

# Food Allergy in *Alergológica*-2005

M Fernández Rivas

Allergology Service, Hospital Clínico San Carlos, Madrid, Spain

## ■ Abstract

*Background:* *Alergológica*-2005 is a cross-sectional study carried out in Spain in 4991 new patients prospectively recruited in allergy clinics.

*Objective:* To describe the characteristics of food allergic patients included in *Alergológica*-2005.

*Results:* Food allergy was diagnosed in 369 subjects (7.4%, 95% CI, 6.7%-8.1%). The most common offending foods were fruits (33.3% of cases), nuts (26%), shellfish (22%), egg (16%), milk (13.9%) and fish (9.8%). Rosaceae fruits and crustaceans elicited 23.6% and 18.7% of the reactions, respectively. Milk and egg were the most common foods in patients < 5 years of age, whereas fruits and nuts were the most prevalent foods in patients over 5 years. The most frequent manifestations included skin reactions (65.3%), oral allergy syndrome (33.6%), digestive symptoms (24.7%) and anaphylaxis (17.9%). The clinical presentation differed among foods. Prick-tests were carried out more frequently than serum immunoglobulin E (IgE) determinations (95.9% vs. 65%). Oral challenges were performed in 13% of patients, and 72.3% of these were open. Food allergy was diagnosed on the basis of medical history and positive IgE in 60.2% of the patients, ranging from 13.7% for milk to 75% for cereals. The self perception of patients' quality of life was lower than that of the 75% of Spanish reference population.

*Conclusion:* Food allergy is diagnosed in 7.4% of the patients seen in allergy clinics across Spain, and has an important impact on the quality of life of patients. The foods involved in reactions change with age. The clinical presentation changes with the food, although the skin is the most frequently affected organ.

**Key words:** Allergy Diagnosis. Food. Fruit. Oral challenge. Nuts. Prevalence. Spain.

## ■ Resumen

*Antecedentes:* *Alergológica*-2005 es un estudio transversal realizado en España sobre 4991 pacientes nuevos seleccionados prospectivamente en consultas de alergia.

*Objetivo:* Describir las características de los pacientes alérgicos a alimentos de *Alergológica*-2005.

*Resultados:* Se diagnosticó alergia a alimentos en 369 pacientes (7,4%; IC95% 6,7%-8,1%). Los alimentos más frecuentemente implicados son las frutas (33,3%) seguidas de frutos secos (26%), marisco (22%), huevo (16%), leche (13,9%) y pescado (9,8%). Las frutas rosáceas y los crustáceos inducen el 23,6% y 18,7% de las reacciones, respectivamente. Leche y huevo son los alimentos más frecuentes en menores de 5 años, mientras que frutas y frutos secos lo son en los demás pacientes. La clínica más frecuente es cutánea (65,3%), síndrome de alergia oral (33,6%), digestiva (24,7%) y anafilaxia (17,9%), aunque varía con cada alimento. Para el diagnóstico se realizaron pruebas cutáneas en 95,9% de los pacientes, determinaciones séricas de inmunoglobulina E (IgE) específica en 65%, y provocaciones orales en 13%, de las que el 72,3% fueron abiertas. El 60,2% de los diagnósticos se realizaron con historia clínica e IgE específica, variando de 13,7% en los alérgicos a leche a 75% en los alérgicos a cereales. La percepción de calidad de vida en los alérgicos a alimentos es inferior a la del 75% de la población española de referencia.

*Conclusiones:* La alergia a los alimentos se diagnostica en 7,4% de los pacientes atendidos en consultas de alergia en España, y tiene un impacto importante en la calidad de vida. Los alimentos implicados cambian con la edad. La presentación clínica varía con el alimento, aunque la piel es el órgano más frecuentemente afectado.

**Palabras clave:** Alergia. Alimentos. España. Diagnóstico. Fruta. Frutos secos. Prevalencia. Provocación oral.

## Introduction

The general population perceives food allergy as a major health problem, although only a minority of suspected cases can be confirmed after a full clinical evaluation including

oral food challenges. There is a marked heterogeneity in the prevalence of food allergy among studies that results from differences in design or methodology, or differences between populations [1, 2]. Despite this, it is generally accepted that food allergy may affect 1% to 3% of the general population. It

is more frequent in children, especially in those under 3 years of age in whom the prevalence may be up to 8% [1, 2]. Within the context of the European Union funded project EuroPrevall [3], an epidemiological study is being carried out in 8 European countries – including Spain (Madrid) – that aims at establishing the prevalence of food allergy in the general population.

However, most of the current knowledge on food allergy – as in any other allergic and non-allergic conditions – does not come from studies carried out in the general population, but from case series of patients referred to expert clinics for evaluation. Most of the studies comprise a limited number of patients who are selected in a certain area. Large studies with a country-wide base are exceptional. The study we present here, *Alergológica-2005*, is a cross-sectional study carried out throughout Spain on almost 5000 patients visiting allergy clinics for their first evaluation. The main objective was to analyse the clinical practice of Allergy in Spain, and to establish the clinical and epidemiological characteristics of Spanish patients who demand specialised Allergy care. In this manuscript we report the data on food allergy within *Alergológica-2005*.

## Methods

*Alergológica-2005* is a cross-sectional study carried out in Spain from March 2005 to February 2006 by the Spanish Society of Allergology and Clinical Immunology (SEAIC), and sponsored by Schering-Plough. More than 300 allergists working in public and private clinics across the country

prospectively selected 4991 patients (first visits). The study design, ethical aspects and statistical analysis are described in a previous article in this issue of the Journal of Investigational Allergology and Clinical Immunology [4]. Written informed consent was obtained from all the patients or their legal representatives.

## Statistical analysis

For qualitative variables the frequency (percent) and its 95% confidence interval (95% CI) was estimated. For quantitative variables, mean and standard deviation (SD) were calculated. Median, minimum and maximum values are given in those quantitative variables with large dispersion and atypical distribution. Frequencies were compared using the  $\chi^2$  test. *P* values <0.05 were considered significant.

## Results

### Prevalence

The prevalence of diagnosed food allergy among patients first seen in Allergy clinics across Spain was 7.4% (95% CI, 6.7%-8.1%) (369 cases). This is the fifth most important allergy diagnosis after rhinoconjunctivitis, asthma, drug allergy and urticaria/angioedema.

Figure 1 shows the prevalence by regions. As can be seen, this varies from 2.3% in Asturias to 13% in Navarra. There is

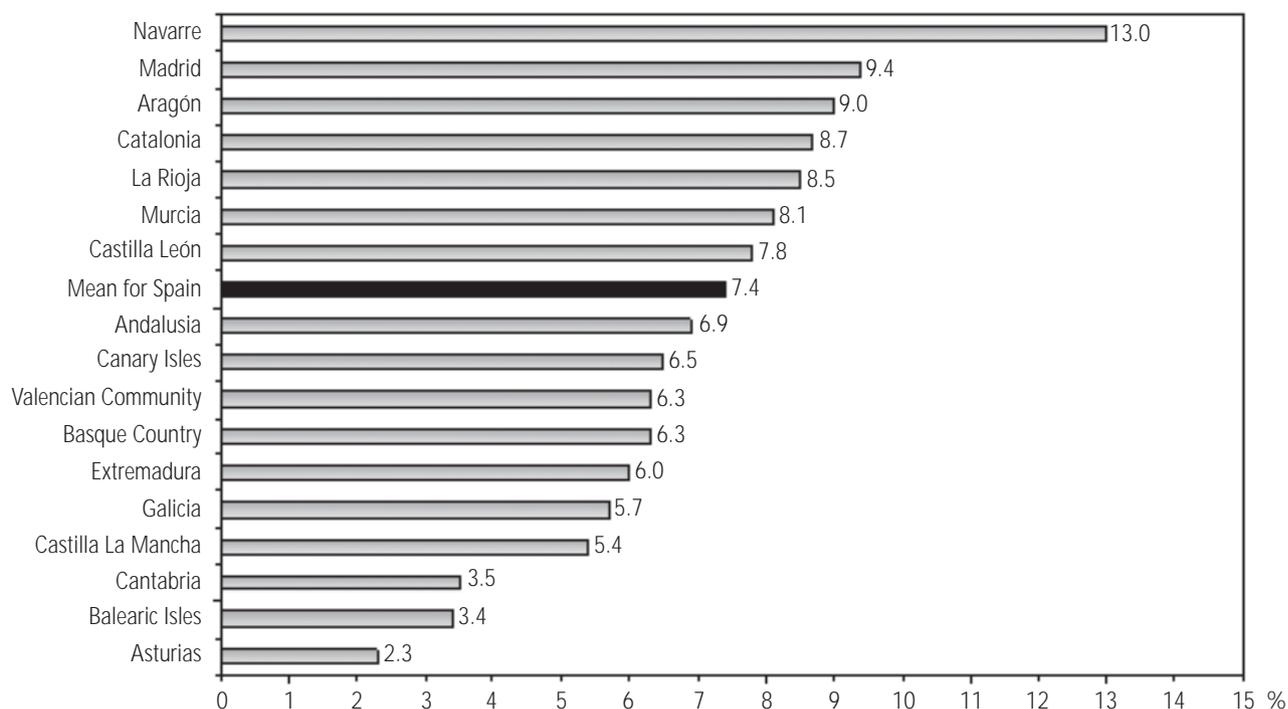


Figure 1. Prevalence of Food Allergy in Different Regions of Spain.

a significant ( $P < .05$ ) decrease in the frequency of food allergy in different age groups: 47.2% of study patients below 3 years of age were diagnosed with the disorder, whereas the figure in 3 to 5 year-olds was 21.1%. In patients over 5 years it was below 9%, ranging from 3.1% in those over 50 years of age and 8.7% in those 16 to 20 years-old.

### Demographics

Food allergic patients had a mean age of 22.9 years (1 to 88 years, SD 18.10 years), and there was a higher proportion of females (54.9%,  $P < .05$ ). Two thirds of the patients (66.4%) came from urban areas, and 92% had a middle socioeconomic status.

### Associated atopic and non-atopic diseases

Personal and family history of atopy were commonly found in patients with food allergy. The most frequent familiar atopic conditions reported were rhinitis (31.1%), followed by asthma (22.9%), conjunctivitis (16.7%), atopic dermatitis (10.2%) and food allergy (9%). In the personal history of atopy, the most frequently associated allergic disease was rhinoconjunctivitis (40.70%), followed by asthma (21.2%), urticaria/angioedema (18.1%) and atopic dermatitis (9.6%).

Complaints different from the atopic disorders mentioned above were uncommon. Gastroesophageal reflux was present in 3.8%, hypertension in 2.4%, diabetes in 0.5%, hypercholesterolemia in 3.8%, rheumatic diseases in 2.4%, and cardiologic diseases in 0.5%.

Childhood diseases were only recorded in patients under 14 years of age. The most frequent exanthematic disease was

chickenpox (varicella) (84.1% of cases), followed by viral exanthemas (27.3%), measles (15.9%), rubella (11.4%), and mumps (9.1%). Other infections were reported by 53.5% of children, and the commonest was otitis (47.1%), followed by infectious diarrhoeas (38.2%), tonsillitis (25%), bronchiolitis (23.5%) and laryngitis (16.2%). Adenoidectomy was performed in 3.3% of children and tonsillectomy in 2.5%. The great majority of children (99.2%) had been vaccinated according to the standard calendar.

### Breast feeding and introduction of cow's milk formula and solid foods

Among food allergic patients below 14 years of age, 62.8% were exclusively breast fed, whereas 20.7% received exclusively cow's milk formula, and the remaining 16.5% both. The type of cow's milk formula received was conventional formula in 74.3%, partial hydrolysed in 6.8%, and extensively hydrolysed in 12.2%. During maternity care 43.7% of newborns received a bottle which consisted of conventional cow's milk formula in 83.7% of cases.

Fruits and gluten-free cereals were introduced into the babies' diet at 5 months of age (mean value). Gluten-containing cereals, fish and egg were introduced later at 8, 10 and 11 months, respectively. Cow's milk was introduced at 13.4 months.

### Referral for allergy evaluation

Half of patients (50.4%) were referred to the allergist by general practitioners and 33.7% by other specialists, mainly paediatricians (70.4%), and with a much lower

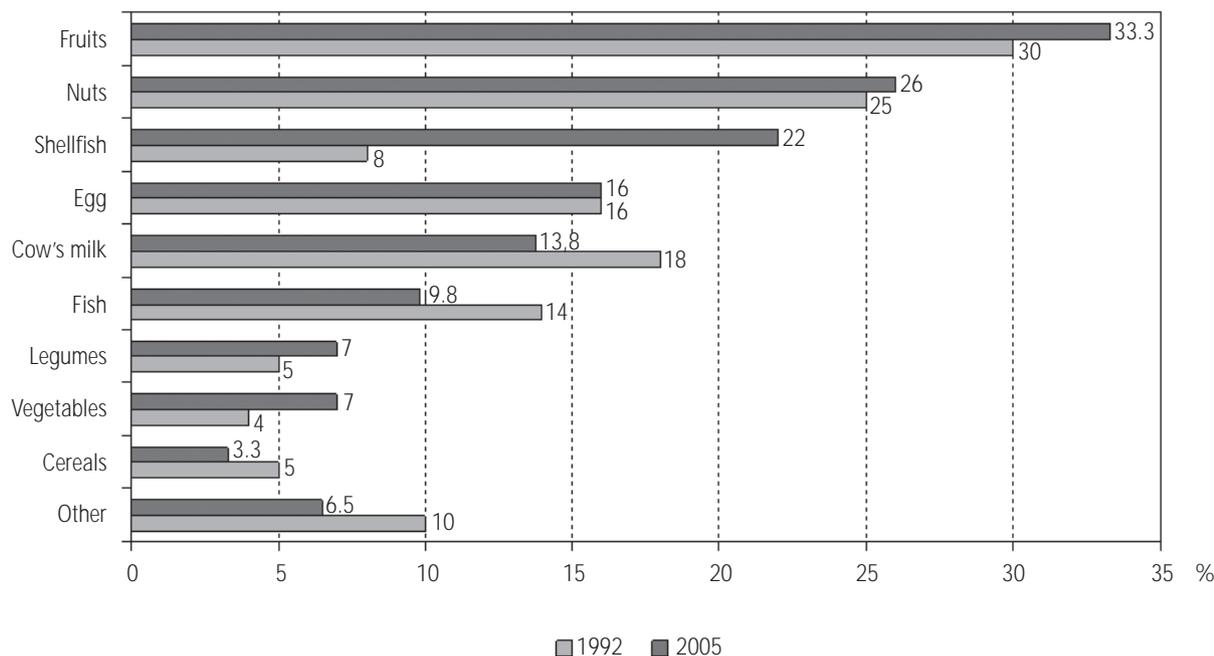


Figure 2. Offending Foods in *Alergológica*-1992 and *Alergológica*-2005.

frequency by pulmonologists (5.6%), ENT specialists (5.6%), gastroenterologists (3.2%) and dermatologists (2.4%). Emergency room services referred 11.2% of the patients. Only 13.8% of subjects requested an allergy evaluation on their own initiative. Following referral, patients waited to be first seen by an allergist a mean of 81 days (median 30 days, SD 142.4).

In 68.9% of the patients finally diagnosed with food allergy, the reason for referral was adverse reactions to foods. The remaining patients consulted for other symptoms (mainly nasal, bronchial, skin symptoms and anaphylaxis) that were related to associated allergic diseases, although these figures may also reflect the fact that the patient had not been able to establish a causal relationship between the food ingestion and the onset of symptoms.

Sixty one percent of patients consulted after the first reaction. The remaining 39% had had previous reactions that were of similar characteristics in 81.6% of cases. A significantly ( $P < .05$ ) higher frequency of previous (repeated) reactions was found for nuts, fruits, legumes and vegetables.

The mean age at onset was 18.3 years (median 15, SD 15.8). When first seen the patients had presented symptoms for almost 2 years (mean 21.8 months, median 10, SD 27.6) and had suffered a mean of 2.4 reactions in the previous 12 months (median 1, SD 3.0).

#### Offending foods

Food allergy was diagnosed in 369 patients, and the foods involved were the following: fresh fruits in 123 patients (33.3%), nuts in 96 (26%), shellfish in 81 (22%), egg in 59 (16%), milk in 51 (13.9%), fish in 36 (9.8%), legumes in 26 (7%), vegetables in 26 (7%), cereals in 12 (3.3%) and spices in 6 (1.6%) (Figure 2). Among fruits, the Rosaceae family induced reactions in 87 patients, which represents 70.7% of the reactions induced by fruits (87/123) and 23.6% (87/369) of all

the food allergic reactions. Crustaceans induced reactions in 69 subjects, which is 85.2% of the reactions induced by shellfish (69/81) and 18.7% (69/369) of all food allergic reactions.

When compared to the foods involved in the Alergológica-1992 survey (Figure 2), there is only a significant increase in the frequency of allergic reactions to shellfish (8% in 1992 vs. 22% in 2005,  $P < .001$ ).

There was a higher proportion of allergic reactions to milk in males (18.0% vs. 10.1%,  $P < .05$ ), but for the remaining foods no differences were found in sex distribution.

Reactions with fruits appeared with a higher frequency in spring (40.7%) and summer (36.0%) ( $P < .05$ ), which is probably related to the seasonal pattern of consumption of several fruits. No seasonal patterns were observed for the remaining foods.

The frequency a food is involved in allergic reaction changes with age as is shown in Figures 3A and 3B. There are significant differences between children ( $\leq 15$  years-old) and adults ( $> 15$  years-old), and even within the paediatric population there are differences in the first 5 years of life. Almost two thirds of the patients with cow's milk allergy are in the group  $< 2$  years of age, and 78.9% of patients with egg allergy are aged below 5 years. Milk and egg are the main foods in children  $< 5$  years, and especially in those  $< 2$  years of age. Fish allergy is already diagnosed in patients  $< 2$  years of age, but its frequency increases in older children and adults. A similar trend is seen with legumes. In contrast, allergy to fruits and nuts starts to be diagnosed later, in older children and adolescents, and these two food groups are the most prominent in adults. More than 90% of the allergies to shellfish, vegetables and spices were diagnosed in patients older than 15 years.

#### Clinical presentation

The most frequent manifestations of food allergy included skin reactions (65.3% of patients), oral allergy syndrome (OAS)

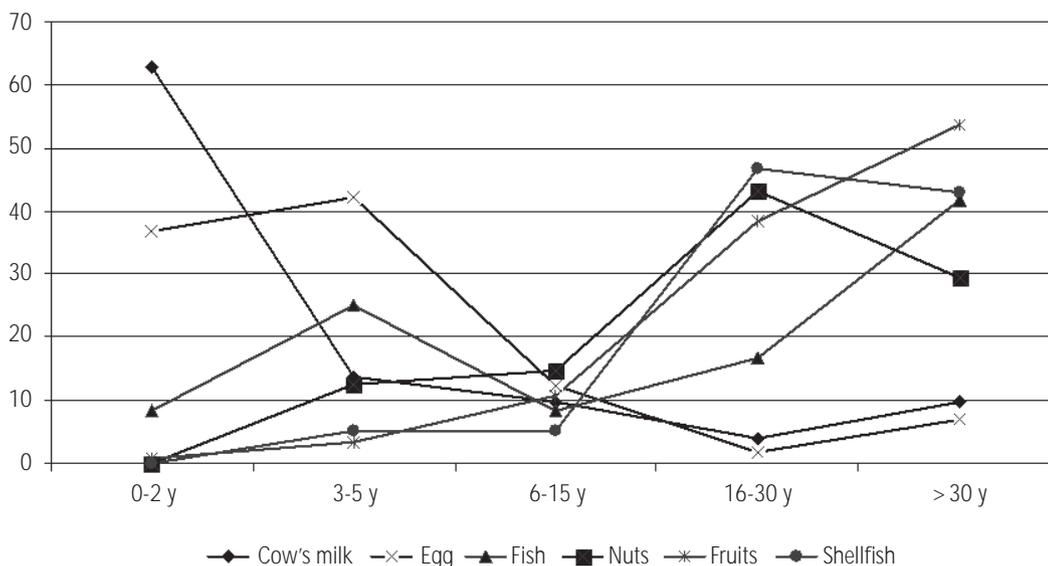


Figure 3A. Frequency of Allergy to Foods in Different Age Groups.

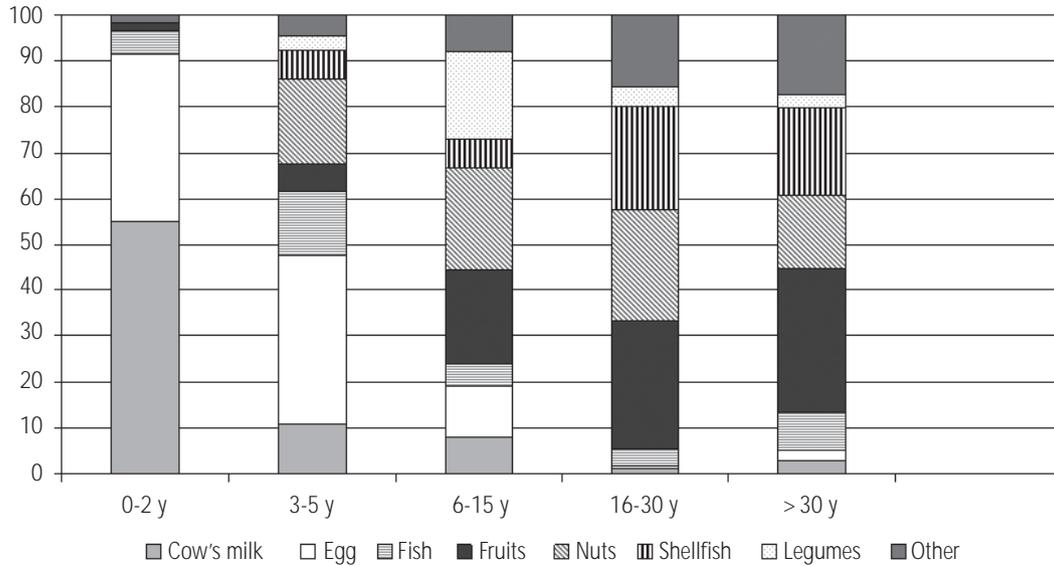


Figure 3B. Frequency of Allergy to Foods Within Age Groups.

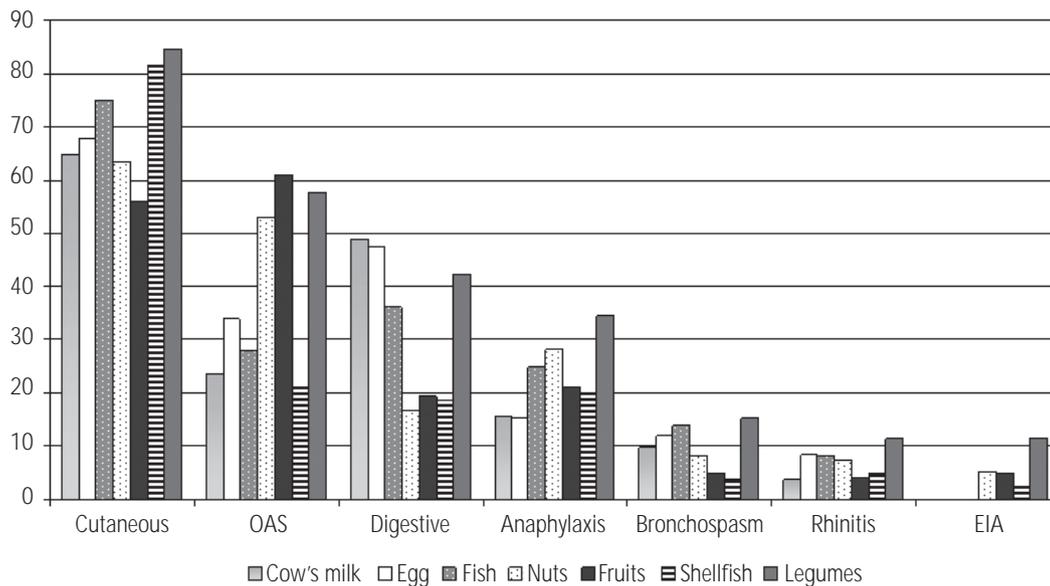
(33.6%) and digestive symptoms (24.7%). Anaphylaxis was found in 17.9% of patients, and exercise-induced anaphylaxis in 2.4%. Bronchospasm and rhinitis were observed in 4.6% and 4.1% of patients, respectively. Within the cutaneous manifestations, urticaria/angioedema was the most frequent (43.4%), followed by contact urticaria (29.8%) and atopic dermatitis (7.0%).

The clinical presentation of different foods is depicted in Figure 4. Skin reactions are the most frequent for all the foods (> 64%) with the exception of fruits (56%) in which OAS is seen with a higher frequency (61%). OAS is reported by 53% to 61% of patients

allergic to nuts, legumes and fruits, but only by 21% to 34% of patients allergic to animal foods such as cow's milk, egg, fish and shellfish. Digestive symptoms are also seen more frequently (36% to 49%) among those allergic to milk, egg, fish and legumes, than among the subjects allergic to fruits, nuts and shellfish (< 20%).

*Diagnostic workup*

The number of days needed to establish the diagnosis of food allergy ranged from 1 to 180, with a mean value of 19.1 (median 9.0, SD 26.3).



\* OAS indicates oral allergy syndrome; EIA, exercise-induced anaphylaxis.

Figure 4. Clinical Presentation of Reactions to Foods\*.

Table 1. Diagnostic Tests Performed\*

Food	MH PhE (%)	SPT (%)	Serum sIgE (%)	Total IgE (%)	Elimination diet (%)	Oral challenges (%)	Diagnosis with +ve MH +ve SPT/sIgE
ALL	98.9	95.9	65.0	52.8	26.8	13.0	60.2
Cow's milk	98.0	90.2	74.5	60.8	54.9	31.4	13.7
Egg	100	100	81.3	69.5	39.0	16.9	44.1
Fish	97.2	97.2	66.7	47.2	33.3	27.8	38.9
Nuts	100	99.0	63.5	52.1	24.0	5.2	70.8
Fruits	98.4	97.6	49.6	39.8	19.5	5.7	74.8
Vegetables	100	100	65.4	65.4	38.2	5.5	56.3
Legumes	100	96.2	61.5	53.8	30.8	11.5	57.7
Shellfish	98.8	97.5	70.4	55.5	22.2	9.9	67.9
Cereals	100	100	58.3	50.0	16.7	8.3	75
Spices	100	100	100	100	50.0	16.7	33.3

Abbreviations: \* MH indicates medical history; PhE, physical exam; SPT, skin prick test; sIgE, specific immunoglobulin E; and +ve, positive.

The diagnostic tests used are shown in Table 1. Skin prick tests (SPT) were carried out in 95.9% of patients without significant differences among foods (from 90.2% to 100%), whereas serum specific immunoglobulin E determinations (sIgE) were performed in a significantly ( $P < .001$ ) lower number of patients (average 65%). The frequency of sIgE testing varied significantly ( $P < .01$ ) among foods: from 49.6% for fruits to 100% for spices.

Elimination diets with diagnostic purposes were carried out in 26.8% of patients, and there were significant differences among foods ( $P < .001$ ), that range from 16.7% for cereals to 54.9% for cow's milk.

Oral challenge tests were only performed in 48 of the 369 patients diagnosed with food allergy (13%) with the use of this test varying from 5.2% for nuts to 31.4% for milk. However, since the number of oral challenges carried out with many food items is low (Table 2), reliable comparisons among foods could not be made. As shown in Table 2, 65 oral challenges were performed in 48 patients, and comprised 47 open challenges (72.3%), 13 single-blinded (20%) and 5 double-blinded challenges (7.7%). The frequency of the open challenges is

significantly higher ( $P < .01$ ) than that of the blinded challenges. It cannot be established whether the blinded challenges were placebo-controlled, because that information was not collected in the case record forms (CRF) of the study.

Based on the data presented in Tables 1 and 2, we calculated the frequency of food allergy diagnosis made solely on the basis of a suggestive medical history together with positive IgE to the food assessed by SPT and/or serology. For this estimation, we subtracted the number of elimination diets and oral challenges from the number of patients diagnosed (assuming that they are mutually exclusive which is not the case in food allergy diagnosis). As shown in the right-hand column of Table 1, 60.2% of patients were diagnosed this way, ranging from 13.7% to cow's milk to 75% to cereals.

### Treatment

Avoidance was the most frequent therapeutic recommendation given to food allergic patients (93% of cases). Antihistamines were given to 35.2% of patients and corticosteroids to 10.3%. Unfortunately, a specific category for epinephrine was missing in the CRF, and therefore it cannot be established how frequently it was recommended.

### Costs

Two thirds of the patients (66.5%) had consulted their general practitioner for their allergy – not specifically the food allergy – in the previous 3 months (mean 1.9 times, median 1, SD 1.8), and 26.2% had visited other specialists in the previous year (mean 1.4 times, median 1, SD 0.9). More than half (52.1%) required emergency room treatment in the previous 12 months (mean 1.6 times, median 1, SD 1.1), but only 4.2% needed hospitalisation (none of them more than once) for a mean number of days of 2.5 (median 1, SD 2.3).

More than 60% of the patients (61.1%) had received medications in the previous year. The drugs most frequently used were antihistamines (69.3% of patients treated). Corticosteroids were received by 50% of subjects: 26.4% orally or parenterally, 18.9% via inhalation, and in 15.1% topically

Table 2. Oral food challenges

Food	Double blind	Single blind	Open	Total
ALL	5	13	47	65
Cow's milk	0	2	14	16
Egg	0	1	9	10
Fish	0	3	6	9
Nuts	2	1	2	5
Fruits	1	1	5	7
Vegetables	0	1	1	2
Legumes	0	0	4	4
Shellfish	1	2	5	8
Cereals	0	1	0	1
Spices	1	0	0	1
Other	0	1	1	2

onto the skin. Bronchodilators were given to 21.2% of patients and most of these were short-acting beta agonists.

Seven percent of the patients had taken days off work because of their allergy (any allergy, not specifically the food allergy) in the previous year (mean 1.1 times, median 1, SD 0.3) for a mean of 11.1 days (median 3, SD 26.2). Up to 17.6% of parents of allergic children had taken days off due to illness for a mean of 5.8 days (median 3, SD 5.6). Due to their allergies, students were absent from school a mean of 14.7 days in the previous year (median 7, SD 20.5). Students' performance was good in 81.8% of the patients, medium in 16.7% and poor in 1.5%.

### Quality of life

The mean value on the physical scale of the quality of life (QL) questionnaire SF12 was 45.8 (percentile 25 – P25 - of the reference Spanish population), and 46.6 (P20-P25) on the mental scale. This means that patients with food allergy perceived their QL as being lower than 75% of the Spanish population with a similar sex and age, both on the physical and mental scales.

## Discussion

In *Alergológica*-2005 we have found that the prevalence of food allergy in Spain, in the highly selected population of patients referred to allergy clinics, is 7.4% (95% CI, 6.7%-8.1%). This figure is significantly higher ( $P < .001$ ) than the 3.6% obtained in the *Alergológica* survey carried out in 1992 with the same methodology [5]. The reasons for this increase (higher awareness, better diagnostic tests, changes in dietary habits, among others) cannot be established. This result is in line with previous studies that show an increase in the prevalence of tree nut and peanut allergies, and in severe allergic reactions induced by foods [6-8].

*Alergológica* has provided a ranking of offending foods in the Spanish population that are, in decreasing order, fruits, nuts, shellfish, egg, cow's milk, fish, legumes, vegetables, cereals and spices. Cow's milk and egg are the most important foods in children below 5 years of age, as is the case in Western countries. This reflects the early introduction of these foods into the child's diet and their natural history with a frequent development of tolerance [1, 2, 9]. The foods most commonly involved in allergic reactions after late childhood are fruits, and among these, those belonging to the Rosaceae family. This finding is in agreement with previous Spanish series [10-14], and other studies performed in the Mediterranean area [1, 2, 15, 16]. After fruits, the second food group involved in allergic reactions are nuts. Tree nuts are common offending foods, and the peanut is especially relevant in the USA and UK, and it is gaining importance in Central and Northern Europe [1, 2, 6-8]. Unfortunately, in *Alergológica*, the prevalence of peanut allergy cannot be established since this food was not coded for independently, and thus it may have been included in either nuts or legumes due to language use issues and lack of pertinent instructions in the CRF. Another interesting finding is the high frequency of adverse reactions to shellfish in *Alergológica*, which in more than 85% of cases are due to crustaceans. Shellfish allergy has already been described as the most

prevalent food allergy in the Canary Islands [12]. Additionally, this is the only group of foods in which a significant increase has been observed from 1992 to 2005.

When considering all the foods together, the most frequent clinical manifestations of food allergy included skin reactions, mainly urticaria/angioedema, followed by OAS, digestive complaints and anaphylaxis. It is well known that the skin is the target organ most frequently involved in food allergic reactions, and that foods are frequent causes (even the leading cause in some series) of anaphylaxis [17, 18]. However, when the clinical manifestations are categorised by foods, some interesting differences emerge. OAS is infrequently reported in reactions to cow's milk, egg and fish. This result should be considered with caution since the majority of patients allergic to these foods are small children that may be unable to communicate their problem. OAS is also infrequent in patients with shellfish allergy, and this is not related to the age of the patients since this food allergy is uncommonly seen in children. In contrast, OAS is the most frequent symptom elicited by plant foods such as fruits and nuts, and this is probably related to its frequent association to pollen allergy and labile cross-reactive allergens [19]. Digestive symptoms are seen with a higher frequency among patients allergic to milk, egg, fish and legumes, than among those allergic to fruits, nuts and shellfish. It would be interesting to study which factors (age, maturity of the digestive tract, route of sensitisation, type of allergens, etc...) may condition the frequency of digestive symptoms.

*Alergológica* provides a good perspective on how food allergy is diagnosed in the routine allergy practice in Spain. SPTs were carried out with a significantly higher frequency than specific IgE determinations. This reflects the fact that SPTs are the method of choice of Spanish allergists probably because such tests can be carried out in any clinical setting, on the first visit in most cases, and they are easy, safe, cheap, and results are available in 15 minutes. Furthermore, it seems possible that after a positive SPT to a certain food, serum sIgE determinations are not carried out. We also found significant differences in the frequency of use of sIgE determinations among foods. This may be related to the sensitivity of SPT, and to the diagnostic performance of the sIgE, as well as to factors such as the type of reaction, costs, the clinical setting (hospital, outpatient clinic, private vs. public healthcare, and so on).

In the majority of patients, the diagnosis of food allergy was established on the basis of a positive case history together with the presence of specific IgE. With this approach, food allergy has probably been over-diagnosed taking into account the diagnostic performance of SPT and sIgE (without a 100% positive predictive value even with a positive case history) [20-23]. Although the oral challenge is the only conclusive method of establishing the diagnosis of food allergy [20, 21], it was only carried out in 13% of the cases and 72.3% of the challenges were open. The gold standard in food allergy is the double-blind, placebo-controlled, food challenge [20, 21], but it is well known, and *Alergológica* is a good example, that this technique is hardly used in routine clinical practice because of its complexity and high sanitary cost. This study clearly shows the gap between the "official scientific recommendations" in the diagnosis of food allergy and everyday practice in allergy clinics, and should be a matter of reflection.

One of the objectives of *Alergológica* was to assess the socioeconomic costs and the impact on QL of allergic diseases. For the costs, the study collected health care utilisation, medication needs, days of sick leave of allergic patients and parents of allergic children, and number of school days missed. The information presented here corresponds to the 369 patients diagnosed with food allergy but many of these had other associated allergic diseases and therefore the costs – and the same applies to QL – directly and exclusively related to food allergy cannot be distinguished. Although QL was assessed with the SF12 questionnaire which is not disease specific, it has shown that patients diagnosed with food allergy had a reduced QL when compared with the Spanish reference population. Despite these limitations, *Alergológica* has explored and highlighted for the first time the costs and impact on QL of food allergy in the Spanish population. These aspects are currently under investigation in Spain, and in some other European countries, in the EuroPrevall project by means of questionnaires specifically developed for food allergy [3, 24, 25].

## References

- Rona RJ, Keil T, Summers C, Gislason D, Zuidmeer L, Sodergren E, Sigurdardottir ST, Lindner T, Goldhahn K, Dahlstrom J, McBride D, Madsen C. The prevalence of food allergy: a meta-analysis. *J Allergy Clin Immunol*. 2007;120(3):638-46.
- Zuidmeer L, Goldhahn K, Rona RJ, Gislason D, Madsen C, Summers C, Sodergren E, Dahlstrom J, Lindner T, Sigurdardottir ST, McBride D, Keil T. The prevalence of plant food allergies: a systematic review. *J Allergy Clin Immunol*. 2008;121(5):1210-1218.
- Mills EN, Mackie AR, Burney P, Beyer K, Frewer L, Madsen C, Botjes E, Crevel RW, van Ree R. The prevalence, cost and basis of food allergy across Europe. *Allergy*. 2007;62(7):717-22.
- Caballero Martínez F. *Alergológica* 2005. Methodological Aspects and Sample Characteristics of the Study. *J Investig Allergol Clin Immunol*. 2009;Vol19,suppl 2:38.
- Alergia a Alimentos. En: Sociedad Española de Alergología e Inmunología Clínica y Alergia e Inmunología Abelló, S.A., eds. *Alergológica. Factores Epidemiológicos, Clínicos y Socioeconómicos de las Enfermedades Alérgicas en España*. Ed. Nilo. Madrid 1995. p. 163-83.
- Grundy J, Mathews S, Bateman B, Dean T, Arshad SH. Rising prevalence of allergy to peanut in children: data from 2 sequential cohorts. *J Allergy Clin Immunol*. 2002;110(5):784-9.
- Sicherer S, Munoz-Furlong A, Sampson HA. Prevalence of peanut and tree nut allergy in the United States by means of a random digit dial telephone survey: a 5-year follow-up study. *J Allergy Clin Immunol*. 2003;112(6):1203-7.
- Gupta R, Sheikh A, Strachan D, Anderson HR. Increasing hospital admissions for systemic allergic disorders in England: analyses of national admissions data. *BMJ*. 2003;327(7424):1142-3.
- Host A, Halken S, Jacobsen HP, Christensen AE, Herskind AM, Plesner K. Clinical course of cow's milk protein allergy/intolerance and atopic diseases in childhood. *Pediatr Allergy Immunol*. 2002;13(Suppl 15):23-8.
- Crespo JF, Pascual C, Burks AW, Helm RM, Esteban MM. Frequency of food allergy in a pediatric population from Spain. *Pediatr Allergy Immunol*. 1995;6(1):39-43.
- Joral A, Villas F, Garmendia J, Villareal O. Adverse reactions to food in adults. *J Investig Allergol Clin Immunol*. 1995;5(1):47-9.
- Castillo R, Delgado J, Quiralte J, Blanco C, Carrillo T. Food hypersensitivity among adult patients: epidemiological and clinical aspects. *Allergol Immunopathol (Madr)*. 1996;24(3):93-7.
- Alvarado MI, Pérez M. Study of food allergy in the Spanish population. *Allergol Immunopathol (Madr)*. 2006;34(5):185-93.
- Cuesta Herranz J, Lázaro M, Figueredo E, Igea JM, Umpierrez A, de las Heras M. Allergy to plant derived fresh foods in a birch and ragweed free area. *Clin Exp Allergy*. 2000;30(10):1411-1416.
- Ortolani C, Ispano M, Pastorello EA, Bigi A, Ansaloni R. The oral allergy syndrome. *Ann Allergy*. 1988;61(6 Pt.2):47-52.
- Kivity S, Dunner K, Marian Y. The pattern of food hypersensitivity in patients with onset after 10 years of age. *Clin Exp Allergy*. 1994;24(1):19-22.
- Sampson HA. Food allergy. Part 1. Immunopathogenesis and clinical disorders. *J Allergy Clin Immunol*. 1999;103(5 Pt.1):717-28.
- Moneret-Vautrin DA, Morisset M, Flabbee J, Beaudouin E, Kanny G. Epidemiology of life-threatening and lethal anaphylaxis: a review. *Allergy*. 2005;60(4):443-51.
- Mari A, Ballmer-Weber B, Vieths S. The oral allergy syndrome: improved diagnosis and treatment. *Curr Opin Allergy Clin Immunol*. 2005;5(3):263-73.
- Ibáñez MD, Alonso E, Blanco C, Cisteró AM, Cuesta Herranz J, Fernández Rivas M, et al (Comité de Reacciones Adversas a Alimentos de la SEAIC). Metodología diagnóstica en la alergia a alimentos. *Rev Esp Allergol Immunol Clin*. 1999;14:50-62.
- Bindsvlev-Jensen C, Ballmer-Weber BK, Bengtsson U, Blanco C, Ebner C, Hourihane J, Knulst AC, Moneret-Vautrin DA, Nekam K, Niggemann B, Osterballe M, Ortolani C, Ring J, Schnopp C, Werfel T; European Academy of Allergology and Clinical Immunology. Standardization of food challenges in patients with immediate reactions to foods--position paper from the European Academy of Allergology and Clinical Immunology. *Allergy*. 2004;59(7):690-7.
- Perry TT, Matsui EC, Kay Conover-Walker M, Wood RA. The relationship of allergen-specific IgE levels and oral food challenge outcome. *J Allergy Clin Immunol*. 2004;114(1):144-9.
- Verstege A, Mehl A, Rolinck-Werninghaus C, Staden U, Nocon M, Beyer K, Niggemann B. The predictive value of the skin prick test weal size for the outcome of oral food challenges. *Clin Exp Allergy*. 2005;35(9):1220-6.
- Flokstra-de Blok BM, DunnGalvin A, Vlieg-Boerstra BJ, Oude Elberink JN, Duiverman EJ, Hourihane JO, Dubois AE. Development and validation of the self-administered Food Allergy Quality of Life Questionnaire for adolescents. *J Allergy Clin Immunol*. 2008;122(1):139-44.
- DunnGalvin A, de BlokFlokstra BM, Burks AW, Dubois AE, Hourihane JO. Food allergy QoL questionnaire for children aged 0-12 years: content, construct, and cross-cultural validity. *Clin Exp Allergy*. 2008;38(6):977-86.

### ■ Montserrat Fernández Rivas

Hospital Clínico San Carlos  
 Servicio de Alergia  
 C/ Profesor Martín Lagos, s/n  
 28040 Madrid  
 Tel.: 91 330 30 12 - 91 330 30 11  
 E-mail: mfernandezri.hcsc@salud.madrid.org