

BRIEF REPORTS

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## Avoidance of Food Allergens in Childhood Asthma

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*Twenty-four patients of moderate persistent perennial asthma with documented aggravation to severe persistent asthma, during monsoon season in the past two years, were put on specific elimination diet during August and September. The diet was based on results of in-vitro allergy tests for a selected food panel. On specific elimination diet, five patients improved to mild persistent asthma and twelve patients improved to mild persistent asthma with occasional exacerbations. Six patients remained at moderate persistent asthma and only one patient deteriorated to severe persistent asthma. These results indicate that food avoidance may help in asthma control in children.*

**Key words:** Allergy, Asthma, Food-allergens.

**A**LLERGIC bronchial asthma is caused by exposure to environmental and dietary allergens. Allergen avoidance is considered to be an important aspect of management of allergic asthma(1). Many studies show the beneficial effect of environmental allergen avoidance(2). Regarding avoidance of food allergens, studies are available only for neonates and infants in relation to later risk of asthma(3). There is paucity of evidence dealing specifically with avoidance of food allergens in

the clinical management of childhood asthma.

The purpose of this study was to evaluate possible effect of a specific elimination diet (*i.e.*, avoidance of food items for which serum IgE titers were raised) in pediatric asthmatics having seasonal aggravation.

### Subjects and Methods

This study was carried out in pediatric patients of bronchial asthma, attending the out patient department of a general teaching

hospital. Age of the children was in the range of 3 to 15 years. There were 14 males and 10 females.

All children had moderate perennial asthma. Fifteen patients were receiving Step 2 and nine patients were receiving Step 3 treatment as per GINA guidelines(4). Previous two years records showed that all of them deteriorated to severe persistent asthma during the peak monsoon months of August and September and needed upgradation to Step 4 treatment.

Total IgE levels and specific IgE titers for all foodstuffs listed in the *Table I* were measured in all children. The test was performed on clear serum separated from 5 mL venous blood. Total serum IgE was measured by a two stage enzyme immuno-assay sandwich technique. The enzyme lable used was penicillinase manufactured by Hindustan Antibiotics, India. The iodometric method of penicillinase assay introduced by Pollock(5) and modified by Ghosh and Borkar(6) was employed to measure bound enzyme. Penicillin, starch, iodine, gelatin and phosphate buffer formed the substrate mixture. Time taken for decolorisation of substrate mixture was plotted against different dilutions of IgE standards to get a reference curve.

For Specific IgE Titers (Allergy Research Institute Specific IgE Titers: **ARISIT**), extracts of foods were prepared at Allergy Research Institute, Pune as per standard methods(7). Fractions having maximum molecular weight were collected by passing extracts through a ceralose 6 B column (bead size 40 to 190 microns). ELISA was carried out, employing penicillinase enzyme for conjugate.

Sandwich technique was used and iodometric method mentioned above was followed with penicillin, starch, iodine, gelatin

and phosphate buffer forming the substrate mixture. Specific IgE titre was calculated from the time taken in seconds for decolorisation of iodine in the substrate for two different dilutions of serum, a ratio serving as an index of binding of antigen and corresponding specific IgE if present in the serum. At our institute mean specific IgE titers in asymptomatic, non-atopic individuals for each antigen included in the food panel was 1.07 with standard deviation of .002. Specific IgE titers higher than 1.085 were considered positive.

Patients were asked to avoid all food items, which tested positive and parents were asked to maintain a food diary. The tests were carried out in middle of July and patients were asked to start food avoidance immediately.

All patients were called for 8 follow up visits during study period, *i.e.*, weekly. They were instructed to contact for any aggravation of symptoms. If they could not contact the doctor they were asked to make a written note of aggravation and medication required to control the aggravation.

## Results

Twenty four patients having documented deterioration in control of their perenial asthma during months of August and September in two previous years were selected for the study. Their ages ranged from 3 yrs to 15 yrs and there were 14 males and 10 females.

Normal range of total IgE at our Allergy Research Institute has been found to be 150 ng/mL to 400 ngm/mL (with mean of 232 ng/mL and SD 34.7 ngm/mL). Total IgE level in all patients was more than 1500 ng/mL.

The result of specific IgE titers against different food items is presented in *Table I*.

Majority (83%) of children had raised specific IgE titers against rice whereas only

**TABLE I**—*Specific IgE Titers in Study Subjects Against Different Food Stuffs.*

Food Item	IgE raised n	Food item	IgE raised n	Food item	IgE raised n	Food Item	IgE raised n
<b>Cereals</b>							
Rice	20 (83%)	Wheat	12 (50%)	Maida	9 (38%)	Maize	7(29%)
Jowar	4 (17%)						
<b>Pulses</b>							
Tur Dal	11(46%)	Chana Dal	19 (79%)	Masoor Dal	4 (17%)	Moong Dal	19(79%)
Udid Dal	23(96%)	Soyabean	5 (21%)	Back-eyed beans	19(79%)		
<b>Beverages</b>							
Tea	1 (4%)	Coffee	2 (8%)	Cocoa	5 (21%)		
<b>Vegetables</b>							
Carrot	21 (88%)	Potato	20(83%)	Navalkol	18(75%)	Cauliflower	19(79%)
Cabbage	8(33%)	Cucumber	21(88%)	Tondli	15(63%)	Onions	6(25%)
Ridge- gourd	17(71%)	Cluster-beans	18(75%)	Red- pumpkin	11(46%)	White - pumpkin	21(88%)
Brinjal	22(92%)	French-beans	18(75%)				
<b>Fruits</b>							
Apple	21(88%)	Banana	20(83%)	Mosambi	19(79%)	Lemon	19(79%)
Tomato	2(8%)	Grapes	21(88%)	Orange	4(17%)	Pineapple	19(79%)
Papai	7(29%)	Kokam	19(79%)	Guava	19(79%)	Sugarcane	18(75%)
Water-melon	19 (79%)	Musk-melon	23(96%)	Alphonso	19(79%)	Chikku	18(75%)
<b>Oils</b>							
Groundnut	10 (42%)	Coconut	5 (21%)	Til	9(29%)	Safflower	8(33%)
Mustard	9(29%)	Cotton-seed	8(33%)	Sunflower	9(29%)		
<b>Non-Vegetarian</b>							
Egg	4(17%)	Mutton	19(79%)	Chicken	20 (83%)	Prawns	15 (75%)
Pomphret	17(71%)	Rohu	14 (58%)	Surmai	19(79%)		
<b>Milk Products</b>							
Milk	6(25%)	Cheese	20 (83%)	Curd	17 (71%)	Butter	6 (25%)
Ghee	6(25%)						
<b>Spices</b>							
Garlic	14 (58%)	Ginger	11(46%)	Red Chilly	3 (12.5 %)	Green Chilly	8 (33%)
Turmeric	12 (50%)	Jira	20 ( 83%)	Coriander	20 (83%)	Black-pepper	22 ( 92%)
Hing	15 (63%)						

four (17%) children had raised antibodies against jowar. Among the pulses in vitro hypersensitivity against masoor dal was present in only 17% as compared to 96% and 79% against udid dal and chana dal or moong dal respectively. In the vegetable category, most children were allergic to brinjal while only 25%

were allergic to onions. Among the fruits all but one child had raised titer against musk melon while only two had raised titer against tomato. In the cooking oil group antibody titer for groundnut oil was seen to be positive in 42% of children while corresponding figure for coconut oil was 21%. Among non-vegetarian

### Key Messages

- Children with seasonal asthma have evidence of *in-vitro* hypersensitivity to wide variety of food antigens
- Use of specific elimination diet might help in better control asthma in these children

items antibody titer against chicken was positive in 83% but egg was positive in only 17% children.

After elimination diet patients were classified on basis of their clinical status as per GINA guidelines(4) and their clinical status in August and September of current year was compared with that of previous two years during same months.

During August and September of previous two years, all patients had deterioration of asthma control to severe persistent asthma (Group IV).

During August and September of current year while on specific elimination diet five patients had mild persistent asthma with no aggravation (Group I ) and twelve had mild persistent asthma with occasional aggravation controlled with beta agonist (Group II ). Six patients did not deteriorate to severe persistent asthma and remained in Group III. Only one patient deteriorated to severe persistent asthma during current year while on specific elimination diet.

#### Discussion

In the present study the distribution of clinical status during August and September of the current year with specific elimination diet was compared to that during August and September of the previous years when none of the patients were on specific elimination diet and had deteriorated. The results indicated that deterioration could be prevented in most patients with specific food avoidance in the

vulnerable period. There were certain limitations of the present study. The study was based on speculation that the children would have progressed to severe persistent asthma during August and September without specific elimination diet. However the records of these children showed that they had worsened during these months in the last two years. There was no other obvious reason that they should have not deteriorated this year while age advanced only by one year. Another limitation of the study was lack of control group and a small sample size which precluded any valid statistical interpretation

The beneficial effect of food avoidance in our cases could possibly be explained by the concept of Total Allergen Load introduced by Feinberg(8) and later highlighted by Sheldon (9). Sheldon observed that in comparison with sensitivity to inhalants, sensitivity to foods is more common in infants and children and it is therefore important not to overlook food allergy. Food allergies need not be perennial and patients may manifest symptoms only during seasons when these foods are available or consumed in large amount affecting the allergen load(9). Symptoms occur when mediators are released on degranulation of mast cells. Degranulation results from binding of the double bond of antigen-specific IgE receptors, present for that particular antigen on the mast cells. Thus, degree of response is directly related to product of the dose of antigen with number of antigen-specific IgE receptors.

Each individual antigen on its own may not be able to produce much reaction since number

of antigen-specific receptors for that particular antigen are few. The simultaneous exposure to a number of such antigens, however, would bind enough antigen-specific IgE receptors on a greater number of mast cells and result in symptoms(10).

Overall the results of this study suggested, that children with asthma having seasonal exacerbation have evidence of in-vitro hypersensitivity to a wide variety of food antigens and the use of a specific elimination diet might prevent the seasonal exacerbation. These preliminary results should be confirmed by large well-designed controlled trials.

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