Adult Food Allergy Prevalence: Reducing Questionnaire Bias

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Abstract

Background: Food allergy (FA) prevalence has increased in the last decades, but epidemiologic studies could show overestimated results. The objective of this study is to estimate the prevalence of immediate FA in adults in a region of Central Brazil, using a questionnaire to try to reduce misperceptions about FA reaction. **Methods:** A cross-sectional study was conducted, enrolling an adult population aged 18–65 years comprised of families in a Central Brazilian city. In the first phase, participants answered a self-administered questionnaire for FA screening. In the second phase, the participants who reported an FA in the first questionnaire were visited to complete the second questionnaire applied by trained researchers. **Results:** Of the 4,916 adults visited, 1,583 returned a completed questionnaire. Reported FA occurred in 171 (10.8%) subjects, and the more frequent citations were cow's milk, pork, fruits, shrimp, and vegetables. One hundred and four of these individuals completed the second questionnaire, and 15 (1.0%) were considered to have an FA diagnosis. The main foods were fruits, followed by cow's milk, shrimp, pork, and vegetables. **Conclusion:** After use of a specific questionnaire to recognize possible IgE-

mediated FAs, a low frequency of FA was considered in this population. Use of a directed questionnaire administered by trained researchers could be an alternative for epidemiological IgE-mediated FA studies to achieve more accurate results.

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Introduction

Food allergy (FA) is an adverse immune response that occurs reproducibly upon contact with a specified food. FA frequency has increased by 18% in the last 10 years, but prevalence studies based on self-reported FA show a high familiar and individual perception of FA [1, 2]. In this context, the objective of this study is to estimate the prevalence of immediate FA in adults in a region of Central Brazil, using a questionnaire to try to reduce misperceptions about FA reaction.

Methods

A cross-sectional study was conducted during the period of December 2014 to July 2015 in an enrolled adult population aged 18–65 years, comprised of families in a Family Health Strategy (FHS) area responsible for primary care in the St. George II and III

Fig. 1. Study algorithm flowchart. FA, food allergy.

district in Uberlandia, a Central Brazilian city. All participants were informed about this study, and signed consent was obtained. The exclusion criteria were: illiteracy, refusal to participate, refusal to sign the consent form, absence from home, or incorrect filling in of the questionnaire. This study was approved by the Ethics Committee of the Federal University of Uberlandia.

This study was performed in 2 phases, as shown in Figure 1. In the first phase, a validated self-administered questionnaire for FA screening (online suppl. Table S1; for all online suppl. material, see www.karger.com/doi/10.1159/000453036) was used to collect the data [3]. The FHS mapped 4,916 adults living in the area in 2,325 houses during the study period. To reach the target population, the researchers accompanied the FHS agents on home visits in the district. For each house, the researchers made at least 3 attempts on different days and at different times before considering exclusion due to absence from home. The first questionnaire was delivered to homes where at least 1 adult was present to receive the researchers and the study explanation. A total of 231 (4.7%) adults were illiterate and therefore excluded. We did not receive permission to visit a condominium with 176 apartments with approximately 250 adults. There was no one present during the 3 attempts in around 500 homes, where we were not able to explain or deliver the ques-

tionnaires. In the end, the researchers delivered around 3,350 questionnaires.

The data collected was about gender, age, any atopy (history of rhinitis, atopic dermatitis, and asthma), and reported FA and allergic symptoms related to food, including the type of food and the symptoms experienced.

In the second phase, the participants who reported an FA in the first questionnaire were visited to complete the second questionnaire, applied by the trained researchers. This questionnaire provided more detailed questions about the food involved in the FA reaction, associated symptoms, the time between food intake and the onset of the FA reaction, the reproducibility of the symptoms, and food exclusion in the daily diet (online suppl. Table S2) as previously described [4, 5]. These questions were geared toward building up a clinical history, and a possible diagnosis of FA was considered if the replies met all of the following 3 criteria: the reaction symptoms started within 2 h of ingestion of the food implicated, the reaction was reproducible, and the food was excluded from the daily diet.

Fisher's exact test and the χ^2 test were used for categorical variables. The level of significance for all statistical tests was 2-sided ($p < 0.05$). All analyses were conducted using GraphPad Prism 5.0 (La Jolla, CA, USA).

Table 1. Characteristics reported in the general adult FA questionnaire

Characteristic	Reported FA	Nonreported FA
Subjects	171 (10.8)	1,412 (89.2)
Gender		
Male	36 (21.0)	510 (36.1)
Female	134 (78.9)	875 (63.89)
Reported allergic diseases		
Asthma	17 (9.9)	53 (3.7)
Allergic rhinitis	41 (24.0)	182 (12.9)
Atopic dermatitis	19 (11.1)	23 (1.3)
Main causative food reaction ¹		
Cow's milk	35 (2.2)	
Pork	34 (2.1)	
Fruits	26 (1.6)	
Shrimp and other seafood	21 (1.3)	
Vegetables	15 (0.9)	
Fish	11 (0.7)	
Egg	6 (0.4)	
Main symptoms associated with food reactions ²		
Red spots on the skin	84 (49.1)	
Abdominal pain	44 (25.7)	
Swelling of the mouth and/or eyes	38 (22.2)	
Diarrhea	37 (21.6)	
Dyspnea	24 (14.0)	
Runny nose	6 (3.5)	
Itchiness	4 (2.4)	
Others symptoms	13 (9.3)	

Values are presented as numbers (%). The total number of subjects was 1,583. FA, food allergy. ¹ In relation to 1,583 participants. ² In relation to 171 reported FA.

Results

The FHS unit received 1,583 completed questionnaires (32.2% of 4,916) and signed consent forms. There was a significant female gender predominance (63.7%) in these returned items. Reported FA occurred in 171 (10.8%) first questionnaires. The foods implicated in the FA, the symptoms associated with a food reaction, and any other types of allergic diseases are described in Table 1. Several other foods were cited in the surveys, each one in small amounts. An FA reaction to 1 food was cited 106 (62.0%) times; 26 (15.2%) subjects reported reactions to 2 foods, 17 (9.9%) mentioned reactions to 3 foods, and 5 (5.3%) cited reactions to 4 or more foods.

In the second phase, all individuals who reported an FA history were revisited to answer a specific survey about IgE-mediated FAs. However, 67 people were unavailable at the second visit performed by researchers (af-

Table 2. Clinical responses after the specific FA questionnaire

Characteristic	Value
Subjects, <i>n</i>	104
Gender	
Male	22 (21.1)
Female	82 (78.8)
Causative food ¹	
Fruit	6 (0.4)
Cow's milk	4 (0.3)
Shrimp and other seafood	4 (0.3)
Pork	3 (0.2)
Vegetables	3 (0.2)
Pepper	1 (0.1)
Corn	1 (0.1)
Gluten	1 (0.1)
Main symptoms ²	
Abdominal pain	8 (53.3)
Red spots on the skin	6 (40.0)
Pruritus	6 (40.0)
Nausea/vomiting	5 (33.3)
Eye swelling	3 (20.0)
Mouth swelling	2 (13.3)
Dyspnea	2 (13.3)
Diarrhea	2 (13.3)
Runny nose	1 (6.7)

Values are presented as numbers (%) unless otherwise stated. FA, food allergy. ¹ In relation to 1,516 participants. ² In relation to 15 reported FA.

ter 3 attempts) and 104 (60.8%) participants responded to the second questionnaire.

After the second questionnaire, only 15 (1.0%) people were considered to have a probable IgE-mediated FA. The characteristics, the food implicated in the FA reactions, and the symptoms associated with FAs are described in Table 2. In that questionnaire, 6 (0.4%) persons reported a fruit allergy that included watermelon (*n* = 3), pineapple (*n* = 1), avocado (*n* = 1), and tomato (*n* = 1), while vegetable allergies were all attributed to cucumber.

Discussion

The present study demonstrated an initial FA report in 10.80% of the adult individuals, similar to the rates described in adult FA prevalence studies (i.e., 7–35%) [2, 6–9]. This huge variation probably occurred as a result of

methodological, cultural, and food intake differences [6–9]. The increased female gender was perhaps due to the data collection format, consisting of home visits during business hours depending on the schedule of the FHS agents. On the other hand, previous studies observed a higher perception of FA in females, as seen in our data [7, 8].

After the second questionnaire, only 15 (14.2%) of those with an initial FA report met the probable IgE-mediated FA criteria; FA reports declined from 10.8 to 1.0%. The changes in FA prevalence were substantial (almost 10-fold), especially for cow's milk (from 2.2 to 0.3%), probably because of the confusion between lactose intolerance and FA in the first instance, and for pork (from 2.1 to 0.2%), probably related to indigestion associated with pork meat cooking methods. Other foods such as fruit (from 1.6 to 0.4%), shrimp and other seafood (from 1.3 to 0.3%), and vegetables (from 0.9 to 0.2%) also presented a slight reduction in allergy prevalence. The results of the second questionnaire are similar to the findings of FA prevalence studies performed using food challenges described in a recent published meta-analysis, and they are probably more assertive than previous studies using only prick tests, specific IgE, and a generic questionnaire only [6, 8, 9].

Fruits and vegetables are considered the most frequent cause of FA after adolescence, in concordance with the present study, and they are associated with pollen food syndrome and lipid transfer protein syndrome [10]. The absence of a reported peanut allergy is noteworthy, compatible with the information previously published in another Brazilian study [3].

Only one study has used this methodology to assess FA before, but in childhood. In that study, they found a parental FA perception in 15.1% of the participants, and after specific questions the number decreased to 3.7% [5].

Differences related to food allergens and the presence of gastrointestinal manifestations in the present study were greater than those observed in the present study (around 80%) compared to the Korean study (around 10%), and this was probably related to age differences and different cultural habits.

This study has limitations, such as the nonresponse rate in the first phase, 67 (39.2%) cases of home nonattendance among the selected participants in the second phase, and the fact that it was conducted in a city region, but these limitations do not invalidate the data. Another important point is related to those individuals who excluded a specific food or a group of foods after one isolated reaction; since they had no reproducible reaction in a repeated food intake, the diagnosis of FA by our questionnaire was not possible and could have decreased the estimated prevalence. However, even in the clinical approach, reproducibility is one of the major pillars of FA diagnosis.

In conclusion, after use of a specific questionnaire to recognize probable IgE-mediated FAs, a low frequency of FA was considered in this population. Use of a directed questionnaire administered by trained researchers could be an alternative for epidemiological IgE-mediated FA studies to achieve more accurate results.

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Disclosure Statement

The authors declare that there are no conflicts of interest to disclose.

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