



P-ISSN: 2664-3685  
E-ISSN: 2664-3693  
[www.paediatricjournal.com](http://www.paediatricjournal.com)  
IJPG 2021; 4(1): 85-88  
Received: 17-01-2021  
Accepted: 20-02-2021

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## Evaluation of skin prick test reactivity in children with allergic diseases: A cross sectional study

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**DOI:** <https://doi.org/10.33545/26643685.2021.v4.i1b.136>

### Abstract

Allergic diseases are developed through complex interaction between exposure to environmental substances and genetic susceptibility. The prevalence of allergic diseases has increased during last decade globally. The present cross sectional study was designed to evaluate the skin prick test reactivity in children with allergic diseases. A total of 400 children between age group 1-12 years were recruited. The Skin prick tests (SPT) using 14 standardized allergen extracts were conducted in the volar surface of forearm. Majority children had asthma (52.5%), followed by atopic dermatitis (22.75%) and allergic rhinitis (15.75%). Food habits triggering allergic conditions in 76% children, environmental factors in 4.75% children, pets in 8.25% and indoor conditions in 11% children. Skin prick test was positive to egg (13.5%), milk (22%), wheat (9.75%), apple (4.5%), cereals (6.5%), cat (18%), dog (6%), blatella (9.5%), aspergillus fumigatus (9.5%), fungi (12.75%), Dermatophytes farina (24.75%), Dermatophytes pteromyssinus (23.75%), Blomia tropicalis (9.5%) and Bermuda grass (13.75%). Determination of allergen sensitization patterns in children with atopic disease is crucial for selecting proper preventive and therapeutic strategies which helps to improve quality of life of in children.

**Keywords:** Allergic diseases, precipitating factors, triggering factors, Skin prick test (SPT)

### Introduction

Allergic diseases are a number of conditions induced by hypersensitivity reaction to a specific immune system to substances in the surrounding environment [1]. Allergic diseases are becoming global health burden affecting all age groups. The common allergic condition are bronchial asthma, allergic rhinitis, and atopic dermatitis. Allergic conditions like asthma, rhinitis and eczema have reached a high prevalence in last decade and around 300-400 million people are suffering with bronchial asthma and allergic rhinitis globally with mortality rate of 2,50,000 deaths [2, 3].

Allergic diseases have notable harmful effect on the socio economic status and quality of life patients. In few individuals, allergic conditions occur together with atopy which requires multi stage approach for diagnosis and treatment with increased economic burden [4]. Due to high prevalence in the children, the need for allergy testing has increased [5]. Skin prick test is a standardized, sensitive and cost effective procedure to detect antigen mediated allergic diseases. It yields details about the existence of specific antigen to protein and peptide antigens (allergens). Determination of common aeroallergens in an area is important, in order to educate the individual on what allergens to avoid and also help find the suitable formulation of allergen immunotherapy for effective AR treatment [6]. The present study was designed to evaluate the skin prick test reactivity in children with allergic diseases.

### Material and methods

The Present cross sectional study was conducted in the Department of Pediatrics, MNR Medical College and Hospital, Sangareddy during June 2019 to March 2020. A total of 400 children between age group 1-12 years were recruited. Children with symptoms like allergic conjunctivitis, asthma, allergic rhinitis, atopic dermatitis, acute urticaria, chronic urticaria, recurrent wheezing was included in the study. Informed consent was obtained from the guardian or parent or teacher and study protocol was approved by institutional ethics committee.

Detailed history of various condition i.e. allergic conjunctivitis, asthma, allergic rhinitis, atopic dermatitis was collected from all the study participants.

Demographic details and parameters like disease onset, precipitating factors, duration of each attack, familial history previous history of skin diseases and therapeutic methods were collected. Details of current medication and history co morbidities were collected. Weight of the children was measured by using electronic weighing machine; height was measured by infantometer for the children below 2 years and with stadiometer for the participants above 2 years.

**Skin prick test procedure**

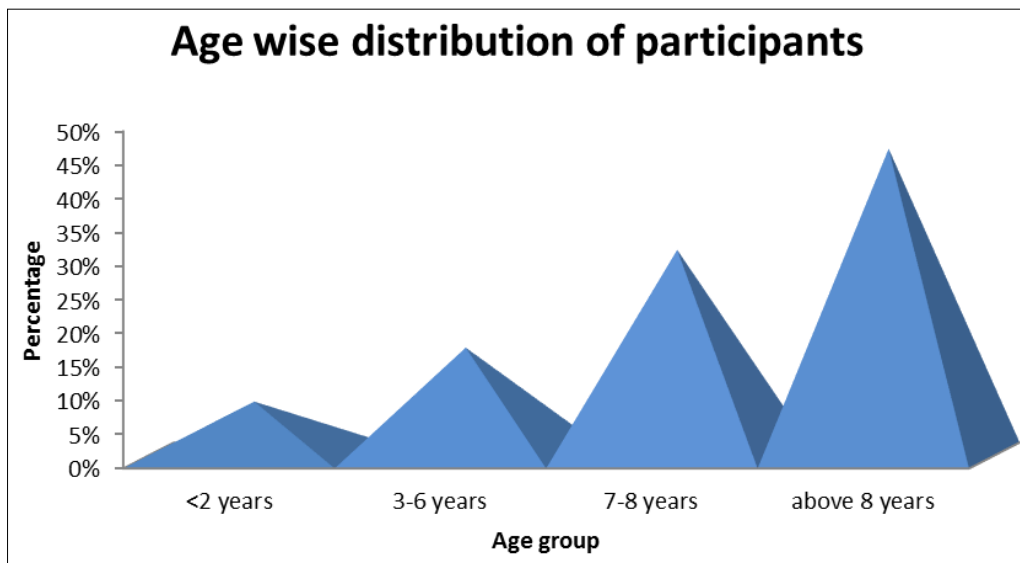
Before procedure, the skin was cleaned with alcohol swab and allowed to dry. The skin of forearm was used for this purpose. The pricks are done 2-3cm away from the wrist and cubital fossa. The skin is marked with numbers and separate circles to identify the corresponding allergens. The standardized extract of allergens used as antigens i.e. egg, milk, wheat, apple, cat, dog, aspergillus fumigatus, dermatophytes farina, dermatophytes pteromyssinus, Blomia tropicalis, blatella, cereals, Bermuda grass and fungi. A prick was made epicutaneously with a specific allergy testing lancet over applied solution. A minimum 2 cm gap was maintained between two allergens to avoid false

positive reactions due to overlap. The reactions were recorded after 20 minutes. Histamine solution and normal saline solution were used as positive and negative controls respectively. For negative control, > 3mm induration diameter was considered as positive for skin prick test. When induration diameter was double the size of histamine response it was scored as IV, larger than histamine response as III, half the size of histamine response recorded as II.

The SPSS version 23.0 software was used to carry out statistical analysis relevant to the study. Descriptive statistics were used to represent demographic and clinical characteristics in the form of frequency and percentages.

**Results**

A total of 400 children between age group 1-12 years were recruited. Majority children were belonged to above 8 years (45.5%) followed by 7-8 years (30.5%), 3-6 years (16%) and below 2 years (8%) (Fig 1). In this study, majority participants were males (69.5%) than females (30.5%). A total of 61% children were belonged to urban area and 39% were belonged to rural area.



**Fig 1:** Age wise distribution of study participants.

**Table 1:** Distribution of participants according to disease triggers and category.

Condition	Frequency	Percentage
<b>Disease categories</b>		
Allergic conjunctivitis	5	1.25%
Asthma	210	52.5%
Allergic rhinitis	63	15.75%
Atopic dermatitis	91	22.75%
Allergic conjunctivitis with Allergic rhinitis	5	1.25%
Asthma with Allergic rhinitis	17	4.25%
Allergic rhinitis with Atopic dermatitis	06	1.5%
Atopic dermatitis with Asthma	03	0.75%
<b>Triggers distribution</b>		
Food	304	76%
Environment	19	4.75%
Pets	33	8.25%
Indoors	44	11%
<b>Precipitating factors</b>		
Seasonal	87	21.75%
Activities	10	2.5%
Seasonal with activities	244	61%
No valid reason	59	14.75%

Among the study participants, 266 children were under medication and remaining was not under medication or

adhering the medication for allergic diseases. 24.5% children had positive family history to allergic diseases.

**Table 2:** Distribution of study children according to allergy detected by skin prick test.

Antigen test	Frequency	Percentage
<b>Food</b>		
Egg	54	13.5%
Milk	88	22%
Wheat	39	9.75%
Apple	18	4.5%
Cereals	26	6.5%
<b>Animals</b>		
Cat	72	18%
Dog	24	6%
<b>Insects</b>		
Blatella	38	9.5%
<b>Moulds</b>		
Aspergillus fumigatus	12	3%
fungi	51	12.75%
<b>Mites</b>		
Dermatophytes farina	99	24.75%
Dermatophytes pteromyssinus	95	23.75%
Blomia tropicalis	38	9.5%
<b>Others</b>		
Bermuda grass	55	13.75%

## Discussion

The incidence of allergic conditions in children of pediatric age group is rapidly increasing in India [7]. Accurate diagnosis of allergies depends on the results of allergy tests. Skin prick tests is a safe, reliable, sensitive and gold standard methods in the diagnosis of aeroallergens and is considered superior to sIgE [8]. The present study was designed to evaluate the skin prick test reactivity in children with allergic diseases. The present study includes a total of 400 children of pediatric age group i.e. 1-12 years. Among the children, majority were belonged to above 8 years (45.5%) followed by 7-8 years (30.5%), 3-6 years (16%) and below 2 years (8%). The male participants (69.5%) were more than female participants (30.5%). In view of residential status 61% children were belonged to urban area and 39% were belonged to rural area.

In this study, majority children had asthma (52.5%), followed by atopic dermatitis (22.75%), allergic rhinitis (15.75%), asthma with allergic rhinitis (4.25%), allergic rhinitis with atopic dermatitis (1.5%), Allergic conjunctivitis (1.25%), allergic conjunctivitis with allergic rhinitis (1.25%) and atopic dermatitis with asthma (0.75%). A study by Alemayehu Mekonnen *et al.*, noticed asthma (61.2%) as common disease in children followed by allergic rhinitis (57%) and atopic dermatitis (40.5%) [9]. A study by Jobran Miree Alqahtani found prevalence of allergic conditions was 27% for bronchial asthma, 13.1% for atopic dermatitis and 5% for allergic rhinitis [10]. A cross sectional study by Cristina Ochoa-Aviles *et al.*, on 535 children aged between 3-5 years reported asthma in 18% of children, rhinitis in 48% and eczema in 28% [12]. A cross sectional study by Shyna KP *et al.*, included 60 children noticed comorbidities like asthma in 25%, urticaria in 3.3%, allergic conjunctivitis in 10%, sinusitis in 18.3% and atopic dermatitis in 18% [6].

In this study, food habits triggering allergic conditions in 76% children, environmental factors in 4.75% children, pets in 8.25% and indoor conditions in 11% children. A study by Alemayehu Mekonnen *et al.*, found common triggers for asthma exacerbations include URTI, changes and exposure to

passive cigarette smoke [9].

In this study, seasonal changes are precipitating factors for allergic conditions in 21.75% children, activities are the precipitating factors in 2.5% children, activities related to specific seasons are precipitating factors in 61% children and 14.75% children did not mentioned a valid reason for the allergic condition. Among the study participants, 266 children were under medication and remaining was not under medication or adhering the medication for allergic diseases. 24.5% children had positive family history to allergic diseases. A cross sectional study by Cristina Ochoa-Aviles *et al.*, found that 4.6%, 27.2% and 13% children had positive history of maternal asthma, maternal rhinitis and maternal eczema respectively and 2.7%, 23.5% and 8% children had positive allergic family history of paternal asthma, paternal rhinitis and paternal eczema respectively [12]. A cross sectional study by Shyna KP *et al.*, found positive family history for allergic rhinitis in 63% children [6].

In this study, skin prick test was positive to egg (13.5%), milk (22%), wheat (9.75%), apple (4.5%), cereals (6.5%), cat (18%), dog (6%), blatella (9.5%), aspergillus fumigatus (9.5%), fungi (12.75%), Dermatophytes farina (24.75%), Dermatophytes pteromyssinus (23.75%), Blomia tropicalis (9.5%) and Bermuda grass (13.75%). A study by Shyna KP *et al.*, found positive skin prick test for house dust mites (33%), followed by cockroach (25%), alternaria (16.66%), parthenium (10%), cat dander (8.35%), sorghum (5%) and dog dander (5%) [6]. In a study by Alemayehu Mekonnen *et al.*, 46.2% of asthmatic cases were skin prick test positive and sensitized to grass, moulds, dust mites and animal dander, whereas cases with allergic rhinitis and atopic dermatitis were sensitized to trees and all allergens identified in asthmatics [9]. A study by Jobran Miree Alqahtani found positive skin prick test for 20.8% for Bermuda grass, 18.9% for cat fur and 12.7% for Dermatophagoides pteromyssinus [10]. A study by Enas M Al-Zayadneh *et al.*, among 277 children between 6 months to 14 years reported that 67% of children with bronchial

asthma were sensitized to one or more inhaled allergens. The most common allergens were olive pollens (18%), cat fur (13.5%), and *Dermatophagoides pteronyssinus* (11.9%) (11). A study by Cristina Ochoa-Aviles *et al.*, reported skin prick test positive for mites (24.3%), *Dermatophytes farina* (21%), *Dermatophytes pteromyssinus* (19.6%), *Blomia tropicalis* (4.3%), pollen (3.7%), cockroach (2.6%), cat (2.1%), dog (1.5%), salix (1.5%), feather mix (1.1%), ash tree (0.9%), fungi (0.9%), latex (0.7%) [12]. A cross sectional study by Beatrix Siregar *et al.*, on 192 subjects found skin prick test positive for pet ownership (52.6%), history excessive breast feeding (32.3%) and cigarette smoke exposure (37.5%) [13]. A study by P Cullinan *et al.*, included 552 children and followed from birth to 5.5 years of age found positive skin prick test for dust mites (9.6%), cat fur (8.5%), grass pollens (8.9%) and other allergens (16.7%) [14]. A study by Vare RA *et al.*, notice During allergy testing by SPT, 56 allergens were tested and amongst 39 patients' results were positive out of 100 patients. House dust was the most common allergen found, followed by congress grass and egg, 7% each. 6% patients were positive for mite [15].

### Conclusion

The most common allergen found was house dust mites i.e. *Dermatophytes farina* (24.5%), *Dermatophytes pteromyssinus* (23.75%) followed by milk (22%), cat (18%), Bermuda grass (13.75%), egg (13.5%) and fungi (12.75%). The early identification of allergens and triggers of disease exacerbations will be important for planning primary and secondary prevention strategies which helps to improve the quality of life in children. Determination of allergen sensitization patterns in children with atopic disease is crucial for selecting proper preventive and therapeutic strategies.

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