)	62 (23.4)	77 (29.7)	59 (22.7)	44 (8.5)
Asthma 88 (9.4)	56 (63.3)	47 (53.4)	05 (5.7)	20 (22.7)	12 (13.6)	09 (10.2)
AR with Asthma 338 (36.1)	244 (72.2)	235 (69.5)	154 (45.6)	105 (31.1)	103 (30.5)	82 (24.3)
Others$^{€}$ 332 (35.5)	173 (52.1)	165 (49.7)	83 (25)	100 (30.1)	94 (28.3)	59 (17.7)
Seasonality						
Perennial	150 (68.2)	150 (68.2)	38 (17.3)	73 (33.2)	51 (23.2)	34 (15.4)
Seasonal	85 (48.3)	97 (55.1)	18 (10.2)	35 (19.8)	31 (17.6)	16 (9.1)

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Perennial with seasonal exacer-bations	404 (74.7)	379 (70)	248 (45.8)	194 (35.8)	186 (34.4)	144 (26.6)

DP: *Dermatophagoides pteronyssinus*; DF: *Dermatophagoides farinae*; BT: *Blomia tropicalis*; AS: *Acarus siro*; LD: *Lepidoglyphus destructor*; TP: *Tyrophagus putrescentiae*; AR: Allergic Rhinitis; AD: Atopic Dermatitis; €: Atopic Dermatitis, Food allergy, urticaria, angioedema, allergic conjunctivitis and various combinations of these.

The association of size of a wheal in SPT with different categories of age, seasonality of symptoms, and type of diseases was determined among *D. farinae* sensitized children (n=626) in Table 4.

Table 4: Association of size of wheal in SPT with age, seasonality and IgE mediated diseases among *Dermatophagoids Farinae* sensitised children (n-626)

Variables	**Category of Size of Wheal in SPT**				**Pearson chi-square**	**P value**
	3 to 5 mm n (%)	**6 to 8 mm n (%)**	**9 to 11 mm n (%)**	**> 11 mm n (%)**		
Age						
< 6 Years	84 (13.14)	40 (6.25)	07 (1.09)	02(0.31)	43.10	<**0.0001***
6 to 13 Years	171(26.76)	120(18.77)	52(8.13)	23(3.60)		
> 13 Years	43 (6.73)	52 (8.14)	24 (3.75)	21(3.28)		
Seasonality						
Perennial	87 (13.09)	44 (8.14)	01 (1.75)	11(0.95)	37.47	< **0.0001***
Seasonal	55 (8.60)	21 (3.28)	04 (0.62)	5(0.78)		
Perennial with seasonal exacerbation	155 (24.25)	124 (19.40)	74 (11.58)	26 (4.06)		
Types of Diseases						
AR@	87 (13.61)	54 (8.45)	15 (2.34)	10(1.56)	66.92	> 0.05
Asthma	27 (4.22)	24 (3.75)	01 (0.15)	04(0.62)		
AR & Asth-ma	108(16.90)	79 (12.36)	40 (6.26)	17(2.66)		

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**** Statistical significance***

We found that the strength of the association was weak but statistically significant for age (Cramer's V= 0.169, p < 0.0001) and seasonality of symptoms (V= 0.193, p <0.0001) but non-significant for type of diseases (V= 0.190, p >0.05).

A significant différence was found in the mean serum specific IgE between categories of wheal in SPT among *D. farinae* sensitized children (one-way ANOVA, F: 3, 622: 39.57; p <0.0001) (Table 5).

Table 5: Comparison between categories of wheal in SPT and Serum Specific IgE (kUA/l) among*Dermatophagoids Farinae* sensitised children

F (3, 622) = 39.57, p < 0.0001			
Category of Wheal in SPT	**Mean (SD)**	**Group Comparisons**	**p-value***
Cat I (3 to 5 mm)	5.0 (3.2)	Cat I vs Cat II	> 0.05
Cat II (6 to 8 mm)	6.3 (5.1)	Cat I vs Cat III	< 0.0001*
Cat III (9 to 11 mm)	15.5 (20.2)	Cat I vs Cat IV	< 0.0001*
Cat IV (> 11 mm)	22.7 (34.2)	Cat II vs Cat III	< 0.0001*
		Cat II vs Cat IV	< 0.0001*
		Cat III vs Cat IV	< 0.001*

* ***Statistical significance***

A Tukey's post hoc test revealed that the mean serum specific IgE (22.7±34.2 kUA/l) of category IV was significantly higher than the category III (15.5±20.2, p <0.001), category II (6.3±5.1, p <0.0001) and category I (5.0±3.2, p <0.0001). There was no significant (p >0.05) difference in the mean serum specific IgE between category I (5.0±3.2) and category II (6.3±5.1).

A weak positive correlation was found between serum-specific IgE and the size of wheal in SPT among *D. farinae* sensitized children (Pearson Correlation Coefficient 0.391, p <0.001). Association of the size of wheal in SPT with different categories of age, seasonality of symptoms, and type of diseases was determined among *D. pteronyssinus* sensitized children (n=639) in Table 6.

Table 6:Association of size of wheal in SPT with age, seasonality and IgE mediated diseases among *Dermatophagoids pteronyssinus* sensitised children (n-639)

	Category of Size of Wheal in SPT				**Pearson chi-square**	**P-value**
	3 to 5 mm n (%)	**6 to 8 mm n (%)**	**9 to 11 mm n (%)**	**> 11 mm n (%)**		

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Age						
< 6 Years	90 (14.37)	38 (6.07)	11 (1.75)	02(0.32)	35.96	<**0.0001***
6 to 13 Years	162(25.87)	117(18.69)	42 (6.70)	19(3.30)		
> 13 Years	56 (8.94)	40 (6.38)	34 (5.43)	15(2.39)		
Seasonality						
Perennial	82 (13.09)	51 (8.14)	11 (1.75)	06(0.95)	46.84	<**0.0001***
Seasonal	71 (11.34)	20 (3.20)	02 (0.32)	04(0.63)		
Perennial with seasonal ex-acerbation	155(24.76)	124(19.80)	74(11.82)	26(4.15)		
Types of Disease						
AR[@]	99(15.81)	54 (8.62	19 (3.03)	07(1.11)	67.66	> 0.05
Asthma	22(3.51)	17(2.71)	04(0.63)	04(0.63)		
AR with Asthma	118(18.84)	66(10.54)	39 (6.23)	12(1.91)		

Statistical significance

We found a weak but statistically significant association with age (V= 0.184, p < 0.0001) and seasonality (V= 0.171, p <0.0001) but non-significant association with the type of diseases ((V= 0.187, p >0.05). A weak positive correlation existed between serum-specific IgE and the size of wheal among *D. pteronyssinus* sensitized children (Pearson Correlation Coefficient = 0.299, p <0.001).

A significant différence was seen in the mean serum specific IgE between different catégories of wheal in SPT among *D. pteronyssinus* sensitized children (one way ANOVA, F: 3, 635: 7.30; p <0.0001) (Table 7).

Table 7: Comparison between categories of wheal in SPT and Serum Specific IgE (kUA l) among*Dermatophagoids pteronyssinus* sensitised children (n-639)

F (3, 635) = 7.30, p < 0.0001			
Category of Wheal in SPT	Mean (SD)	Group Comparisons	p value*
Cat I (3 to 5 mm)	4.84 (2.2)	Cat I vs Cat II	> 0.05
Cat II (6 to 8 mm)	5.0 (2.6)	Cat I vs Cat III	> 0.05
Cat III (9 to 11 mm)	6.09 (8.1)	Cat I vs Cat IV	< 0.0001*

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Cat IV (> 11 mm)	9.35 (19.6)	Cat II vs Cat III	> 0.05
		Cat II vs Cat IV	< 0.0001*
		Cat III vs Cat IV	< 0.001*

**** Statistical significance***

A Tukey's posthoc test revealed that mean serum specific IgE (9.35±19.6 kUA/l) of category IV was significantly higher than the category III (6.09±8.1, p <0.001), category II (5.0±2.6, p < 0.0001), and category I (4.84±2.2, p <0.0001). There was no significant difference in the mean serum specific IgE between category III (6.09±8.1) and category II (6.3±5.1, p >0.05) and category I (4.84±2.2, p >0.05). No significant difference (p > 0.05) was found in the mean serum specific IgE between category II (5.0±2.6) and category I (4.84±2.2, p >0.05).
For *B. tropicalis* sensitized children (n=304), the strength of association was weak and statistically significant for the severity of symptoms (Cramer's V=0.147, p <0.05) but non-significant for age (V= 0.097, p >0.05) and type of diseases (V= 0.241, p >0.05). A weak positive correlation was found between serum-specific IgE and the size of wheal among *B. tropicalis* sensitized children (Pearson Correlation Coefficient = 0.143, p < 0.05). No significant différence in the mean serum specific IgE between different categories of wheal in SPT among *B tropicalis* sensitized children (one way ANOVA, F: 3, 300: 2.20; p >0.05).
The association between seasonality of symptoms and size of the wheal in SPT was statistically significant among *A. siro* (Pearson chi-square 27.46, p <0.001), *L. destructor* (Pearson chi-square 26.94, p <0.01), and *T. putrescentiae* (Pearson chi-square 32.69, p <0.0001) sensitized children. Although the strength of this association was weak for *A. siro* (V= 0.121), *L. destructor* (V= 0.120), and *T. putrescentiae* (V= 0.132).
The association between five different geographical areas of India and three categories of age group distributions among *L. destructor, A. siro,* and *T. putrescentiae* sensitized children was statistically significant (p <0.01). However, the strength of this association was poor for *A. siro* (Cramer's V = 0.352), *L. destructor* (V = 0.344), and *T. putrescentiae* (V = 0.384). Serum specific IgE for AS, LD, and TP could not be done due to the non-availability of in vitro testing for these dust mites in India.

Discussion

HDM allergy is a global health problem affecting the quality of life as per World Health Organization (Mondal et al, 2019). India is ranked as one of the highest HDM density (Hoy & Marjorie A, 2010). Shivpuri in the year 1962 and 1977, conducted several studies showing the prevalence of HDM sensitization among Indian adults. This is the first study conducted in India for assessing demographic profile of HDM sensitization using standardized allergens among children.
Most of the cases in our study were from Tamilnadu followed by West Bengal and indoor allergens were the most common triggering agents. Perennial rhinitis with seasonal exacerbations was most commonly (57.7%) seen in our study which is corresponding with studies by Radon et al, 2008; Tsao et al, 2011 and Ghosh et al, 2012.In India, perennial rhinitis is commonly seen due minimal fluctuation in indoor temperature and seasonal variations as per Zhang C et al, 2012.
Demographic variables such as age and sex play a contributing role in driving the HDM allergy. In our study we got statistically significant association with age among *D. pteronyssinus* and *D. farinae* but not with *B. tropicalis*. Study conducted by Hannaway et al, 1997 and

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Murray AB et al, 1983 also coincides with our study. The majority of the children in our study were males which is quite similar to the results found in the studies conducted by Al-Zayadneh EM et al, 2019; Mondal P et al, 2018 and Goldhahn K et al, 2009. In contrast, Podder, Gupta, and Saha, 2010 found no age and gender predilection for HDM sensitization. This may be due to selection bias of our study population.*D. pteronyssinus* was found to be the most common type of HDM sensitization among six standardized allergens tested in our study. Most of the children were found to be polysensitized with all six varieties of house dust mites. These findings are comparable with a study conducted in Kolkata by Mondal P et al, 2018; Gupta & Saha, 2010; Dutta SP et al, 2007; Ghosh A et al, 2018; Nagaraju K et al, 2018; Kuravi N et al, 2019 and Dey et al, 2019.

SPT is considered as the gold standard test for diagnosis of HDM sensitization (Silva et al, 2013; Gelber et al, 1993; Call et al, 1992; Peat et al, 1993). Gaur et al in 2019 mentioned in his research article about the use of nasal provocation test for allergy sensitization to dust mites but however it's not available in India. In our study, we have used standardized allergen extracts for detection of allergy sensitization for better results (Christopher et al, 2018; Nelson, 2000). Indian dust mite allergens have low potency as compared to FDA approved allergens (Christopher et al, 2018).
After detection of IgE (Ishizaka, Ishizaka and Hornbrook, 1966), in vitro test for detection of serum specific IgE became very popular, almost comparable with SPT (Matricardi et al, 2016). In our study we had a strong correlation between size of wheal in SPT and serum sp IgE for two different house dust mites i.e, *D. pteronyssinus, D. farinae* but not for *B. tropcalis.*
In our study, we found AR with asthma as a common clinical entity which is also similar to previous studies (Al-Zayadneh EM et al, 2019; Shin, Jung and Park, 2018; Su et al, 2019).
The present study draws its strength from the large sample size and wide geographic diversity of the participants. This is the first study to evaluate the demographic profile of six house dust mites sensitization in children using standardized allergen extracts by skin prick tests. The comparison was done with in-vitro test using ImmunoCAP technique which was not recorded earlier in the Indian literature. We werenot able to compare the serum-specific IgE levels for *A. siro, L.destructor,* and *T. putrescentiae* due to the non-availability of standardized allergens in India. Apart from this, sampling bias cannot be ruled out which limits its generalizability.

Conclusion

D. pteronyssinus is the most common house dust mite sensitization seen in IgE mediated allergic diseases among children. Asthma associated with allergic rhinitis was found to be the most common IgE mediated disease among *D. pteronyssinus* sensitized children. Skin prick test is the gold standard for identifying house dust mite allergy sensitization, however serum allergen specific IgE test by using ImmunoCAP technique can be used as an alternative to it for *D. pteronyssinus, D. farinae,* and *B. tropicalis* for those who are not trained in doing skin prick tests. Whenever available, it is highly recommended to compare serum allergen specific IgE levels by using ImmunoCAP technique with size of wheal from skin prick tests for the three storage mites (*A. siro, L.destructor, T. putrescentiae*).

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