ELSEVIER

Toxicology 93 (1994) 77–83

TOXICOLOGY

Role of new allergens and of allergens consumption in the increased incidence of food sensitizations in France ☆

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Received 5 November 1993; accepted 25 February 1994

Abstract

Food allergy is a group of distinct clinico-pathological entities that have an immunological basis in common, and in which an abnormal or exaggerated immunological response to a specific food leads to disease. Some clinical pictures involving multiple organ system (anaphylaxis) are potentially fatal. The data on the incidence, prevalence, mortality rate and food products involved in food-induced anaphylaxis and the evolution of food sensitization compared with changes in eating habits are not very reliable. In the present study we analysed, over a period of 9 years (1984–1992), a group of 580 patients with pathological reactions to foods, 60 of which presented severe, near-fatal reactions. We sought the etiologic components and food sensitization in comparison with the principal tendencies of food consumption in France. Food products most frequently incriminated in anaphylactic reactions are not of a primary nutritional importance: celery (30%), crustaceans (17%), fish (13%), peanuts (12%), mango (6%), mustard (3%), but they are often hidden allergens in commercial foods. The sensitization to food products in the group of 580 patients reveals, in decreasing order of frequency: wheat (39%), peanuts (37%), crab (34%), celery (30%), soy (30%). Compared with previous data, the frequency of sensitization to different foods has changed; for instance, the sensitizations to wheat, soy, peanuts, celery, mustard, rice, are definitely increasing. The increased consumption and more attentive clinical research may be the reasons for this evolution. For products such as egg and pork, the data are stable and parallel with consumption, whilst for other products like milk and other dairy products, the increased consumption is accompanied by a decrease of the incidence of sensitization. The reactivity to some allergens may be affected by the way of preparing the food.

☆ Presented at the Second Summer School in Immunotoxicology, Beaune, France, 13–15 October 1993.

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SSDI 0300-483X(94)02878-X

Keywords: Food sensitization; Food allergens; Anaphylaxis; Food consumption; Epidemiology

1. Introduction

The digestive tract of man has a remarkable capacity to adapt to different patterns of eating as well as to the enormous variety of foods which are consumed. Regulatory mechanisms exist for the induction and suppression of immunological reactions to the antigens of ingested food (André et al., 1974, 1975; Richman et al., 1978; Lafont et al., 1982) and an abnormal immune response to food antigens is defined as food allergy. A cause-and-effect relationship between specific antibodies and/or immunocompetent cells on the one hand, and clinical symptoms on the other hand, is required for the diagnosis of food allergy. In many cases of clinical reactions to food, an immunological mechanism will not be demonstrable and in these cases the term 'intolerance' is preferable and the concept of pseudo-allergy is more or less synonymous with intolerance. The term intolerance should be further elaborated, not only by describing its signs and provoking products, but also by speculating on the operative mechanism that might be involved. Thus, reference can be made to food intolerance due to non-IgE mediated mast cell degranulation or to biogenic amine loads contained in food.

Food products may be food allergens, that trigger a pathological reaction through an immunological mechanism, or they may be constituents capable of provoking a reaction without involvement of the immune system: food allergy and food intolerance, respectively. The manifestations ascribed to food hypersensitivity enclose a wide spectrum, although it is not known why the manifestations of food allergy and intolerance differ between individuals since the same food allergen may cause quite different complaints in different patients.

A wide range of symptoms have been described:

- gastrointestinal symptoms: vomiting, diarrhoea, abdominal pain (colic), malabsorptive disorders;
- respiratory manifestations: rhinitis, asthma;
- cutaneous manifestation: urticaria, oedema, pruritis, atopic dermatitis; and
- anaphylaxis (shock).

Anaphylaxis is an acute, and in principle life-threatening, immunological generalized reaction that results from sudden mast cell degranulation with mediators release. Mast cell degranulation on a non-immunological basis is called anaphylatoïd reaction. The failure to recognize the severity of these reactions and to administer epinephrine promptly increases the risk of a fatal outcome. The data on the incidence, prevalence or mortality rate for food-induced anaphylaxis are not very reliable. Fatal food-induced anaphylaxis is rarely reported although Yunginger et al. (1988) described seven cases of fatal post-prandial anaphylaxis and Sampson et al. (1992) reported six children and adolescents who died of anaphylactic reactions to

food and seven others who experienced near-fatal anaphylactic reactions. The foods most frequently incriminated as a trigger of anaphylaxis were: peanuts (eight cases), nuts (six cases), pecan (one), crab (one), fish (one), egg (one) and milk (one). However, recently the spectrum has become wider with, for instance, two cases of anaphylactic reactions set off by the ingestion of a small amount of mustard sauce (Montreal et al., 1992), and a case of anaphylaxis caused by banana (Savonius and Kanerva, 1993) was also reported, completing the picture of severe reactions to food.

It may be noted that the foods which are the most implicated in food-induced anaphylaxis are not part of everyday food, but the low number of reports in the medical literature does not permit general conclusions with regard to food products that are involved in severe reactions and the evolution of food sensitization compared with changes in eating habits. In the present study we analysed, over a period of 9 years (1984–1992), a group of 580 patients with pathological reactions to food, comparing the evolution of food sensitization with the main tendencies of food consumption in France.

In a group of 60 of these patients who presented severe reactions to foods, attempts were made to determine the most frequently involved food products in anaphylaxis.

2. Patients and methods

Over a period of 9 years (1984–1992), 580 patients, 480 adults and 100 children, with a mean age of 30 (range, 1–83), 290 females and 290 males, were investigated for food allergy in the same clinical department and proved to have both food sensitization and food allergy to at least one substance by an oral provocation test, except in those with anaphylaxis. The clinic pictures included urticaria (in 254 cases), atopic dermatitis (172), asthma and/or rhinitis (54), anaphylaxis (60), and irritable bowel syndrome (40).

In the group of 60 patients with severe reactions to food, consisting of 41 women and 19 men aged between 15 and 83 years with a mean age of 34, 52 experienced anaphylactic shocks (two with cardiac arrest), six had angioedema (one needing tracheal intubation and another tracheotomy) and two severe bronchospasms that needed mechanical ventilation.

In order to identify the sensitizations, a clinical history was completed for all of the patients. Skin tests were made with the prick test technique in all the patients to whom antihistaminic drugs had not been administered. The tests were made on the volar part of the forearm by using Stallerpoint needles and the following solutions: (i) glycerol food extracts; (ii) glycerol solvent for the negative reference solution; and (iii) codein phosphate at 9% for the positive reference solution (Stallergénes S.A., Fresnes, France). Sometimes tests were also made with fresh food extracts by the method prick by prick. Skin tests were considered as positive if the diameter of the weal was at least 5 mm and 3 mm larger than that of the negative reference test. Tests were made systematically for egg, cow milk, wheat, soy, peanut, orange, crab, fish, celery, tomato, pork, and baker's yeast. The other foods tested depended on each individual's clinical history.

Specific IgE were assayed on a plasma sample by the radioimmunological method (RAST, Pharmacia, Uppsala, Sweden) following the producer's instructions. The following tests were made systematically: peanut, wheat, celery, crab, cow milk proteins, egg white, onion, orange, parsley, fish, pork, soy, and tomato. The remaining specific IgE tests were made on the basis of each individual's clinical history.

The evolution of sensitization to food products was compared with statistical data, obtained from the French Institut National de la Statistique et des Etudes Economiques, on the evolution of food products consumption over the same period (Abramovici, 1992).

3. Results

In the group of 60 cases with severe reactions to food, the most frequently implicated products were: celery (30%), crustaceans (17%), fish (13%), peanuts (12%), mango (7%), mustard (3%). The detailed results are shown in Table 1.

The only food sensitizations that were taken into account in the 580 patients were those identified by the presence of plasma IgEs. Indeed, the reactivity of skin tests clearly proved to be too weak: for instance, in the same patients the positivity was only 25% for wheat and soy, 24% for peanut, 37% for crab, 29% for celery and 26% for cow milk proteins.

The sensitization to food products in the group of 580 patients reveals, in decreasing order of frequency: wheat (39%), peanuts (37%), crab (34%), celery (30%), soy (30%); the detailed results are shown in Table 2. Over the 1984–1992-period there

Table 1
Food Involved in anaphylactic reactions, Lyon — 1984–1992

Food	Incidence frequency
Celery	18
Crab	10
Fish	8
Peanut	7
Mango	4
Mustard	2
Soy	2
Lychee	2
Kiwi	2
Cow milk	2
Egg	1
Almond	1
Coconut	1
White bean	1
Ewe milk	1
Avocado	1
Beef	1
Orange	1
Camomile	1

Table 2
Evolution of sensitizations over the period 1984–1992

Food	Period								Tendency		
	1984–1986 $n = 149$		1987–1989 $n = 192$		1990–1992 $n = 239$		1984–1992 $n = 580$		Sensitization	Consumption (Abramovici, 1992)	
	n	%	n	%	n	%	n	%			
Wheat	43	29	69	36	114	48	226	39	↑	bread cereals	↓ ↑↑ (>20%)
Peanut	54	36	64	33	95	40	213	37	=		↑
Crab	63	42	59	31	77	32	199	34	=		↑
Celery	51	34	69	36	53	22	173	30	=		↑
Soy	26	17	68	35	79	33	173	30	↑		↑
Parsley	48	32	55	27	76	32	179	31	=		↑[a]
Tomato	34	23	44	23	83	35	161	28	↑		↑ (> 18%)
Orange	31	21	41	21	68	28	140	24	↑		↑[a]
Fish	32	21	52	27	55	23	139	24	=		↑ (> 18%)
Egg	36	24	50	26	48	20	134	23	=		=
Hazelnut	28	19	45	23	55	23	128	22	=		↑[a]
Yeast	25	17	39	20	59	25	123	21	↑		↑
Onion	22	15	41	21	55	23	118	20	↑		↑[a]
Pea	26	18	54	28	33	14	113	20	=		↑[a]
Milk	31	21	45	23	31	13	107	18	↓	milk dairy products	↓ ↑↑ (>40%)
Garlic	19	13	34	18	48	20	101	18	↑		↑[a]
Potato	29	19	40	20	30	13	99	17	↓		↓
Pork	23	15	43	22	32	13	98	17	=		=
Rice	11	7	39	20	50	21	100	17	↑		↑↑ (> 50%)
Rye	16	11	33	17	52	22	101	17	↑		↑[a]
Carrot	33	22	32	17	28	12	93	16	↓		↑[a]
Apple	24	16	33	17	31	13	88	15	=		↑
Shrimp	23	15	29	15	29	12	81	14	=		↑
White Beans	8	8	41	21	23	10	72	12	=		↑[a]
Maize	12	5	26	14	29	12	67	12	↑		↑[a]
Kiwi fruit	11	7	37	19	16	7	64	11	=		↑[a]
Melon	15	10	24	13	23	10	62	11	=		↑[a]
Mustard	8	5	27	14	27	11	62	11	↑		↑↑ (> 55%)

[a]Consumption of fruits and vegetables increased generally.

was an increase in frequency for allergens such as wheat, soy, yeast, onion, garlic, rice, rye and mustard. The frequency is relatively stable for peanuts, crab, shrimp, celery, fish, orange, egg, pork, hazel nut and apple, and there was a gradual decrease in frequency for milk, potato, carrot and strawberry. For comparison, the changes in the consumption of food products (Abramovici, 1992) are shown in Table 2. There was a gradual decrease in the consumption of bread, but a significant increase for cereals (20%), a gradual increase for milk but a significant increase for dairy produce (>40%), a significant increase for rice (>50%), for seasoning sauces (>55%), for tinned, canned, bottled, deep-frozen foods (>40%), fish (>18%), fresh fruits and vegetables (>18%). Eggs, beef and pork consumption were stable but potato consumption decreased.

4. Discussion

It may be noted that better modern diagnosis and greater skill of physicians contribute significantly to the increase of food sensitization. However, the present study clearly shows that the incidence of food sensitization is increasing regularly. This observation is consistent with the observation of a general increase of atopy in other countries like Japan (Nakagomi et al., 1994). As far as food sensitization is concerned, symptoms caused by an allergy to fruits and vegetables have been also reported more frequently in Italy (Ortolani et al., 1993). The number of patients reported by these authors was also very high with 706 observations, and anaphylaxis present in 2%.

The data collected in the 580 patients from the present study show clearly that the sensitivity of skin-prick tests, averaging at best 25%, is too low to be considered as satisfactory in an epidemiological study; this report relies on plasma specific IgE determination only. Methodological limitations of the present study should be mentioned: a possible development of the sensitivity of the RAST assay over the concerned period, restrictive research on food sensitization as a function of clinical history,and changes in the medical approach to food allergy by physicians.

As in the other studies mentioned (Yunginger et al., 1988; Montreal et al., 1992; Sampson et al., 1992; Savonius and Kanerva, 1993), the food products frequently involved in anaphylaxis are not of primary nutritional importance. Some have a high frequency of sensitization (peanuts, celery, crustaceans, fish), whilst others are less frequent, but all may be masked in many preparations. A real problem is how to avoid hidden allergens in commercial foods, as most dramatic accidents occurred after dining away from home or by unknowingly ingesting the foods responsible for the reactions.

The sensitization to food products in the whole group of patients of the present study reveals the increase in frequency to allergens such as wheat, soy, yeast, onion, tomato, garlic, rice, rye, white beans, orange and mustard. In comparison with previous data on the frequency of sensitization to different food products in France (Moneret-Vautrin and Andre, 1983) there are notable differences. For instance, the sensitization to peanuts (4%), wheat (4%), celery (7%), and mustard (1%) increased significantly and other products like rice and soy, which were not mentioned in these data, appear to be important allergenic products.

Increased consumption and a more attentive clinical examination may be reasons for this evolution. For example, sensitization to rice followed the increase of rice consumption, sensitization to wheat parallels consumption of cereals in spite of the decrease in bread consumption. Despite an increased consumption, one may observe a stable but already high frequency of sensitization to peanuts (37%), crab (34%), celery (30%).

Surprisingly, a significant increase in dairy produce consumption corresponds to a stable or slow rate of decrease of sensitization to milk and some allergens may be affected by the method of preparing the food.

Patterns of cross allergenicity may also interfere in drawing up the clinical picture. Cross allergenicity among celery — cucumber — carrot — watermelon and between peanut — soy — garden peas — haricot beans or between hazelnut — rye grain — sesame seeds — kiwis — poppy seeds has demonstrated by possession of common allergenic structures. However, the differing developments of sensitization to peanut (which remains stable) and soy (which increases) or the sensitization to tomato (which increases) and potato (which decreases), although belonging to the same vegetable family, prove that cross allergenicity is not a determinant factor. The fact that specific IgEs were assayed systematically or not systematically in the 580 patients did not modify the conclusions.

Essentially, the present tendency of sensitization, of a continuous increase, follows the changes in eating habits.

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