

Skin prick test results to food allergens in patients with allergic rhinitis

Gul Aslihan Cakir Akay¹, Esin Yalcinkaya²

¹ Ufuk University Faculty of Medicine Department of Dermatology, Ankara, Turkey

² Medisun Hospital, Department of Otorhinolaryngology, Ankara, Turkey

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Abstract

Aim: The role of food allergy in etiology of allergic rhinitis (AR) has not been well established. Allergic rhinitis may be a component of other atopic disorders. So it is difficult to assess the true prevalence of food induced allergic rhinitis. The aim of this study is to evaluate the skin prick test (SPT) results for some food allergens in allergic rhinitis patients.

Material and Methods: A total of 31 items SPT results of 110 patients diagnosed with allergic rhinitis including food allergens and inhalant allergens were evaluated retrospectively. Chi-square test was used for statistical analysis. P value < 0.05 was considered as statistically significant.

Results: Out of all patients 76.4% had positive reaction to at least one allergen while 23.6% had negative SPT to all allergens. Sixty point nine % of patients had positive result for at least one food allergen and 67.5% for at least one inhalant allergen. Nine point one % of patients had positive test results for only food allergens. The most common positively detected food allergens were flours (rye, barley, oat flour) and peanut. Positive test results for cow's milk was higher in patients under 18 years of age. Also positive test results to egg and cow's milk were statistically significantly higher in patients with atopic status than non - atopic.

Conclusion: According to our study findings, allergic rhinitis patients may have uncertain sensitivity to cereal flours. It seems that; independently from allergic rhinitis, atopic status is the main condition in patients with cow's milk and egg allergies.

Keywords: Allergic rhinitis; food allergies; allergens.

INTRODUCTION

Allergic rhinitis (AR) is a diagnosis characterized with symptoms like sneezing, nasal pruritus, nasal congestion and clear nasal discharge. AR is caused by immunoglobulin E- (IgE) mediated reactions against inhaled allergens (1). However, the responsible agent may not always be an inhaled allergen, thus collecting initial detailed history is important in determining the type of the exposed allergen. Although some food may trigger the symptoms, it is not easy to identify the real prevalence of food induced allergic rhinitis. One reason is that, AR accompanies with other atopic conditions such as asthma, eczema, urticaria, and gastrointestinal symptoms (2). In addition, cross-reactions exist between inhaled allergens and some food allergens which cause allergic rhinitis.(3,4).

The aim of this study is to evaluate the skin prick test

(SPT) positivity to some food allergens in AR patients.

MATERIAL and METHODS

The study has been approved by local ethics committee. A total of 110 patients who underwent SPT (Alk-Albio; Berkshire, UK®) with the diagnosis of AR between 2015 and 2018 were included in our study. The diagnosis and classification of AR were established according to the Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines (5). Demographic data, serum total immunoglobulin E (Ig E) levels and atopic status of patients were recorded. The categorization of AR is defined as 'intermittent' AR (if the symptoms are present for less than 4 days in a week and less than 4 weeks continuously in a year) and 'persistent' AR (if the symptoms are present more than 4 days in a week and more than 4 weeks continuously in a year) (5). Oral antihistamines were stopped 1 week before SPT

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Corresponding Author: Gul Aslihan Cakir Akay, Ufuk University Faculty of Medicine Department of Dermatology, Ankara, Turkey

E-mail: aslihancakir@gmail.com

was applied. A total of 31 items including food allergens (strawberry, whole egg, peanut, tomato, cow's milk, walnut, apple, banana, orange, peach, hazelnut, wheat flour, oat flour, barley, rye flour) and inhalant allergens (mixture of grasses, *Artemisia vulgaris*, *betulaceae*, *Aspergillus fumigatus*, *Alternaria Alternata*, *Dermatophagoides farinae*, *Dermatophagoides pteronyssinus*, cat fur, dog fur) were applied to both left and right front arms of the patients. Allergens were penetrated into dermal tissue by Stellarpoint® prick test needles. After 15 minutes, the test results were evaluated as following: Erythema \leq 15 mm without edema: + positive, erythema $>$ 15 mm and edema $<$ 3 mm: ++ positive, edema 3-6 mm: +++ positive, edema $>$ 6 mm: ++++ positive. Test results with +++ and ++++ were considered as positive SPT results.

The data were analyzed using SPSS 22.0. The following descriptive statistics were noted: frequency for categorical variables, mean \pm SD for continuous variables. Chi-square test was used for statistical analysis. P value 0.05 was considered as statistically significant.

RESULTS

The mean age of the patients was 28.91 ± 16.04 . Out of 110 patients, 46.4% were female and 53.6% were male. The mean duration of symptoms was 23.01 ± 22.23 months. Demographic data of patients are shown in table 1. Seventy six point four % of patients had positive reaction to at least one allergen while 23.6% of patients had negative SPT to all allergens. Sixty point nine % of patients had positive result for at least one food allergen and 67.5% for at least one inhalant allergen. Nine point one % of patients had positive test results for only food allergens, 15.5% of patients for only inhalant allergens and 51.8% of patients for both inhalant and food allergen. The most common positively detected food allergens were flours (rye, barley, oat flour) and peanut (Table 2). The distribution of positive reactions to allergens are listed in Table 2. There was no statistically significant difference between patients who had and had not positive reaction to at least one food allergen in terms of age group, gender, type of AR, serum Ig E level, atopic status, asthma, allergic conjunctivitis and atopic dermatitis (χ^2 p: 0.144, p: 0.677, p: 0.697, p: 0.702, p: 0.446, p: 0.416, p: 0.109, p: 0.289 respectively).

Positive test results for cow's milk was higher in patients under 18 years of age and in patients who had serum IgE levels higher than 100 (χ^2 p: 0.011, p: 0.037). Also positive test results to egg and cow's milk were statistically significantly higher in patients with atopic status than non-atopics (χ^2 p1: 0.005, p2: 0.013). Patients with atopic dermatitis and patients having a family history of AR had statistically higher positive results for whole egg (p < 0.001, p: 0.019). Some food allergens were detected as statistically significantly higher in some patients who had positive test results for inhalant allergens (table 3). Among all patients who had positive SPT for food allergens, 37.3% had clinical compliance.

Table 1. Demographic data of patients

Patients subgroup	N(%)
Age	
<18 years age	37(33.6)
>18years age	73(66.4)
Gender	
Male	59(53.6)
Female	51(46.4)
Serum IgE	
>100	34(30.9)
<100	76(69.1)
Type of AR	
Persistent	46(41.8)
Intermittent	64(58.2)
Atopic status	
present	38(34.5)
none	72(65.5)
Comorbidities	
Allergic asthma	
present	19(17.3)
none	91(82.7)
Allergic conjunctivitis	
present	18(16.4)
none	92(83.6)
Atopic dermatitis	
present	15(13.6)
none	95(86.4)
Family history of AR	
present	21(19.1)
none	89(80.9)

Table 2. Distribution of allergens detected as positive in skin prick test

Food allergens	N (%)	Inhalant allergens	N(%)
Rye flour	33(30)	Mixture of grasses	38(34.5)
Barley flour	30(27.3)	Cat fur	17(15.5)
Oat flour	24(21.8)	<i>Dermatophagoides farinae</i>	16(14.5)
Peanut	13 (11.8)	<i>Aspergillus fumigatus</i>	12(10.9)
Whole egg	11(10.0)	<i>Dermatophagoides pteronyssinus</i>	12(10.9)
Peach	11(10.0)	<i>Betulaceae</i>	11(10.0)
Hazelnut	11(10.0)	Dog fur	10(9.1)
Wheat flour	10(9.1)	<i>Alternaria alternata</i>	10(9.1)
Strawberry	10(9.1)		
Apple	10(9.1)		
Tomato	10(9.1)		
Banana	10(9.1)		
Walnut	10(9.1)		
Orange	10(9.1)		
Cow's milk	10(9.1)		

Table 3. Distribution of food allergen positivity in patients with inhalant allergen positivity

	Mixture of grasses		P
	Positive (n=38)	Negative (n=72)	
Oat flour positive	16	8	<0.001
Barley flour positive	20	10	<0.001
Rye flour	25	8	<0.001
Artemisia vulgaris			
	Positive (n=)	Negative (n=)	
Strawberry	3	7	0.016
Whole egg	3	8	0.027
Walnut	3	7	0.016
Hazelnut	3	8	0.027
Betulaceae			
Apple	3	7	0.027
Hazelnut	3	8	0.044
Aspergillus			
Strawberry	3	7	0.042
Tomato	4	6	0.002
Cow's milk	3	7	0.042
Apple	3	7	0.042
Alternaria alternata			
Walnut	3	7	0.016
Apple	3	7	0.016
Banana	3	7	0.016
D. farinae			
Whole egg	6	5	<0.001
Peanut	6	7	0.001
Walnut	4	6	0.017
Apple	5	5	0.001
Peach	6	5	<0.001
Hazelnut	5	6	0.002
Wheat flour	6	4	<0.001
D.ptery			
Whole egg	4	7	0.004
Tomato	3	7	0.042
Apple	4	6	0.002
Hazelnut	5	6	<0.001
Cat fur			
Tomato	4	6	0.024
Peach	4	7	0.043
Wheat flour	4	6	0.024
Dog fur			
Whole egg	3	8	0.027
Walnut	3	7	0.016
Banana	4	6	<0.001
Hazelnut	3	8	0.027

DISCUSSION

A food-induced allergic reaction may affect respiratory tract as well as skin and gastrointestinal tract. It is mediated by both IgE and non-IgE dependent mechanisms (6). However, food reactions leading to AR are not considered as true allergy, by some authors (7). Another problem is that, it is not easy to diagnose food allergy. Double-blind placebo-controlled food challenge (DBPCFC) is considered as the gold standard method in diagnoses of food allergy. However, it is not routinely performed due to its risks and high cost (8,9). Despite the false negative and false positive reactions, SPT is mostly recommended test in determining the allergens in AR patients (10).

Although there are several studies which include SPT results related to inhalant allergens, those with food allergens are limited (11-14). In literature, 29.3% positive reaction was reported to at least one food allergen in 470 AR and asthma patients (15). In the same study, rice, black gram and lentil were most commonly reported allergens (respectively 6.2%, 5.9% and 5.5%). Also positive test results for citrus fruit, banana and egg were reported as 5.3%, 3.6% and 0.6% respectively (15). Our positive test results for at least one food allergen (60.9%) and for egg (10%) were higher than Kumar et al's study, In addition, while Kumar et al's (15.) found a relation between citrus fruits sensitization and Aspergillus fumigatus allergy, in our study positive test results for strawberry, apple, tomato, cow's milk were found to be higher in patients who had positive reaction to Aspergillus. Herrera et al (16) found a cross-reaction between airborne molds such as Alternaria alternata, Aspergillus fumigatus and food allergies to Aspergillus bisporus mushrooms and spinach. The authors emphasize the possible existence of some non-identified cross-reacting proteins. Although the foods which have cross reaction with aspergillus were different in all of these studies including our study, it seems, the correlation needs to be discussed in further studies.

In a retrospective study; high rate of AR patients were found to be allergic to grass pollens which is consistent with our study. On the other hand the most common food allergen was walnut in the same study (17). In another retrospective study, 23.4% of patients having positive SPT results for inhalants were also positive for peanut and 13.2% were positive for milk (18). In our study, positive test results for peanut were also significantly higher in patients who had positive reaction to Dermatophagoides farinae. These common findings may support the possible relationship of peanut allergy with preexisting or coexisting inhalant sensitization.

In our study, positive test results for egg were higher in patients who had family history of AR. Also in literature, family history of AR was defined as the strongest predictor of food allergy (mostly egg) in patients between 0-3 years of age (19).

Positive SPT response was most common in flours and peanut among food allergens in our study. Rice flour was

detected as the most common allergen among flours and egg white among food allergens in a retrospective study including 192 patients (20). Similarly egg white was the top food allergen in another study including 435 Asian patients (21). Rhinitis is also defined as one of the major health effect of flour dusts as well as asthma, conjunctivitis and skin conditions. The contents of cereal flours like enzymes (α -amylase), additives, flavorings and preservatives may be responsible for these reactions (22, 23). In addition, these flours may have cross-reactivity with each other. Although wheat flour is determined as the most common cause of baker's asthma and rhinitis, other flours such as rye flour may also play a role as irritant or immunological allergen (24). In our study among the patients who had positive test results for cereal flour, only 13 had reported clinical correlation as occupational.

Cow's milk is defined as an important food allergen in children with a prevalence of 2-6% (3,25). In our study cow's milk had also higher positive results in children than adults. In a prospective study, 36 children sensitized with cow's milk from 12 to 18 months of age were followed up 5 years and most of them developed nasal allergy symptoms and respiratory symptoms (26). In our study, egg and cow milk positivity was found to be more common in patients with atopic status which is consistent with the literature (27-29).

Our study findings are based on retrospective data, and do not include DBPCFC test results which is gold standard in diagnosis of food allergy. Although these two factors are among the limitations of our study, in literature there are limited numbers of studies evaluating the relation between food allergens and AR. In addition, high positivity of cereal flours in AR patients and cross-reactions between inhalant and food allergens seems to be important findings of our study. Since the type of contact (either inhalant or ingestion) with cereal flours in patients is not certain in our study, it is difficult to assess the pathogenic pathway of the relationship.

CONCLUSION

Further prospective studies also including the DBPCFC test results may clarify the exact relation between food allergens and AR.

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Gul Aslihan Cakir Akay ORCID:0000-0003-2310-1763}
Esin Yalcinkaya ORCID:0000-0002-3980-3850

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