

Sensitization to Food Allergens in Mureş Region Atopic Children by *in vitro* Specific Ig E Assay

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Background: Food allergies are adverse immune reactions to food proteins that affect up to 6% of children. There are little data regarding the frequency of different foods that cause hypersensitivity in Romania.

Objective: To determine the frequency of sensitization to food allergens in children seen in pediatric immuno-allergy services from Tîrgu Mureş, Romania.

Patients and methods: Specific Ig E serum levels to allergens were measured in 113 children in pediatric allergy services and in 36 control children with matching ages. RAST equal or higher than class 1 was considered as positive.

Results: Frequency of positive reaction was significantly higher among atopics (92/113; 81.4%) when compared to controls (8/36; 25.8%). There were little differences according to gender. The frequency of positive reaction to all evaluated allergens was higher among atopics when compared to controls. In relation to food allergens we observed: cow's milk = 46.9% x 2.8% ($p < 0.05$), egg = 11.5% x 0.0% ($p < 0.05$). With respect to age, food allergen sensitization predominates in young children.

Conclusions: Food allergens were responsible for a significant proportion of sensitization, mainly in infants.

Keywords: allergen, specific Ig E, food

Introduction

A recent systematic review estimates that >1% to 2% but <10% of the population is affected by food allergies. A cross-sectional survey of data on food allergy among children <18 years revealed that the prevalence of reported food allergy increased 18% from 1997 through 2007 [1,2]. In addition to genetic potential, environmental exposure to allergens is fundamental to atopic sensitization and disease expression [3].

In children smaller than two years hospitalized for wheezing, the presence of a positive reaction for wheat, egg white and domestic dust mites was associated with an increased frequency of asthma later in life [4]. Atopic diseases often have onset in early childhood and etiologic diagnosis is not always easy to perform.

The presence of allergen specific Ig E antibodies in the serum characterizes allergic etiology [2]. These antibodies can be detected by *in vivo* testing or by biological *in vitro* tests. Immediate hypersensitivity skin tests are most often used to identify specific Ig E *in vivo* in the serum. In infants, cutaneous allergic inflammatory responses are reduced [5], making a larger proportion of false-negative results possible.

In vitro tests attempt to identify specific Ig E in the patient's serum and as such they require a substrate in which this immunoglobulin can be fixed for quantifying. Ig E-mediated food allergy in children has increased in prevalence over the last few years [6,7], with variations in the most common foods causing food hypersensitivity in different countries [8,9]. There is little data regarding the different foods that cause hypersensitivity in Romania. This study aims to assess the presence of food allergen specific serum Ig E antibodies in a population of Mureş county children treated at a pediatric allergy center.

Patients and methods

A prospective observational study was conducted at the Paediatric Clinic Allergy Department, Tîrgu Mureş, Romania, between 2008–2010. One hundred thirteen children participated in the study (48 girls – 42.5% and 65 boys – 57.5%) aged between 6 months and 18 years.

A single physician took the history and performed the skin prick test. Details of atopic conditions (including eczema, asthma, allergic rhinitis and urticaria/angioedema), were collected at the same time.

The children were classed into 6 age groups as follows: 0 to 2 years, 2 to 4 years, 4 to 6 years, 6 to 8 years, 8 to 12 years, >12 years. Children were classed as atopic if they presented at least one positive immediate hypersensitivity skin test (mean wheal diameter greater than or equal to 3 mm) [10] to at least one inhalant or food allergen. The control group was made up of 36 children with no history of allergic disease and negative immediate hypersensitivity skin tests results for the same allergens used.

Peripheral blood samples were taken from both allergic and control patients so that Ig E serum levels specific to inhalant allergens and food allergens (cow's milk, egg, peanut, hazelnut, wheat, carrot and potato) (Synlab Germany) could be assayed [11,12]. Specific Ig E levels (RAST) greater than or equal to 0.35 UI/ml (class 1) were defined as positive [12,13].

Parametric tests were employed to analyze variables. (SPSS Software version 19: Z test).

Results

The distribution of allergic patients, in terms of age groups is presented in Table I.

Serum Ig E tests were positive for 60/113 (53.0%) of the patients and 2/36 (5.5%) of the controls ($p < 0.0001$).

Table I. Distribution of patients by age group

Age group (years)	n	%
0–2	25	22.1
2–4	24	21.2
4–6	21	18.6
6–8	18	16.0
8–12	11	9.8
>12	14	12.3
Total	113	100.0

The presence of specific Ig E to food allergens was variable, being significantly more common among younger allergic patients (Table II).

Table III contains the frequency of each result according to the tested allergen (food category: cow's milk, egg, peanut, hazelnut, wheat, carrot, potato). Significantly higher specific IgE serum levels for cow's milk ($p < 0.0001$), egg ($p < 0.03$) and hazelnut (0.05) were observed among the atopic compared with non-atopic children (Table III).

Table IV shows the frequency of positive results for each of the tested allergens by age group, taking the total number of positive results for each particular allergen as a reference. There was a high frequency of sensitization to cow's milk across all age groups, but the sensitization in general is lower between 8–12 years ($p < 0.05$) and is significantly lower after 12 years ($p < 0.0003$) (Table IV).

We found that sensitization to foods predominated in the first few years of life. Sensitization to more than one allergen was observed in 85% of the patients, particularly among the oldest.

Discussions

The studied children are served by a hospital closely linked to the local population, so our study is not a true population-based study.

When assessing allergic patients it is important to bear the concept of allergic march in mind [14,15]. It is known that allergic manifestations progress from atopic eczema and food allergies in younger children to respiratory allergy later on, manifesting as asthma and rhino-conjunctivitis [16]. This fact was taken into account for the present study.

Cow's milk was the most often identified food allergen, followed by egg white, peanut, hazelnut, carrot, wheat,

Table III. Distribution of patients according to positivity to the different allergens

Allergen	Atopic (n = 113)		Control (n = 36)		Fisher's exact test (two-tailed)
	Positive RAST	%	Positive RAST	%	
Cow's milk	53	46.9	1	2.8	<0.0001
Egg	13	11.5	0	0	0.0385
Peanut	13	11.5	1	2.8	
Hazelnut	11	9.7	0	0	
Carrot	8	7.1	0	0	
Wheat	7	6.2	0	0	
Soy	6	5.3	0	0	
Potato	2	1.7	0	0	

Table II. Patients with specific IgE food allergens in different age group

Age group (years)	Atopic Positive specific Ig E			Control Positive specific Ig E		
	n total	n	%	n total	n	%
0-2	25	15	60.0	6	0	0
2-4	24	17	70.8	6	1	16.7
4-6	21	10	47.6	6	0	0
6-8	18	11	61.1	6	0	0
8-12	11	4	36.4	6	1	16.7
>12	14	3	21.4	6	0	0
Total	113	60	53.0	36	2	5.5

Chi-square test: 492.549 1 degrees of freedom, $p < 0.0001$
Fisher's exact test: $p < 0.0001$

soya and potato (Table III). In general cow's milk proteins are the first heterologous dietary proteins with which infants come into contact, which explains early sensitization [17]. Within this population we observed a predominance of sensitization to cow's milk among children smaller than four years old and sensitization to potato occurred among older children. Around 15% of the patients assessed were monosensitized. Food allergen sensitization was more prevalent among younger subjects. The presence of serum Ig E specific to food allergens was significantly greater among atopic subjects and was related to age, oscillating between 60.0% for those younger than 2 years to 21.4% for those over 12 years. While there were positive results in the control group, Ig E levels were lower and reached a maximum of 16.7% of positive exams. Table IV lists the frequency of positivity to the allergens tested. The most common foods causing allergy in our study were broadly similar to those documented in other studies from the USA and Europe [18–21].

Our findings need to be confirmed by a more detailed population-based study, ideally using food challenges in addition to history and skin prick testing.

This study does have some limitations. We did not collect detailed dietary history including breastfeeding or introduction of solids, nor detailed ethnic demographic data. Food challenges were not undertaken to confirm food allergy in any child.

Conclusions

It has to be emphasised that this study was not designed to define the prevalence of food allergies in Romanian children, but is the first study of food sensitization in children in Romania. Although the number of children in the study group is limited, sensitization distribution on age groups confirms indirectly the allergic march: from food sensitization in small ages to environment sensitization in adolescents.

The findings are important in terms of health education for these children and their families, particularly when advising about the risk of developing food allergy, and the number and variety of food allergies that may be involved.

Table IV. Patients according to specific IgE (RAST) to different allergens. Data (%) shown regarding the total number of positive patients in each category

Allergen	0–2 years		2–4 years		4–6 years		6–8 years		8–12 years		>12 years		Total n
	n	%	n	%	n	%	n	%	n	%	n	%	
Cow's milk	14	26.4	16	30.2	9	17	9	17	3	5.6	2	3.8	53
Egg	2	15.3	5	38.4	2	15.4	3	23.1	1	7.7	0	0	13
Peanut	3	23.1	2	15.3	4	30.7	2	15.4	2	15.4	0	0	13
Hazelnut	3	27.3	3	27.3	2	11.2	2	18.2	1	9.1	0	0	11
Carrot	2	25	1	12.5	2	25	2	25	0	0	1	12.5	8
Soy	2	33.3	0	0	2	33.3	1	16.6	0	0	1	16.6	6
Potato	0	0	0	0	0	0	1	50.0	0	0	1	50.0	2
Total	26		27		21		20		7		5		

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