

# PREVALENCE OF PEANUT, TREE NUT, SESAME, AND SEAFOOD ALLERGY IN MEXICAN ADULTS

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## ABSTRACT

**Objective:** To identify the prevalence of perceived and probable allergic reactions to peanuts, tree nuts, sesame seed, or seafood and its association with the personal history of allergic disease. **Methods:** A cross-sectional study was performed in four cities of the metropolitan area of Guadalajara, located in western Mexico. Through sampling by gender and age, 1,126 subjects were included. Using a structured questionnaire, we investigated: (i) history of atopic disease, (ii) perception of allergic reaction after food intake, and (iii) probable allergic reaction to peanuts, tree nuts, sesame, or seafood. Prevalence and 95% confidence intervals were calculated. A multivariate analysis of factors associated to perceived and probable allergic reactions to food was performed by logistic regression. **Results:** Men were 49.8%; mean age was 28.1 years; personal history of atopic disease included: allergic rhinitis (6.9%), asthma (6.8%), and atopic dermatitis (3.8%). Prevalence of perceived and probable food allergy was, respectively: pecan 0.4 and 0.3%; peanut 0.6 and 0.6%; sesame 0.1 and 0.1%; shellfish 4.2 and 4.0% (mainly shrimp); mollusk 0.8 and 0.7%; fish 1.4 and 1.2%. Asthma was significantly associated with perceived and probable allergy to pecans, peanuts, fish, or seafood. Atopic dermatitis was associated with perceived and probable allergic reaction to sea snail, seafood, shellfish, or mollusks. Finally, allergic rhinitis was associated with allergy to shrimp and crustaceans. **Conclusions:** This study shows that the prevalence of peanut, tree nut, sesame seed, and seafood allergy in this Mexican population is similar to that reported in developed countries. (REV INVES CLIN. 2015;67:379-86)

**Key words:** Nut hypersensitivity. Peanut hypersensitivity. Seafood. Sesame.

## INTRODUCTION

Food allergy is considered a health problem in children and adults. Self-perception of an adverse reaction to

food ranges from 5.2 to 35.0% in adults<sup>1-6</sup>. Due to the severe adverse reactions that can persist throughout life, allergy to peanut, tree nut, sesame seed, and seafood has been studied<sup>7-9</sup>.

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The self-reported prevalence of peanut or tree nut allergy in the USA<sup>9</sup>, Canada<sup>8</sup>, and Europe<sup>10</sup> nears 1%. For sesame seed allergy, the frequency reported is 0.1%<sup>8</sup>. In the same countries, perception of an adverse reaction regarding seafood allergy is less than 2%<sup>2,7,10,11</sup>.

One of the most determinant risk factors for the development of food allergy is heredity<sup>4,5,12</sup>, although factors such as food availability, habits, and frequency of consumption also play relevant roles.

In Latin America, information regarding food allergy<sup>13,14</sup>, including products such as peanuts, tree nuts, sesame seed, and seafood, is scarce. To continue to fill the information gap concerning adverse reactions to such allergens, the objectives of this study were: (i) determine the prevalence of perceived and probable allergic reactions to peanuts, tree nuts, sesame seed, or seafood; and (ii) to determine its association with the personal history of allergic disease.

## MATERIALS AND METHODS

### Ethics

The Ethics and Research Committee of the Universidad Guadalajara Lamar and the Municipal Sports Council from each city approved this study. All participants granted verbal consent.

### Setting and design

A cross-sectional study was performed in four of the main cities that constitute the metropolitan area of Guadalajara, located in western Mexico, with an approximate population of 2,546,309 adult inhabitants<sup>15</sup>.

This study is a secondary analysis and its methodology has been previously described<sup>16</sup>. A total of 1,126 participants were included, with young adults (18-24 years of age) accounting for 50.1% (564/1,126) and adults (25-50 years of age) accounting for the remaining 49.9% (562/1,126). Recruitment took place in the Vía Recreativa (Recreational Pathway) from December 2, 2012 until April 7, 2013. The Vía Recreativa is a model concept in which public spaces and avenues of the cities in the metropolitan area of Guadalajara transform into recreational spaces to perform physical or cultural

activities. Every Sunday, approximately 150,000 individuals attend the Vía Recreativa.

The surveys were conducted by two medical students and one nutrition sciences student, who received previous training in allergic disease and survey application techniques.

### Sampling

To conduct sampling, operating modules were strategically located in the four cities. A total of 1,126 adults were included by means of a non-probabilistic sampling, prearranged by quotas for each city, by gender (50% for each), and by age (50% for the 18-24 age group and 50% for the 25-50 age group).

By conventional means for this study, every Vía recreativa was a stratum. The sample size was distributed by proportional assignment for each of the cities that constitute the metropolitan zone; for example, if a city contributed with 10% to the universe of adult inhabitants, the size of the subsample of participants for the stratum of the city corresponded to 10% of the total sample.

### The survey instrument

To identify allergic hypersensitivity to peanuts, tree nuts, sesame seed, and seafood, participants answered a survey. They were initially questioned regarding the presence of allergic reactions after consuming any food or beverage. In the case of an affirmative answer, they were questioned for an association between these reactions and any of the food of interest in the study, and for the type of adverse reaction produced; with that in mind, questions were used that had been previously validated in epidemiological studies<sup>8</sup>. Finally, they were questioned about their personal history of allergic disease (e.g., asthma, allergic rhinitis, atopic dermatitis) diagnosed by a physician.

### Definitions

#### ***Allergic reaction perception after food intake***

We included all cases in which the subjects self-reported an allergic reaction after the intake of any food or beverage, independent of the history or presence of confirmatory tests<sup>8</sup>.

## Probable allergic reaction

According to the definition by Sicherer, et al.<sup>17</sup> in vast epidemiological studies in the USA, a probable allergic reaction was that in which the symptoms and organs affected were the typical ones: urticaria and angioedema, respiratory difficulty, wheezing, feeling of oppression at the throat, or vomiting and diarrhea occurring in the first two hours following the intake of the offensive food. According to this definition, in a study, up to 93% of the subjects were found to have specific immunoglobulin E (IgE) antibodies against the implicated food<sup>18</sup>.

For the present study, pecan, hazelnut, pistachio, and almond were designated as tree nuts. The shellfish category included crustaceans (shrimp and lobster) and mollusks (clams and sea snails); shellfish and fish composed the seafood group<sup>7</sup>.

## Statistical analysis

Prevalence of perceived and probable allergic reaction to each of the aforementioned food and its respective 95% confidence interval (95% CI) were calculated. Proportions were compared with the chi-square test or Fisher's exact test. Odds ratio (OR) was calculated in multivariate models of associated factors to perceived and probable allergic reactions to the studied food (dependent variables). In every model, the independent covariates were, personal history of asthma, allergic rhinitis and atopic dermatitis; as well as gender and age. Adjusted OR were calculated by binary logistic regression ("forward conditional" method). A  $p$ -value  $\leq 0.05$  was considered statistically significant. Data processing was performed with the IBM SPSS, v.20.0 software for Windows (Armonk, NY, USA).

## RESULTS

### Subject characteristics

Men accounted for 49.8% of the sample (561/1,126). Mean age was  $28.1 \pm 9.1$  years. In the 1,126 participants, the personal history of atopic disease was: asthma 77 (6.8%; 95% CI: 5.4-8.3), allergic rhinitis 78 (6.9%; 95% CI: 5.4-8.4), and atopic dermatitis 43 (3.8%; 95% CI: 2.7-4.9).

## Estimated prevalence

Because there were no documented adverse reactions to hazelnuts, pistachios, or almonds, the perceived and probable allergy in the tree nut category was mostly for pecans, 0.4% (95% CI: 0.2-1.1) and 0.3% (95% CI: 0.1-0.9), respectively (Table 1). The perceived and probable allergy was the same for both peanuts (0.6%) and sesame seed (0.1%). Among the investigated food, the seafood category was the most prevalent; 55 (4.9%) of the 1,126 participants perceived some type of reaction, and in 53 (4.7%) this was considered probable. For shellfish, crustaceans, or mollusks, the prevalence of perceived and probable allergy was approximately 4%. In the shellfish category, the perceived and probable prevalences for shrimp were 4.0 and 3.8%, respectively. Two participants reported an adverse reaction to crab, but only one had symptoms compatible with a probable allergic reaction. There were no documented events related to lobster consumption. Perceived allergy concerning clams and sea snails was 0.6 and 0.2%, respectively, while prevalence of a probable reaction was 0.4 and 0.1%. The second most prevalent food category was fish, with a perceived allergy of 1.4% and a probable allergy of 1.2%.

The perceived or probable food allergy showed no statistically significant differences between genders (results not presented in tables). Table 2 demonstrates that when participants were categorized according to age (18-24 and 25-50), the prevalence of peanut and sesame allergy had a trend to be more common in the 25-50 age group, but did not reach a statistically significant difference. In contrast, the most prevalent category in the 18-24 age group was seafood, where crustaceans predominated. In the case of mollusks and fish, there was no difference between the age groups.

## Associated factors

Table 3 illustrates the association between the personal history of allergic disease and food allergy. A history of asthma was associated with perceived and probable allergy to pecans ( $p = 0.015$  and  $0.009$ ) and peanuts ( $p = 0.042$  for both cases); as a category, seafood was associated as well ( $p = 0.006$  and  $0.004$ ), but fish individually demonstrated a statistically significant association ( $p = 0.0007$  and  $0.032$ ). In the case of personal history of allergic rhinitis, there was only an association with the perceived allergic reaction to

Table 1. Prevalence of perceived and probable food allergy in 1,126 adults

Food	Perceived			Probable*		
	n	%	95% CI	n	%	95% CI
Any tree nuts						
– Pecan <sup>†</sup>	5	0.4	0.2-1.1	4	0.3	0.1-0.9
– Hazelnut	–	–	–	–	–	–
– Pistachio	–	–	–	–	–	–
– Almond	–	–	–	–	–	–
Peanut	7	0.6	0.3-1.3	7	0.6	0.3-1.3
Sesame	1	0.1	0-0.6	1	0.1	0-0.6
Seafood	55	4.9	3.8-6.3	53	4.7	3.6-6.1
– Shellfish	47	4.2	3.1-5.5	45	4.0	2.9-5.3
• Crustacean	45	4.0	2.9-5.3	43	3.8	2.8-5.1
▪ Shrimp	45	4.0	2.9-5.3	43	3.8	2.8-5.1
▪ Crab	2	0.2	0-0.7	1	0.1	0-0.6
▪ Lobster	–	–	–	–	–	–
– Mollusk	9	0.8	0.4-1.5	8	0.7	0.3-1.4
• Clam	7	0.6	0.3-1.3	6	0.5	0.3-1.3
• Snail	2	0.2	0-0.7	2	0.2	0-0.7
• Octopus	–	–	–	–	–	–
– Fish	16	1.4	0.9-2.3	13	1.2	0.6-2.0

\*Oral allergy syndrome, anaphylaxis, urticaria.

<sup>†</sup>Pecans represent the tree nut group.

95% CI: 95% confidence interval.

tree nuts ( $p = 0.016$ ), but not with a probable allergic reaction ( $p = 0.193$ ). Finally, atopic dermatitis was related with the mollusk category, both in perceived reaction ( $p = 0.014$ ) and probable reaction ( $p = 0.009$ ).

Risks of perceived and probable allergic reaction adjusted by means of a multivariate analysis are presented in table 4. History of asthma was significantly associated with perceived and probable allergy to pecans, peanuts, fish, and seafood. Atopic dermatitis was a significant predictor of perceived and probable allergic reaction to sea snail, seafood, shellfish, and mollusks. Allergic rhinitis demonstrated only a probable association with shrimp and crustacean allergy. Age was significantly associated with perceived and probable shrimp, seafood, shellfish, and crustacean allergy. Gender was not shown to be associated with any of the aforementioned food allergies.

## DISCUSSION

The present study shows that peanut, tree nut, sesame seed, and seafood allergy occurs regularly in

the Mexican population. Therefore, the results of the present study serve as a starting point to evaluate allergy trends towards allergies to the food examined in this study.

In our study, the number of people that were perceived to be allergic to tree nuts or peanuts was similar to the number of cases reported in the USA<sup>9</sup>, Canada<sup>8</sup>, and Europe<sup>10</sup>. Only in Denmark was the incidence of peanut allergy greater than in Mexico<sup>3</sup>. No data regarding the frequency of allergies associated with sesame seeds were available; a frequency of 0.1% was proposed, although this number may decrease to 0.09% when confirmatory allergy measurements are established<sup>8</sup>. Only one case of a probable sesame seed allergy was found in our study. The prevalence of allergy to tree nuts, peanuts, and sesame seeds has increased in some age groups in the world, especially in the pediatric population<sup>9</sup>; the prevalence of sesame seed allergy in adults has not been measured yet. The frequency of tree nut, peanut, and sesame seed allergy has not been reported in Mexico, making our results a baseline on which to compare future research.

Table 2. Self-reported and probable prevalence of food allergy according to age

Participants: age group and type of reaction	Tree nuts*	Peanut	Sesame	Seafood <sup>†</sup>	Shellfish <sup>†</sup>	Crustacean <sup>†</sup>	Mollusk	Fish
18-24 years (n = 564)								
- Perceived	0.5 (0.1-1.6)	0.4 (0-1.4)	0	6.6 (4.8-8.9)	5.7 (4.0-7.9)	5.5 (3.9-7.7)	0.9 (0.3-2.1)	1.6 (0.8-3.1)
- Probable	0.4 (0-1.4)	0.4 (0-1.4)	0	6.6 (4.8-8.9)	5.7 (4.0-7.9)	5.5 (3.9-7.7)	0.9 (0.3-2.1)	1.4 (0.7-2.8)
25-50 years (n = 562)								
- Perceived	0.4 (0-1.4)	0.9 (0.3-2.1)	0.2 (0-1.1)	3.2 (2.0-5.0)	2.7 (1.6-4.4)	2.5 (1.5-4.2)	0.7 (0.2-1.9)	1.2 (0.6-2.6)
- Probable	0.4 (0-1.4)	0.9 (0.3-2.1)	0.2 (0-1.1)	2.9 (1.7-4.6)	2.3 (1.3-3.9)	2.1 (1.2-3.7)	0.5 (0.1-1.6)	0.9 (0.3-2.1)

\*Pecans alone represent the tree nut group.

<sup>†</sup>p < 0.05 value: 18-24 vs. 25-50.

The values represent proportions; 95% confidence intervals are shown in parenthesis.

Perception of the prevalence of shellfish allergy in Mexican adults is higher when compared to the USA, Canada, or Europe. Two independent studies in the USA reported a self-perceived prevalence of shellfish allergy of 1.5-2.0%<sup>2,7</sup>. Data were similar in Canada<sup>11</sup>. In Europe, the adult population reported a prevalence that varied from 0.5-2.0%<sup>10</sup>. In our study, in the crustacean group, shrimp was the primary cause of allergy in adults. The prevalence of allergy to shrimp was similar to shellfish allergy, with the exception of some Asian countries that tend to show much higher figures; for example, Malaysia, Singapore, Japan, or China, among others<sup>19,23</sup>. The prevalence of crab allergy has seldom been studied in the adult population; however, it was estimated to be 6.5% in university students<sup>12</sup>, a figure greater than ours. Allergy to mollusks (clam, octopus, or snail) has rarely been investigated. In our research, the prevalence of mollusk allergy was found to be similar to that determined for peanuts or pecans; in young adults in Denmark the reported frequency was 0.4%<sup>3</sup>, while that for Portuguese adults was 5.8%<sup>1</sup>. Finally, fish allergy in our population, either self-perceived or probable, appears to be higher compared to countries like Canada<sup>11</sup> or the USA<sup>7</sup>. Instead, it tends to behave in a more similar fashion to that observed in the majority of European countries<sup>10</sup>; exceptionally among the population in Portugal<sup>1</sup> or Australia<sup>20</sup>, the prevalence was higher than ours. A possible explanation to address the higher prevalence of seafood allergy in Mexicans can be found in the low intake of this type of food since the annual average consumption

*per capita* is lower when compared with diverse Asian or European countries<sup>21</sup>. Conversely, the Mexican diet is traditionally based on the consumption of corn and beans; it was not until the Spanish colonization that the dietary habits started to change substantially. The time that the Mexican population has been exposed to seafood is considerably shorter when compared to other world populations. As a consequence, mechanisms of immunological tolerance to seafood probably have not yet been defined, favoring adverse reactions against this type of food. Additionally, the large amount of species that comprise the seafood group result in an even greater diversity of available allergens.

Like other studies<sup>2,4</sup>, this work shows that the prevalence of perceived and probable allergy to tree nuts, peanuts, sesame seed, and fish was not significantly modified according to age, except in the crustacean category that had a significantly higher prevalence in the 18-24 age group, similar to other authors' reports<sup>7</sup>. This behavior may be explained by a spontaneous resolution of crustacean allergy or due to a misinterpretation of the symptoms associated with food allergy by the participants. On the other hand, the data reported by Kotz, et al. in England showed that peanut allergy decreased with age<sup>22</sup>.

The personal history of allergic diseases has been described as an associated factor with food allergy<sup>4,5,12</sup>. In our study, subjects with asthma had a higher probability of being allergic to tree nuts, peanuts, or fish;

Table 3. Association between atopic disease and perceived and probable food allergy

Food	Atopic diseases					
	Asthma OR (95% CI)	p	Allergic rhinitis OR (95% CI)	p	Atopic dermatitis OR (95% CI)	p
Tree nuts						
– Perceived	9.29 (1.53-56.50)	0.015	9.17 (1.51-55.69)	0.016	6.42 (0.70-58.72)	0.099
– Probable	13.96 (1.94-100.49)	0.009	4.52 (0.46-44.0)	0.193	8.57 (0.87-84.14)	0.065
Peanut						
– Perceived	5.57 (1.06-29.18)	0.042	2.25 (0.27-18.97)	0.454	1.65 (0.09-29.35)	0.733
– Probable	5.57 (1.06-29.18)	0.042	2.25 (0.27-18.97)	0.454	1.65 (0.09-29.35)	0.733
Sesame						
– Perceived	4.51 (0.18-111.63)	0.358	4.45 (0.18-110.09)	0.362	8.29 (0.33-206.57)	0.197
– Probable	4.51 (0.18-111.63)	0.358	4.45 (0.18-110.09)	0.362	8.29 (0.33-206.57)	0.197
Seafood						
– Perceived	2.88 (1.35-6.14)	0.006	2.05 (0.89-4.70)	0.089	3.42 (1.38-8.49)	0.008
– Probable	3.02 (1.42-6.45)	0.004	2.15 (0.93-4.93)	0.071	3.57 (1.44-8.89)	0.006
Shellfish						
– Perceived	2.08 (0.85-5.06)	0.107	2.05 (0.84-4.98)	0.114	4.12 (1.65-10.31)	0.002
– Probable	2.19 (0.89-5.34)	0.085	2.15 (0.88-5.26)	0.091	4.34 (1.73-10.89)	0.002
Crustacean						
– Perceived	2.19 (0.89-5.34)	0.085	2.15 (0.88-5.26)	0.091	2.61 (0.89-7.64)	0.081
– Probable	2.31 (0.94-5.66)	0.067	2.27 (0.93-5.57)	0.072	2.74 (0.93-8.06)	0.067
Mollusk						
– Perceived	1.71 (0.21-13.87)	0.614	0.69 (0.04-12.08)	0.804	7.48 (1.51-37.22)	0.014
– Probable	1.96 (0.24-16.13)	0.532	0.78 (0.04-13.63)	0.865	8.76 (1.71-44.71)	0.009
Fish						
– Perceived	6.5 (2.2-19.4)	0.0007	1.9 (0.43-8.71)	0.385	1.7 (0.22-13.14)	0.613
– Probable	4.21 (1.13-15.64)	0.032	1.12 (0.14-8.74)	0.913	2.12 (0.27-16.73)	0.474

OR: odds ratio; 95% CI: 95% confidence interval.

those with allergic rhinitis were more likely to be allergic to shrimp; and participants with atopic dermatitis were more likely to be allergic to snail. These results highlight the importance of heredity in the development of allergic diseases, but also suggest the possibility that these foods may act as a disease trigger.

In general, there was a narrow gap between the prevalence of perceived and probable allergy to some of the food studied; this could be because only a small percentage of participants who perceived themselves as allergic to one of these food had a confirmed diagnosis yet. It has been shown that when oral challenge tests are used, the gap increases considerably.

The main limitation of this study was the impossibility to confirm the food allergy diagnosis by detection of specific IgE or the oral challenge test. However, as it is done in other epidemiological surveys, our results can be considered an adequate approximation to the real prevalence of the study problem. Some subjects refused to participate, but this was not an issue because the survey content was not revealed at the beginning of the evaluation. Because Mexico has vast gastronomic diversity and food availability, our results can only define the population of study or the cities that share similar characteristics. Also, because there are no previous reports from Mexico, it was not possible to compare with other areas in the country. Future



Table 4. Multivariate model of associated factors to perceived and probable food allergy

Types of food allergy*	Perceived reaction			Probable reaction		
	OR	95% CI	p	OR	95% CI	p
Tree nut allergy <sup>†</sup>						
– Asthma	9.3	1.5-56.5	0.015	14.0	1.9-100.5	0.009
Peanut allergy <sup>†</sup>						
– Asthma	5.6	1.1-29.2	0.04	5.6	1.1-29.2	0.04
Seafood allergy <sup>‡</sup>						
– Asthma	2.5	1.2-5.5	0.02	2.6	1.2-5.7	0.02
– Atopic Dermatitis	3.0	1.2-7.6	0.02	3.1	1.2-8.0	0.02
– Age (years)	0.96	0.9-0.99	0.02	0.95	0.91-0.99	0.007
Shellfish allergy <sup>#</sup>						
– Atopic Dermatitis	4.3	1.7-10.9	0.002	4.6	1.8-11.8	0.001
– Age (years)	0.95	0.91-0.99	0.02	0.94	0.9-0.98	0.006
Crustacean allergy <sup>§</sup>						
– Allergic rhinitis	–	–	0.054	2.6	1.03-6.3	0.04
– Age (years)	0.95	0.91-0.99	0.02	0.93	0.9-0.98	0.004
Shrimp allergy <sup>§</sup>						
– Allergic rhinitis	–	–	0.054	2.6	1.03-6.3	0.04
– Age (years)	0.95	0.9-0.99	0.02	0.93	0.9-0.98	0.004
Mollusk allergy <sup>¶</sup>						
– Atopic dermatitis	7.5	1.5-37.2	0.01	8.7	1.7-44.7	0.009
Snail allergy <sup>¶</sup>						
– Atopic dermatitis	25.8	1.6-419.0	0.02	25.8	1.6-419.0	0.02
Fish allergy <sup>†</sup>						
– Asthma	6.6	2.2-19.4	0.001	4.2	1.1-15.6	0.03

\*Dependent variable: types of food allergies. Independent covariates: asthma, allergic rhinitis, atopic dermatitis, gender, and age.

<sup>†</sup>Covariates adjusted by allergic rhinitis, atopic dermatitis, gender (males) and age (years).

<sup>‡</sup>Covariates adjusted by allergic rhinitis and gender (males).

<sup>#</sup>Covariates adjusted by asthma, allergic rhinitis and gender (males).

<sup>§</sup>Covariates adjusted by asthma, atopic dermatitis and gender (males).

<sup>¶</sup>Covariates adjusted by asthma, allergic rhinitis, gender (males) and age (years).

Sesame allergy and clam allergy did not show association with any variables.

Odds ratio was obtained by means of logistic regression by the “forward conditional” method.

Odds ratio is not calculated for variables excluded from the model.

All covariates were categorical, with the exception of age (years), which was introduced in a continuous scale.

OR: odds ratio; 95% CI: 95% confidence interval.

investigations, performed with representative samples of every region in Mexico, will allow a better definition of the behaviors associated with tree nut, peanut, sesame, and seafood allergy.

In summary, our study is the first in Latin America to determine the prevalence of food allergy to peanut, sesame, tree nuts, and seafood in adults. We found that these percentages are similar to those of developed countries. In addition, our results emphasize the role of heredity in the development of food allergy.

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