

ORIGINAL COMMUNICATION

Food hypersensitivity in Portuguese adults

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Objective: To describe the frequency and epidemiological features of self-reported food hypersensitivity in Portuguese adults.

Design: Cross-sectional.

Setting: Participants were selected by random digit dialing among residents of Porto.

Subjects: In total, 659 individuals over 39 y were asked to recall the occurrence of food hypersensitivity, and to describe the most serious episode. The adoption of eviction diets and previous medical diagnosis of food allergy were recorded, and recent dietary intake was evaluated using a validated food frequency questionnaire.

Results: Self-reported food allergy was more frequent in women than men (7.3 vs 1.9%, $P < 0.01$) and decreased with age. Age- and sex-standardized (European population ≥ 40 y) prevalence of food hypersensitivity was 4.8% (95% CI 3.4–6.9%). Most subjects (67.6%) referred allergy to a single food, fresh fruits being the more frequently incriminated (25%). Approximately 90% that reported food allergy declared the adoption of eviction diets, although 53% in fact ingested the incriminated foods during the previous year.

Conclusions: The adult prevalence of food hypersensitivity in Porto is one of the lowest observed worldwide, probably reflecting specificities of the genetic make-up and dietary patterns of our population.

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Introduction

Food allergy is usually considered an uncommon situation among adults. However, the public belief in the importance of food allergy is much higher than should be expected by prevalence data (Jansen *et al*, 1994; Altman & Chiaramonte, 1996; Woods *et al*, 2002). This subjective overestimation may influence the eating habits of all the household members if food allergy is suspected in a single member even in the absence of a formal diagnosis (Sloan & Powers, 1986).

Genetic susceptibility is thought to be an important determinant of food allergy, but sensitization to food proteins and subsequent allergic disease additionally depend on environmental and cultural factors, which ultimately influence the timing, duration and extent of exposure to allergens. Recent changes in eating habits, with the appearance of novel foods (exotic proteins or those derived from animal feed, and

genetically modified organisms) and the growing use of food proteins as ingredients, might constitute new risks and lead to epidemiological changes (Moneret-Vautrin & Kanny, 1995; Moneret-Vautrin, 1998, 2003; Rance, 2000; Kanny *et al*, 2001).

Self-reported food allergy depends on a subjective interpretation of symptoms, which differs across populations and cultures, and depends on methodological options in surveys (Altman & Chiaramonte, 1996). Wide international differences in self-reported food allergy, from 4.6% in Spain to 19.1% in Australia, were attributed to cultural influences, namely dietary choices (Woods *et al*, 2001). Although formal evidence is lacking, it is assumed that the incidence of food hypersensitivity is increasing, in line with other forms of atopic disease (European Allergy White Paper, 1998). In the absence of validated methods for evaluating the allergic risk of food proteins and facing the growing sources of natural and genetically modified food, it is increasingly useful to obtain knowledge on and understand the dynamics of food hypersensitivity at a population level. This study aimed to estimate the prevalence of self-reported food allergy in Portuguese adults, a population with a dietary pattern that combines features of the Mediterranean diet with an important Atlantic influence.

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Methods

We evaluated the initial 659 participants of an on-going (Lopes, 2000) health and nutrition survey of residents of Porto, older than 39 y, recruited by random digit dialing.

The participation rate was 70% (Ramos *et al*, 2004; Lopes, 2000). Nonparticipants were older (61.6 vs 58.5 y, for males, and 62.9 vs 57.7 for females) and more frequently women (66.3 vs 74.7%, $P < 0.001$); males tended to be non-drinkers and to have had a blood test during the previous year; females were additionally more often nonsmokers.¹³ The mean number of medical visits during the previous year was similar in participants and nonparticipants (3.8 vs 4.3 for females and 2.7 vs 3.7 for males).

Each participant was evaluated at our center by trained interviewers, and completed a large questionnaire on demographic, social, behavioral and clinical characteristics. Diet was assessed using a previously validated semi-quantitative food frequency questionnaire comprising 80 individual food items or food groups (Lopes, 2000).

Self-reported food hypersensitivity was considered present when participants answered affirmatively to the question: 'Do you consider you to be allergic to any food item?' Participants admitting food allergy were asked to list the food items involved and to describe the most serious episode. Each subject was classified as having a convincing history of hypersensitivity if gastrointestinal anaphylaxis, urticaria and angioedema, rhinitis or oral allergy syndrome occurred in the 24 h following the ingestion of the incriminated food. A medical diagnosis of food allergy was considered when an eviction diet was adopted after medical advice. A validated food frequency questionnaire was used to assess diet in the previous year.

The software Epi Info 6.4c (Dean *et al*, 1996) was used to store and analyze data. The χ^2 test or Fisher exact test, when appropriate, was used to compare proportions and linear trends. Quantitative variables were compared using the Kruskal–Wallis test. Age- and sex-standardized prevalence was estimated by the direct method using the European reference population above 39 y.

The local ethics committee approved this study, and all participants provided written informed consent.

Results

In this sample of urban adults, food hypersensitivity prevalence was 5.2%, significantly higher in women than men (7.3 vs 1.9%, $P < 0.01$). In females, it decreased from 7.9% in the age group 40–49 y to 5.3% in the group 70 y and over (P trend = 0.45), and in males from 4.4 to 0% (P trend = 0.03). Using the European population as standard, the age- and sex-standardized prevalence of food hypersensitivity was 4.8% in our sample.

The prevalence of food hypersensitivity increased with education, from 4.6% in participants who studied for 5 y or less to 6.6% in those with more than 12 y of formal

education (P trend = 0.40), but these differences were not statistically significant. The place of birth (Porto vs other) was not associated with increased prevalence of food hypersensitivity (6.3 vs 5.3%, $P = 0.87$). The average number of medical visits in the previous year was similar in those reporting food allergy compared with the remaining participants (4.4 vs 3.4, $P = 0.38$).

Most affected subjects (67.6%) reported allergy to a single food item. As shown in Table 1, individual foods more frequently involved in hypersensitivity were strawberries (9.8%), sausages (9.8%), eggs (7.8%), pork (7.8%), codfish (6.0%), chocolate (3.8%), kiwi (3.8%), spices (3.8%), orange (3.8%), milk (3.8%) and octopus (3.8%). One individual each reported allergy to shrimp, tuna, banana, squid, olive oil, olives, kid, tea, persimmons, peas, beans, ham, chicken, ice cream, mango, tomato, whiting and other fish. Overall, food groups more frequently incriminated were fresh fruits (25.0%), meat (23.1%), fish (11.6%) and eggs (7.7%).

Multiple clinical manifestations were described by 23.5% of the participants reporting allergic reactions to food. Urticaria was the clinical manifestation more often reported (Table 2) and, according to the previously defined criteria, convincing histories of food allergy were observed in 68% of subjects. In this sample of urban adults, the self-reported prevalence of a convincing history of food allergy was 3.5%.

Table 1 Food groups reported as food allergens by subjects recalling food-allergy

Foods	n (%)
Fresh fruits	13 (25.0)
Meat	12 (23.1)
Fish	6 (11.5)
Eggs	4 (7.7)
Octopus and squid	3 (5.8)
Chocolate	2 (3.8)
Milk	2 (3.8)
Spices	2 (3.8)
Legumens	2 (3.8)
Other	6 (11.5)

Table 2 Clinical manifestations reported by subjects recalling food allergy

Clinical manifestations	n (%)
Urticaria	22 (42.3)
Isolated itching	6 (11.5)
Oral allergy syndrome	6 (11.5)
Malaise	4 (7.7)
Vomiting	3 (5.8)
Isolated angioedema	2 (3.8)
Diarrhea	2 (3.8)
Dyspnea	2 (3.8)
Migraine	1 (1.9)
Abdominal pain	1 (1.9)
Fever	1 (1.9)
Rhinitis	1 (1.9)
Fainting sensation	1 (1.9)

In all, 15 participants reporting food hypersensitivity, all women, visited a doctor due to suspected food allergy, but only seven (24.1%) performed skin ($n=5$), blood ($n=1$) or challenge tests ($n=1$).

A total of 30 subjects (86.2% of the women and all men reporting allergy) declared to adopt eviction diets, 21 (70%) without medical advice. Withdrawal from diet of incriminated foods was evaluated through checking the consumption information provided for the previous year through the food frequency questionnaire. For nine participants, the specific food item was not evaluated because it was not considered as a single item in food frequency questionnaire, and 16 subjects (53.3%) admitted to consume the incriminated foods during the previous year, although reporting its eviction when questioned to specify the characteristics and attitudes towards the reported food allergy.

Discussion

The prevalence of food hypersensitivity in the present study was 5.2%. Food hypersensitivity was more frequent in women and tended to decrease with age. Fresh foods were the more frequently implicated ones. Convincing histories of food hypersensitivity were observed in about two-thirds of those reporting food allergy, and the adoption of eviction diets was observed in 90%.

To date, eight studies addressed the prevalence of food allergies in random samples of adult populations, relying on self-reports (Table 3). Two of these investigations used double-blind placebo-controlled food challenges in selected subgroups in order to validate the self-report of food allergy

(Jansen *et al*, 1994; Young *et al*, 1994). The estimated prevalence using double-blind placebo-controlled food challenges was 5–15 times lower than the self-reported. However, the whole protocol was completed in nearly half the subjects potentially available for the clinical follow-up study, suggesting a bias due to withdrawals. In one of the studies, a standard battery of eight allergens was tested, allowing inferences only on these substances (Young *et al*, 1994). Two other studies performed skin prick tests or evaluated specific IgE antibodies for a limited number of food allergens and obtained prevalence estimates approximately four times lower compared with self-reports (Bjornsson *et al*, 1996; Woods *et al*, 2002).

Although self-report expectedly overestimates the true prevalence of food hypersensitivity, the extent of this effect is difficult to predict as it may depend on the cultural background of the studied population (Woods *et al*, 2001), and the nature of survey methods, being influenced by the detail of the inquiry. We improved the quality of information of self-reports, and consequently the validity of our prevalence estimates, by collecting information on the symptoms present during the most serious episode, the existence of a medical diagnosis of food hypersensitivity, and the adoption of eviction diets. These data allowed us to quantify the frequency of food hypersensitivity with a convincing history, and the adoption of eviction diets with and without medical advice. Additionally, all participants had their dietary habits in the previous year evaluated through a food frequency questionnaire, allowing the confirmation of the eviction of specific food items.

Table 3 Studies addressing the prevalence of self-reported food allergy or food intolerance in adult population samples

Reference, country	Participants	Age-groups	Prevalence	Foods more frequently implicated
Young <i>et al</i> (1994), UK	7500 households (Wycombe Health Authority) 7500 households (nationwide)	> 6 months	19.9% (High Wycombe) 20.4% (nationwide)	Chocolate, additives, citrus, fish/shellfish, cow's milk, cheese
Jansen <i>et al</i> (1994), The Netherlands	1483 participants	18–70 y	12.4%	Chocolate, vegetables, fruit, animal fat, additives, pork
Altman and Chiaramonte, (1996), USA	5000 households and members of their families Surveyed in 1989, 1992 and 1993	< 18, > 70 y	Households with at least one individual with food allergy: 16.2% (1989)–13.9% (1993)	Milk, fruit, vegetables, seafood/shellfish/dairy products (except milk), chocolate
Bjornsson <i>et al</i> (1996), Sweden	1397 participants	20–44 y	25.0%	
Kanny <i>et al</i> (2001), France	33 110 participants	1–61 y	3.5%	Rosaceae fruits, vegetables, milk, crustaceans, shellfish, fruit cross-reacting with latex
Woods <i>et al</i> (2001), 15 countries	17 280 participants	20–44 y	12.0% (15 countries); range: 4.6% (Spain)–19.1% (Australia)	Chocolate, apple, hazelnut, strawberry, cow's milk, orange, tomato
Schäffer <i>et al</i> (2001), Germany	1537 participants	25–74 y	20.8%	Fruits, nuts, vegetables, wine (sparkling), milk, peanuts
Woods <i>et al</i> (2002), Australia	457 participants	26–50 y	22.0%	Dairy products, fruits, seafood, monosodium glutamate

Food allergy is thought to affect between 5 and 7.5% of children and between 1 and 2% of adults. In our study, the prevalence of food hypersensitivity was 5.2%, one of the lowest compared with samples from other countries (Table 3). A convincing history of food hypersensitivity was present in 68% of subjects, suggesting that its overestimation was probably lower than in other populations (Jansen *et al*, 1994; Young *et al*, 1994). However, approximately half the participants reporting food allergy consumed the incriminated foods in the previous year, as assessed by the food frequency questionnaire.

A study (Woods *et al*, 2001) using a standardized methodology to evaluate samples from 15 countries found an overall prevalence of 12.2%, ranging from 4.6% in Spain to 19.1% in Australia. Such differences were attributed to variation in dietary intakes between countries, and cross-sensitivity between aeroallergens and food allergens (especially fruits and vegetables) (Bousquet *et al*, 1997; Woods *et al*, 2001). The reason for the low prevalence earlier described in Spain (Woods *et al*, 2001) and now observed in our Portuguese survey is unclear. The fact that prevalence of food allergy in Italy was 9% (Woods *et al*, 2001) does not support a straightforward hypothesis of a protective effect of the 'Mediterranean diet' (Woods *et al*, 2001). Specificities in Portuguese dietary patterns or even genetic factors could be an explanation to these results, but future studies are required to clarify these issues, namely surveying frequency trends.

In our study, food hypersensitivity prevalence decreased with age, as in a previous survey in the USA (Altman & Chiaramonte, 1996). When prevalence is measured, even if referring to a relatively recent period, recall bias may influence frequency estimates because a food hypersensitivity diagnosis induces changes in dietary habits and participants may not revive their hypersensitivity status when asked about it many years after a first episode. Therefore, older individuals may not recall minor reactions occurred long ago (Last, 1995).

As in previous studies (Jansen *et al*, 1994; Altman & Chiaramonte, 1996; Schäfer *et al*, 2001; Woods *et al*, 2001), food hypersensitivity was more frequent in women, but no good explanation is available for this gender effect.

None of the participants was excluded from analysis or had the self-reported food allergy status re-classified according to the declared symptoms. However, asthma attacks or general anaphylaxis were never described as symptoms associated with the food hypersensitivity episode. As this study is embedded in a larger health survey, we have information on other health conditions affecting the participants, namely asthma. No asthmatic subject reported a previous food hypersensitivity episode, possibly because asthmatic patients (3.6% of the studied population) may easily overlook a food hypersensitivity episode when the presenting symptoms are similar to an asthma attack. In the same way, none of the subjects from our study reported general anaphylaxis as symptoms associated to the severest

food hypersensitivity episode, probably because general anaphylaxis is the severest manifestation of food hypersensitivity, rare, and associated to a higher risk of death. This may have contributed to an underestimation of food hypersensitivity prevalence, but both general anaphylaxis and asthma are rare and no major underestimation of prevalence is expected to have occurred.

Some of the reported symptoms such as malaise, migraine, and fever are rather unspecific and probably not related to food hypersensitivity (Ortolani *et al*, 1999), and when these were the only symptoms present, the food hypersensitivity history was considered not convincing. Cutaneous symptoms, more probably associated to food hypersensitivity reactions, occurred in 64.7% of subjects, as reported in other large studies (Castillo *et al*, 1996; Werfel, 2001).

Most subjects (67.6%) reported hypersensitivity to a single food item, as previously observed in other populations (Kanny *et al*, 2001). Fruits from the Rosaceae family are widely consumed in the Mediterranean area and have been increasingly reported as causes of allergic reactions, particularly in adults with pollinosis (Cuesta-Herranz *et al*, 1999; Woods *et al*, 2001). In our report strawberries were the single food more frequently incriminated (9.6%).

Some food items reported as suspected, such as strawberries, fish, sausages or chocolate, may be responsible for food hypersensitivity due to high contents in histamine or induction of histamine release, not reflecting an IgE-mediated reaction (Wantke *et al*, 1993; Molkhou, 2000).

In our study sample, males sought no medical advice after a food hypersensitivity episode, suggesting a possible under-diagnosis, although all women had a diagnosis, most clinically. A large proportion of participants suspecting food hypersensitivity declared the adoption of eviction diets, most of them without medical advice. This shows that the mere perception of food allergy, even in the absence of a diagnosis, is sufficient to influence the individual eating habits (Sloan & Powers, 1986). Many participants reporting food allergy did not follow the eviction diets as nearly half affirmed to consume the incriminated foods during the previous year when specifically inquired about it through a food frequency questionnaire. This may reflect the lack of an appropriate diagnosis of this condition or, in the cases where eviction diets were a medical advice, mild hypersensitivity symptoms, or the inappropriate perception of the threats posed by food hypersensitivity.

In conclusion, this survey showed that self-reported prevalence of food hypersensitivity in adults from Porto is one of the lowest observed worldwide, and that an appropriate diagnosis and treatment are substantially lacking.

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