



## Original Article

## Allergen detection and analysis in Eastern Taiwan area

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Submission : 10-Apr-2020  
Revision : 27-May-2020  
Acceptance : 20-Jul-2020  
Web Publication : 15-Oct-2020

## ABSTRACT

**Objective:** Environmental factors, eating habits, and different ages might affect the profiles of allergy sensitization. The purpose of this study was to survey the different profiles of allergen sensitization in different ages in eastern Taiwan. **Materials and Methods:** We analyzed the allergic patients who had allergen sensitization examinations by the Phadiatop (atopy screen; IBT Laboratories, Lenexa, KS, USA) and the Pharmacia CAP System method at Hualien Tzu Chi Hospital from January 2010 to December 2015. Results were compared in different ages. **Results:** A total of 15,455 patients were analyzed. The food and aeroallergen screen sensitization rate of children was significantly higher than that of adults (44.0% vs. 9.9% and 61.9% vs. 52.2%  $P < 0.05$ ). Children had statistically significantly higher cow milk allergen-specific sensitization rate than that of adults (32.9% vs. 5.8%  $P < 0.05$ ). The higher sensitization of shrimp occurred in adults than children. (33.6% vs. 24.8%  $P < 0.05$ ). **Conclusion:** Our data demonstrate that children have higher cow milk allergy sensitization and adults have higher sensitization of shrimp.

**KEYWORDS:** Allergic disease, IgE, Specific IgE

## INTRODUCTION

The prevalence of childhood allergic disease has increased dramatically in recent decades in many parts of the world, including Taiwan [1]. It is very difficult to indicate any one specific reason for this increasing prevalence. Although there are evidences that the major risk factors are atopic, it has also been hypothesized that environmental factors and lifestyles, rather than genetic factors, are liable for this upward trend [2]. The causes of allergic disease are unknown, but many cases, particularly in early childhood, are related with sensitization to food allergens. Children who were atopic and developed dermatitis are at a significantly increased risk of developing atopic asthma and rhinitis in later childhood [3]. This immune reaction includes both helper T cells type 2 (Th2) and IgE antibodies, which are thought to devote to inflammation in the respiratory tract. Moreover, sensitization to indoor allergens (e.g. dust mites, dogs, and cats) is strongly related with allergic rhinitis.

Moreover, increased specific immunoglobulin E (sIgE) levels, together with a possible changes in tolerance or increase in IgE reactivity to major allergens, may have happened over time [4,5].

Environmental factors, age, and genes play important roles in the development of allergy sensitization and allergic diseases. Patients from different geographical regions, ages, and climates may have different allergen sensitization profiles.

Environmental factors and eating habits have a significant effect on the increased sensitization to allergens in children. There have been few large-scale studies of total IgE and specific IgE in allergic patients in eastern Taiwan. In this article, we evaluated the frequency of total and specific IgE among patients from Hualien City in eastern Taiwan.

This study investigated prevalence in common allergen among allergic patients in Hualien City, Taiwan. We analyzed the different allergen profiles with different ages in patients and compared the different allergen profiles between patients.

## MATERIALS AND METHODS

This study evaluated allergic patients who received IgE and allergen-specific IgE tests in our hospital in Hualien City, Taiwan, from 2010 to 2015. A total of 15,455 allergic patients were included in our study. The allergic patients were divided into two groups: children (<18 years old) and adults (>18 years old).

The allergic patients were checked for allergen-specific IgE with the Phadiatop (atopy screen; IBT Laboratories, Lenexa, KS, USA) and the Pharmacia CAP System™ radio-allergo-sorbent (RAST) test. Sera were separated by centrifugation

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Website: [www.tcmjmed.com](http://www.tcmjmed.com)

DOI: 10.4103/tcmj.tcmj\_72\_20

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How to cite this article: Chen CJ, Liu YH, Lin TY, Jan RH. Allergen detection and analysis in Eastern Taiwan area. Tzu Chi Med J 2021; 33(2): 165-8.

and analyzed for concentration of total IgE or specific IgE antibodies. Total IgE (kU/L) was defined by the commercial ImmunoCAP250 system (Pharmacia, Uppsala, Sweden), while those of specific IgE antibodies (kU/L) were defined by the ImmunoCAP250 system. The sensitivity of the assay for total IgE detection was between 2 and 5000 kU/L. Sensitization rates to specific allergens were regarded as positive if at least one of the results of specific IgE against the selected allergen was  $>1$ , with values  $>0.7$  kU/L in the CAP test.

The positive prevalence rates of specific IgE to various allergens were analyzed. The results in different ages were compared and analyzed by Chi-square test. The results were considered statistically significant differences if  $P < 0.05$ . All statistical tests were performed using SPSS statistical software, version 17.0, for Windows XP (SPSS Inc., Chicago, IL, USA).

This study was approved by the Research Ethics Committee of the Hualien Tzu Chi General Hospital (No. IRB 106-61-B).

## RESULTS

A total of 15,455 patients were analyzed in this study, as shown in Table 1. The total serum IgE levels of our patients ranged from undetectable (read as  $<2$  kU/L) to 2000 kU/L. Fifty-three percent of the children (age  $<18$  years) and 59.20% of the adults had levels of  $>150$  kU/L. After testing with the Phadiatop mixed allergen screening test, the food and aeroallergen screen sensitization rate of children was higher (44.0% and 61.9%) than the sensitization rate of adults (9.9% and 52.2%).

Patients received allergen-specific IgE tests. *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, house dust, cow milk, egg white, shrimp, cockroach, crab, dog dander, and wheat were the ten most common allergens identified that induced sensitization in children [Figure 1]. *D. pteronyssinus*, *D. farinae*, house dust, shrimp, crab, cockroach, dog dander, *Candida albicans*, ragweed, and soybean were the ten most common allergens identified that induced sensitization in adults [Figure 2]. In both children and adults, dust mite allergens most frequently induced sensitization. Children had statistically significantly higher cow milk

allergen-specific sensitization rate than adults (32.9% vs. 5.8%  $P < 0.05$ ). The sIgE sensitization to the shrimp became more predominant in the adult patients (33.6% vs. 24.8%,  $P < 0.05$ ).

## DISCUSSION

This study's aim was to evaluate the different profiles of allergen sensitization in different ages in Hualien City, Taiwan. Many epidemiologic researches have recommended an increased incidence of asthma in children in many different areas of the world, although the precise reasons remain unclear. Nevertheless, environmental factors involved during different developmental stages probably emphasize this upward trend in asthma [6,7].

Sensitization to allergen plays a crucial role in the development of atopic disorders. Studies in Hualien city identified that house dust mite is the most common allergen, while those in continental countries have pointed to pollens as dominating allergens [8-11]. This study focused on the effect of ages on the allergen sensitization profiles. We found that mites are the most common allergens. However, we also found that children had significantly higher cow milk allergen-specific sensitization rate than adults. The sensitization to the shrimp became more predominant in the adults.

We also analyzed the different allergen profiles with different diseases and compared the different allergen profiles between different diseases. In patients with atopic dermatitis, allergic rhinitis, and asthma, the allergy sensitization profiles were similar, and the ranking of common allergens was not different, so data not shown.

A previous study conducted in northern Taiwan showed that the allergy sensitization profiles were similar with a 16.7% rate of sensitization to cockroaches [12]. In the current survey, cockroach sensitivity prevalence is around 25%, which may be explained by less modernization and improved sanitation in this population. Sensitization to cockroaches is a strong risk factor for asthma in children.

In inhaled aeroallergens that induced allergy sensitization, dog dander was a common allergen (22% and 18%). One study showed that houses with many dogs and high levels

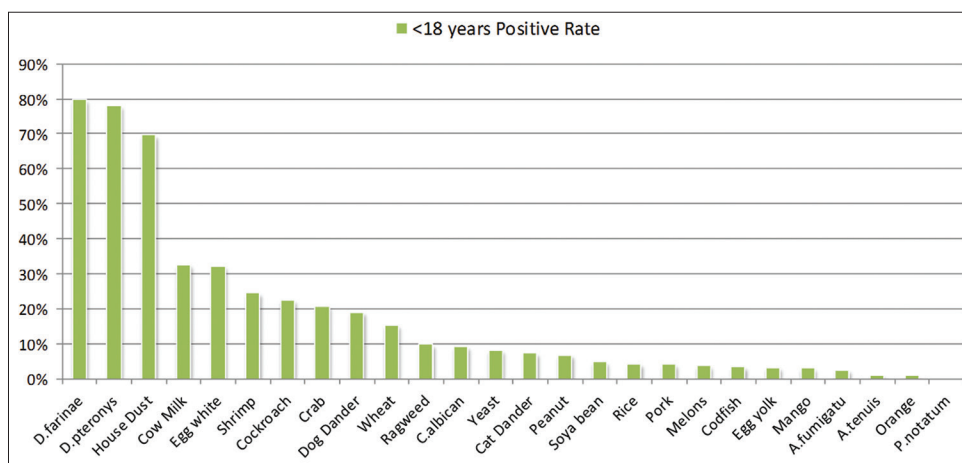


Figure 1: Prevalence of specific allergen sensitivities among children in this study

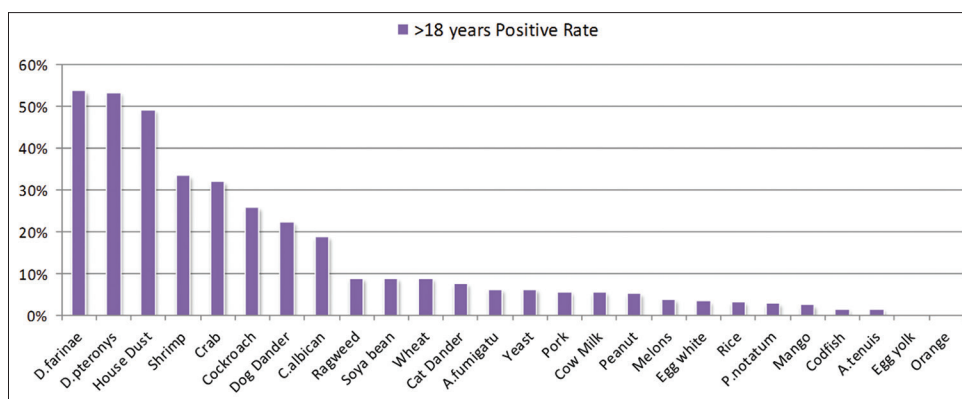


Figure 2: Prevalence of specific allergen sensitivities among adults in this study

Table 1: Allergen sensitization detected by the CAP method in different age populations

Allergen test	Children number	Children positive number	Children positive rate (%)	Adult number	Adult positive number	Adult positive rate (%)
Total IgE	11,639	6212	53.40	3816	2260	59.20
Food allergen screen	402	177	44.00	192	19	9.90
Aeroallergen screen	1029	637	61.90	682	356	52.20

of endotoxins may be more conducive to reduced infantile wheezing [13]. However, the evidence suggested a negative association between dog ownership and the development of atopic diseases in early childhood, and this relationship was only found in families without a history of allergy disorders [14]. Thus, dog dander still plays an important role in children with a history of allergy. Interestingly, cats and dogs are the favored pets in house, although the incidence of sensitization to dog dander is much higher than to cat dander among children and adults.

It has been documented that most children with egg white and cow's milk allergies develop more clinical tolerance over time. Shek *et al.* informed that the rate of decrease in food allergen IgE levels over time could be used to forecast the likelihood of developing tolerance to egg and milk allergy in children [15]. Shrimp and crab were the most frequent seafood allergens to induce more sensitivity in adults and children. The prevalence of sensitization to these types of seafood had been increased.

The avoidance of common allergens is one of the main strategies to improve control of allergic disease and reduce the amount of medication needed. The European Academy of Allergy and Clinical Immunology report and the Expert Panel Report 3 recommended that patients with persistent asthma receive indoor and outdoor allergen tests to assist in allergen avoidance and immunotherapy [16,17]. We found that there was a higher rate of sensitization to aeroallergens than to food allergens in two age groups.

There were limitations in our study: some studies showed that the sIgE level might be a reliable biomarker for clinical condition in allergic patients. In this study, we do not assess clinical severity, so we can not compare the differences. We only analyzed the different allergen profiles in allergic patients with different ages. In future, studies will be conducted on it.

## CONCLUSION

Mites are the most common allergens. Children have higher cow milk allergy sensitization and adults have higher sensitization of shrimp. Therefore, it is important to determine the specific allergens that conduce to the high incidence of atopic diseases in impoverished urban neighborhoods. Furthermore, so as to develop effective preventive interventions, it should be necessary to get a more understanding of the heterogeneous nature of the atopic disease in early childhood, improved characterizations of corresponding environmental exposures, and follow-up of birth cohorts with valid and reliable measures of allergy outcomes.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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