
Distribution of food allergens in pediatric allergic rhinitis

HUANG Xuekun, YANG Qintai, LI Peng*, CHEN Yulian, ZHANG Gehua

Department of Otolaryngology, the Third Affiliated Hospital, Sun Yat-sen University, Guangzhou city, Guangdong Province, China, 510630

Corresponding Author: Dr. LI Peng, Department of Otolaryngology, the Third Affiliated Hospital, Sun Yat-sen University, Guangzhou city, Guangdong Province, China, 510630 (Email:lp76@163.net)

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Abstract: Aims: To investigate the distribution of food allergens in pediatric allergic rhinitis. Methods: 106 children diagnosed with allergic rhinitis were reviewed and divided into two age groups, including preschooler (2-5 years old) group, 48 cases; and school children group (6-13 years), 58 cases. Allergen-specific IgE for the food allergens and inhalant allergens in patient's serum was determined using the AllergyScreen system (Mediwiss Analytic GmbH, Germany). Results: Out of 106 AR children, 88 (83.02%) were tested positive for food allergen-specific serum IgE, 97 (91.51%) positive for inhalant allergen-specific sIgE. Among these children, 79 (74.53%) were positive for both food and inhalant allergens, 9 (8.49%) were positive only for food allergens, and 18 (16.98%) were negative for food allergens but positive for inhalant allergens. Out of 88 children positive for food allergens, 34 (32.08%) were positive for single food allergen, 54 (50.94%) were positive for multiple food allergens. The top 6 food allergens, in the order of their positivity rates, were milk (52.83%), eggs (30.19%), beef (26.42%), cashew (26.42%), lamb (12.26%) and crabs (10.38%). The food allergen-positive rate in the preschooler group was higher than that in the school children group (P<0.05). Conclusion: Majority of the children with allergic rhinitis are also positive for food allergens, suggesting that food allergens might be one of the main causes for pediatric allergic rhinitis.

KEYWORDS: Children; allergic rhinitis; food allergen; specific IgE

Pediatric allergic rhinitis (AR) is a non-infectious disease affecting the nasal mucosa in susceptible children after the contact with allergens, and is mediated by allergen-specific IgE [1]. In the last seven years, there have been increasing cases of pediatric AR worldwide. The percentage of children with AR varies between 2.2-2.4% for those at age 6-7, and 4.5% -45.1% for those at age 13-14, respectively [2]. In China the percentage of AR in children is approximately 10% [3]. Allergen detection plays an important role in the diagnosis and treatment of children AR. Inhalant allergen is a main pathogenic factor for pediatric AR. There have been studies showing the distribution of inhalant allergens in pediatric AR in China [4,5,6]. Previous studies have shown that food allergens are more likely to cause allergic respiratory disease in infants [7]. Herein we reported the distribution of food allergens in 106 children with AR.

Material and Methods

1.1 Study Subjects:

106 children diagnosed with AR and tested positive for allergen-specific IgE during January 2012 - April 2013 in our department were included in this study. Diagnostic criteria is according to the Diagnosis and Treatment of AR (2010, Chongqing) [1]. Out of 106 children, 76 were males and 30 were females, aged 1 to 13 years (mean age, 6.58 ± 3.04 years). Based on their ages, these children were divided into preschooler group (2-5 years old, n=48) and school children group (6-13 years, n=58).

1.2 Specimen Collection

3 mL of venous blood was collected from each child and stored at 2-8 ºC for less than 3 d.

1.3 Allergen Detection

Allergen-specific IgE for 17 (9 types) common inhalant allergens and 11 (9 types) common food allergens in patient's serum was tested using the AllergyScreen system (Mediwiss Analytic GmbH, Germany). The 11 common inhalant allergens include: house dust mites, short ragweed, wormwood, humulus, animal dander mix (cat and dog dander), cockroaches, cypress, mold mix (Alternaria Tenuis, Aspergillus fumigatus, C. Herbarum, Penicillium Notatum), and tree pollen mix (oak, elm, sycamore, willow, cottonwood). The 11
common food allergens include: eggs, milk, fish, crab and shrimp mix, beef, lamb, cashews, peanuts and soy mix, and wheat. 250 μL of serum were added to the nitrocellulose membrane containing the aforementioned allergens, followed by biotin-labeled anti-human IgE antibody and alkaline phosphatase-labeled streptavidin-biotin. After the incubation with BCIP / NBT substrate, the corresponding allergen panel appeared blue, and the color was correlated with the concentration of serum IgE. Images of the testing plate were taken and analyzed using Rapid Reader. According to the criteria of AllergyScreen detection system, the testing results were divided into Grade 0-6 based on the concentration. Those with allergen-specific IgE > 0.75 IU / mL (i.e. above Grade 2) were defined as allergy positive. Positive control was used for each testing plate and experiments were considered invalid when IgE in the positive control was <2.5 IU / mL.

1.4 Statistical Analysis

Statistical analysis was performed using the SPSS 16.0 statistical package. Statistical significance between the preschool and school-age groups was determined using the x2 test. P <0.05 was considered statistically significant.

Results

2.1 Distribution of food allergens in children with AR

Out of 106 AR children, 88 (83.02%) were tested positive for food allergen-specific serum IgE (sIgG), 97 (91.51%) positive for inhalant allergen-specific sIgE. Among these children, 79 (74.53%) were positive for both food and inhalant allergens, 9 (8.49%) were positive only for food allergens, and 18 (16.98%) were negative for food allergens but positive for inhalant allergens. Out of 88 children who were food allergen-positive, 34 (32.08%) were positive for single food allergen, 54 (61.36%) were positive for multiple food allergens, in the order of their positive rates in pediatric AR [8]. In this study, we have found that out of 106 AR children, 88 (83.0%) were tested positive for food allergens, and among them, 79 (74.5%) were positive for both food and inhalant allergens, 9 (8.5%) were positive only for food allergens, and 18 (17.0%) were negative for food allergens but positive for inhalant allergens. The top 6 food allergens, in the order of their positivity rates, were milk (52.8%), eggs (30.2%), beef (26.4%), cashew (26.4%), lamb (12.3%) and crabs (10.4%). These results suggest that food allergen might also play an important role in the pathogenesis of AR.

The prevalence of food allergies has been increasing in the recent years. It is approximately 1% to 2% in adults, and 8% in children under 6 years of age. Adult food allergies are usually related to peanuts, tree nuts, fish and shellfish, whereas common food allergens in children are milk, eggs, peanuts, soybeans, wheat and fish [9,10]. In this study, the top 6 food allergens, in the order of their positive rates in pediatric AR, were milk, eggs, beef, cashew nuts, lamb, prawns and crabs. Our results were slightly different from previous studies, possibly due to the differences in the detection methods and the regions where the children lived. Our study showed that the food allergen-positive rate was higher in the preschooler group than the school children group, suggesting that the positive rate for food allergen-specific IgE decreases with the increase in age. Children outgrow their allergies to certain foods, such as milk, eggs, soy and wheat, as they avoid these foods.

Table 1. Food allergen-positive rate in the preschool and school-age groups

<table>
<thead>
<tr>
<th>Group</th>
<th>Food allergen-negative</th>
<th>Food allergen-positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preschooler (n=48)</td>
<td>3.8% (n=4)</td>
<td>41.5% (n=44)</td>
</tr>
<tr>
<td>School children (n=58)</td>
<td>13.2% (n=14)</td>
<td>41.5% (n=44)</td>
</tr>
<tr>
<td>c2</td>
<td>4.654</td>
<td></td>
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<tr>
<td>P</td>
<td>0.031</td>
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</tbody>
</table>

(50.94%) were positive for multiple food allergens. Food allergen-positive rates were 52.83% for milk (n=56), 30.19% for eggs (n=32), 26.42% for beef (n=28), 26.42% for cashew (28), 12.26% for lamb (n=13), 10.38% for crabs (n=11), 3.77% for wheat (n=4), 1.89% for mango (n=2), 0.94% for peanuts and soy (n=1), and 0.94% for fish (n=1).

2.2 Comparison of food allergen-positive rate

As shown in table 1, the food allergen-positive rate in the preschooler group was higher than that in the school children group (P<0.05).

Discussion

Pediatric AR is a common chronic disease in children, and its major clinical symptoms include nasal congestion, running nose, nasal itching and sneezing. Pediatric allergic rhinitis can cause a variety of complications, such as sinusitis, nasal polyps, pharyngitis, otitis media, tracheobronchitis, asthma and allergic conjunctivitis, seriously affecting the health and life quality of the children [1]. Pediatric allergic rhinitis requires comprehensive treatment, and the ideal prevention measure is to avoid contact with the allergens. Previous studies have indicated that the major inhalant allergens for AR children are dust mites, cockroaches, dog and cat hair, and mold [4,5,6]. Other studies have shown that food allergy is also related to pediatric AR [8]. In this study, we have found that out of 106 AR children, 88 (83.0%) were tested positive for food allergens, and among them, 79 (74.5%) were positive for both food and inhalant allergens, 9 (8.5%) were positive only for food allergens, and 18 (17.0%) were negative for food allergens but positive for inhalant allergens. The top 6 food allergens, in the order of their positivity rates, were milk (52.8%), eggs (30.2%), beef (26.4%), cashew (26.4%), lamb (12.3%) and crabs (10.4%). These results suggest that food allergen might also play an important role in the pathogenesis of AR.

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for a few years and generate the tolerance. However, allergies to peanuts, fish, shellfish and nuts usually last a lifetime [11].

In conclusion, our study showed that the majority of pediatric allergic rhinitis was in combination with food allergen-positive, suggesting that food allergens might be one of the important factors for pediatric allergic rhinitis. Therefore, food allergen detection will not only help the diagnosis of pediatric AR, but also have an important role in its prevention and treatment.

References