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Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

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Evaluation of Sensitization to Various Foods in a Subset of Subjects from Saudi Arabia

A.H. Alsaeed[1], H. Al Harfi[2] and A.P. Shaik[1]
[1]Department of Clinical Laboratory Sciences, College of Applied Medical Sciences,
King Saud University, Riyadh, Kingdom of Saudi Arabia
[2]National Center of Allergy Asthma and Immunology,
Takhassusi District, Riyadh, Kingdom of Saudi Arabia

Abstract: This study investigated sensitization to various foods in a subset of patients presenting to an allergy clinic with symptoms suggestive of a possible food allergy. A total of 243 subjects who visited the clinic were further screened and assessed for specific IgE antibodies to different food allergens by using the Radio Allergosorbent Test (RAST). IgE-antibodies specific for different foods were detected in 15.6% out of 243 patients. The maximum number of positive reactions were observed among these subjects to wheat (45%) followed by egg/egg white (40%), cow's milk (39%), sesame seeds (35%) and soya bean (30%). Positive reactions were also found towards orange, rice, peanut, cashew nuts and dates. Most of the reactions fell in Class 2 followed by Class 3 and Class 1. These results are important and gave an idea of the most common food items to which allergic subjects were sensitized to. However, more studies are needed to gather data with respect to the various types of food allergy in the Saudi Arabian population for appropriate preventive measures to be put in place.

Key words: Food Allergy, IgE, RAST, Saudi Arabia

INTRODUCTION

Allergic reactions to food can occur due to abnormal immune responses and the risk of developing food sensitivity depends on age, gastrointestinal factors and environmental factors. The immune responses against a food allergen depend on its intrinsic properties. Relatively few foods like egg, milk, peanut, tree nuts, fish, shellfish, wheat and soy account for most of the allergic reactions (Radauer *et al*., 2007). In addition, the presence of immunostimulatory factors in the food may also contribute to such sensitization (Shreffler *et al*., 2006). Binding of food allergens by specific IgE on effector cells, such as basophils and mast cells, leads to mediator release causing a variety of symptoms that typically affect the cutaneous, respiratory, gastrointestinal and/or cardiovascular systems (Wang *et al*., 2009).

Food allergy is more prevalent in children than adults. In certain cases, it can be a lifelong concern (Sampson, 2004). The prevalence of food allergy varies with region and age, usually self-reported prevalence would be high compared to the true one (Ebisawa *et al*., 2003; Foucard and Malmheden Yman, 1999; Sicherer, 2002). According to the National Health Interview Survey (NHIS) in 2007, a total of approximately 3 million children under age 18 years (3.9%) were reported to have a food or digestive allergy in the previous 12 months (Branum and Lukacs, 2008). In Toulouse, France, the cumulative and point prevalence of food allergies in a population of school-age children is 6.7 and 4.7%, respectively (Rance *et al*., 2008). Cow's milk, eggs and peanuts were the main foods reported as causing allergies. Exotic fruits, shellfish and tree nuts appeared to be relatively new allergens. In a survey across 13 million children in the United Kingdom and Ireland, whilst food allergy may be becoming more common, fatal reactions to food in childhood are very rare and their rate is not changing (Colver *et al*., 2005). (A cross-sectional epidemiologic study was conducted to test for five common food allergens (cow's milk, peanut, egg white, shrimp and wheat), using a detailed questionnaire (Woods *et al*., 2002). Just over one percent (1.3%, n = 15) had probable IgE-mediated food allergy).

Several anaphylaxis studies reviewed and summarized by Lieberman *et al*. (2006) raise the concern that cases of food anaphylaxis and fatalities are significantly underreported for many reasons. Generally allergic reactions to foods occur within two hours of ingestion Very little information is available on the rates of food allergy in Saudis and its implications on the health of

Corresponding Author: A.H. Alsaeed, Department of Clinical Laboratory Sciences, College of Applied Medical Sciences, King Saud University, Riyadh, Kingdom of Saudi Arabia

individuals. The present study evaluated sensitization to various foods in a high risk population presenting to the allergy clinic with symptoms suggestive of food allergy.

MATERIALS AND METHODS

Patients visiting the allergy clinic at National Centre for Allergy Asthma and Immunology, Riyadh and having symptoms suggestive of food allergy were evaluated for sensitization of various foods. Male and female subjects (12-45 years of age) and otherwise in good health as determined by medical history and physical examination were included screened.

The study was approved by the institutional review board of the participating institute. A signed informed consent was obtained from all patients before collection of samples.

It was also requirement of the project that every patient (or the guardian of the patient) filled out the proforma/questionnaire that contained information on patient history, family history, environmental history, social history, eating habits, symptoms soon after eating, symptoms after a few hours of eating etc. before taking any samples.

Those patients who reported a clinical history of allergy to foods were further screened and assessed for food allergic testing. Serum samples were obtained from the patients and stored at -20°C until analysis. The samples were tested for the presence of specific IgE antibodies to food allergens. Allergens consisted of cow's milk, egg/egg white, wheat, rice, peanut, fish mix, orange, soya bean, strawberry, tomato, chicken, peach, banana, cantaloupe, lamb, cashew nut, almond, cinnamon, cocoa beans, lemon, cucumber, garlic, GS fish mix, onion, sesame seeds, coconut, watermelon, tuna, shrimp, coffee, dates, potato, spinach, carrot, hazel nut, mango, pistachio, lentil, grapes, green bean, apple and yeast.

Specific IgE was measured using the radioallergosorbent assay calibrated against the World Health Organization (WHO) standard IgE and values were expressed as Ku/L. Values <0.35 Ku/L were considered to be negative, those between 0.36 and 0.70 Ku/L to be borderline (Class 1) and those above 0.70 to be positive. Values between 0.70 and 3.5 Ku/L were attributed to Class 2, values between 3.5 Ku/L to 17.5 Ku/L to Class 3, 17.5 to 50 Ku/L to Class 4, 50 to 100 Ku/L to Class 5 and values above 100 Ku/L to Class 6.

RESULTS

Of the 243 patients who were screened for food allergy based on their suggestive symptoms a total of 38 (15.6%) subjects showed a positive specific IgE reaction. The distribution of the reactions to the various food allergens are shown in Table 1. The mean IgE levels in patients reporting food allergy for various allergens is presented in Fig. 1. Specific IgE levels were more frequently encountered for some of the food allergens tested than others. Positive reactions in the 38 subjects were more frequently encountered to Wheat (45%), egg/egg white (40%), cow's milk (39%), sesame seeds (35%) and soya bean (30%). Moderate numbers of positive reactions were found towards orange, rice, peanut, cashew nuts and dates. Most reactions fell in Class 2, followed by Classes 3, 1, 4, 5 and 6. Only one reaction was observed to fall under Class 6. No patient reported allergic reaction to cantaloupe, lamb, cinnamon, lemon, cucumber, garlic, GS fish mix, onion, coconut, water melon, spinach and carrot. The serum IgE levels observed and the rates of IgE mediated allergic reactions to various food allergens are presented in Table 2.

DISCUSSION

Approximately 1-3 individuals per 10, 000 people report anaphylaxis (Moneret-Vautrin *et al*., 2002; Mullins, 2003) and food is the most common cause of these reactions in children (Derby *et al*., 2005) and third most common cause in adults (Worm *et al*., 2012). The present study evaluated IgE-mediated reactions to food allergens in a group of patients from Riyadh, Saudi Arabia. Approximately 32% subjects reported allergies to the various investigated allergens which was high compared to other regions. The blood tests helped in the measurement of the level of IgE specific to a particular allergen. In addition, these tests were used to evaluate sensitivity to various allergens and were found most appropriate based on patient's history.

Patients who suffer from food allergy need to be under constant dietary vigilance, because of adverse reactions which impact the quality of daily life (Le *et al*., 2008; Monga and Manassis, 2006). Since patients with food allergies have higher serum IgE concentrations than nonallergic patients, treating or blocking IgE in the allergic patients may stop or limit an allergic reaction without altering normal immune function (Owen, 2007). In addition, the current treatment modality also consists of avoiding allergens, pharmacotherapy or allergen-specific immunotherapy.

More importantly, patients and their family members should be educated to avoid the ingestion of items to which allergy has been indicated and manage the early stages of IgE-mediated reaction. Patients and family must be educated on what foods and products should be avoided and how to read product labels. In addition, educational institutions need to be informed and educated about the potential exposures and their associated risks.

It is important to note that this study focused on using IgE levels for evaluating sensitivity to certain foods. This

Table 1: The distribution of IgE-mediated allergy to different types of food allergens

		No. of patients in each CAP class					
Allergen	Negative	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
Cow's milk	48	10	12	5	3		
Egg/egg white	46	7	11	9	2	2	
Wheat	43	7	13	11	3		1
Rice	63	2	9	3			
Peanut	69		5	2	1		
Fish mix	73	1	1	2			
Orange	61	1	8	6			
Soya bean	54	4	12	5	2		
Strawberry	73		2	2			
Tomato	66	4	1	6			
Chicken	72	4	1				
Peach	75		2				
Banana	72	1		4			
Cantaloupe	77						
Lamb	77						
Cashew nut	69	3	2	3			
Almond	74	2	1				
Cinnamon	77						
Cacoa beans	75		2				
Lemon	77						
Cucumber	77						
Garlic	77						
Gs fish mix	77						
Onion	77						
Sesame seeds	48	6	6	10	4	1	
Coconut	77						
Water melon	77						
Tuna	75		2				
Shrimp	75			2			
Coffee	77						
Dates	69	1	3	4			
Potato	76			1			
Spinach	77						
Carrot	77						
Hazel nut	73		2	2			
Mango	73	3	1				
Pistachio	72		2	2	1		
Lentil	72	4				1	
Grapes	75			2			
Green bean	74		1	2			
Apple	76	1					
Yeast	76		1				

<0.35 Ku/L = negative, 0.36 to 0.70 Ku/L=borderline (Class 1) >0.70 =positive. 0.70 to 3.5 Ku/L = Class 2, 3.5 to 17.5 Ku/L= Class 3, 17.5 to 50 Ku/L =Class 4, 50 to 100 Ku/L = Class 5 >100 Ku/L= Class 6

was based on studies of Sampson (2004) which showed that the quantity of specific IgE to certain foods can accurately determine the patients' current clinical sensitivity. The IgE thresholds for provocative testing showing <95% probability indicates that a food challenge will be negative and thresholds at which there is a 95% probability indicate it may be positive. However, there is also evidence that sensitization to a particular allergen may not be synonymous with severity. Although the oral food challenge is recommended as a definite diagnosis, the treating physicians in this study were at the discretion of whether to go ahead with this test or not based on the levels of IgE and patient history. Only those cases suspected to be having multiple food allergy and cases who are at high risk were recommended for further evaluation using oral food challenge (the results not shown).

Since the nutritional habits vary in different populations, it can be understood that there will be variations in the types of foods implicated in food allergy. Therefore, the data from this study can be helpful to diagnose patients with food allergy and propose treatment options, patient counseling and creating better awareness.

Table 2: Serum IgE levels observed and the rates of IgE mediated allergic reactions to various food allergens

Allergen	Minimum igE levels observed (Ku/L)	Maximum igE levels observed (Ku/L)	Total no. of positive reactions	Percentage of positive reactions
Cow's milk	0.3	49.6	30	38.96
Egg/egg white	0.3	93	31	40.25
Wheat	0.3	101	35	45.45
Rice	0.3	10.1	14	18.18
Peanut	0.3	26.8	8	10.38
Fish mix	0.3	4.8	4	5.18
Orange	0.3	13.1	15	19.48
Soya bean	0.3	26.5	23	29.87
Strawberry	0.87	14.6	4	5.18
Tomato	0.3	5.97	11	14.28
Chicken	0.3	0.68	5	6.49
Peach		3.3	2	2.59
Banana	0.48	14.6	5	6.49
Cantaloupe				
Lamb				
Cashew nut	0.3	9.74	8	10.38
Almond	0.3	1.17	3	3.89
Cinnamon				
Cacoa beans	0.03	2.68	2	2.59
Lemon				
Cucumber				
Garlic				
Gs fish mix				
Onion				
Sesame seeds	0.3	64.3	27	35.06
Coconut				
Water melon				
Tuna		1.33	2	2.59
Shrimp	0.03	4.18	2	2.59
Coffee				
Dates	0.3	4.82	8	10.38
Potato	0.3	5.18	1	1.29
Spinach				
Carrot				
Hazel nut	0.3	7.18	4	5.19
Mango	0.3	1.76	4	5.19
Pistachio	0.3	23.3	5	6.49
Lentil	0.54	62.3	5	6.49
Grapes		4.05	2	2.59
Green bean		1.28	2	2.59
Apple		0.66	1	1.29
Yeast		0.86	1	1.29

<0.35 Ku/L = negative, 0.36 to 0.70 Ku/L=borderline (Class 1) >0.70 =positive. 0.70 to 3.5 Ku/L = Class 2, 3.5 to 17.5 Ku/L= Class 3, 17.5 to 50 Ku/L = Class 4, 50 to 100 Ku/L = Class 5 >100 Ku/L= Class 6

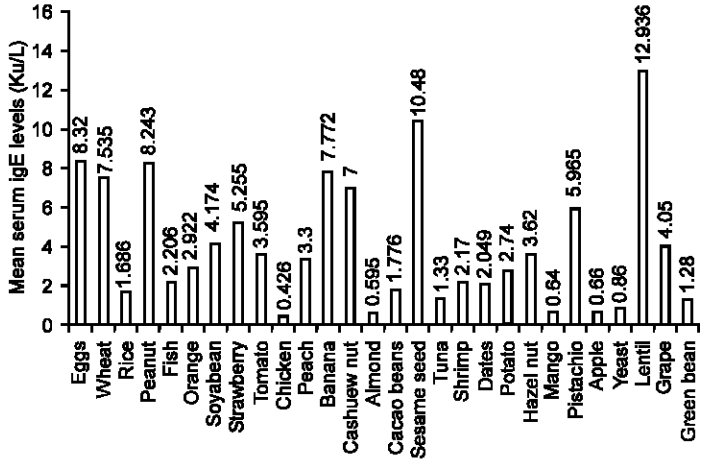

Fig. 1: Mean Serum IgE levels of food allergens. <0.35 Ku/L = negative, 0.36 to 0.70 Ku/L=borderline (Class 1) >0.70 = positive. 0.70 to 3.5 Ku/L = Class 2, 3.5 to 17.5 Ku/L= Class 3, 17.5 to 50 Ku/L = Class 4, 50 to 100 Ku/L = Class 5 >00 Ku/L= Class 6

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