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Prevalence of self-reported food allergy in the National Health and Nutrition Examination Survey (NHANES) 2007–2010

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To the Editor

Food allergy is a common condition, with widely varying estimates of prevalence worldwide and within the United States. The National Health and Nutrition Examination Surveys (NHANES) is a periodic survey conducted by the National Center for Health Statistics (NCHS) of the Centers for Disease Control (CDC), which examines a nationally representative sample of approximately 5000 subjects each year. Further description of NHANES methodologies can be found in the Online Supplement. In the two most recently published NHANES, 2007–2008 and 2009–2010, information on specific food allergies was collected by questionnaire. To our knowledge, this is the first report of the overall prevalence of food allergy, the prevalence of specific food allergies, and information on demographic characteristics and comorbidities in both children and adults from this survey.

For this analysis, the prevalence of self-reported food allergy was assessed by a positive response to the question, “Do you have any food allergies?” If the subject answered yes, they were asked, “What foods are you allergic to?” with options including allergies to wheat, cow’s milk, eggs, fish, shellfish, corn, peanuts, other nuts, soy products, and other foods. Self-reported food allergy was then compared to the subject’s reported consumption of milk, shellfish, and fish over the previous 30 days. Self-reported peanut allergy was compared to reported consumption of peanut in the 24-hour dietary recall. These methods are detailed in the Online Supplement. Predictors of food allergy, including demographic

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features and other medical conditions were then examined, as is also detailed in the Online Supplement.

To account for oversampling, complex sampling methods, and non-response, weights and survey strata provided with the surveys were used for all analyses. As the prevalence of food allergy in the 2007–2008 and 2009–2010 were found to be similar, these data were combined (Supplementary Tables E1 and E2). All analyses were done in STATA SE/11 (College Station, TX).

A total of 20,686 individuals were surveyed between 2007 and 2010. Overall, the prevalence of self-reported food allergy was 8.96% (CI 8.32–9.60%), corresponding to 6.53% in children (95% CI 5.69–7.37%) and 9.72% in adults (95% CI 8.94–10.5%). When limiting the analysis to adults who reported allergy to peanuts, tree nuts, fish, and shellfish, which are more likely to persist into adulthood,(1) this prevalence decreased to 3.51% (95% CI 3.01–4.02%). “Other,” milk, peanut, and shellfish were the most common self-reported allergies in both children and adults (Table I). “Other” allergy likely includes symptoms with fruits and vegetables, such as found in pollen-food allergy syndrome, and this value is consistent with prevalence estimates reported in a systematic review on plant food allergy.(2)

Of the subjects with self-reported milk allergy, 34.4% (34.2% of children and 34.5% of adults) reported drinking cow’s milk in the month prior to the interview. We similarly found that 24.6% (11.0% of children and 26.5% of adults) of those with shellfish allergy and 34% (21.7% of children and 37.8% of adults) of those with fish allergy reported consumption of the respective food over the previous month. Only 4.8% of subjects with peanut allergy (5.4% of children and 4.6% of adults) reported recent peanut consumption, but by necessity, this question was more limited (24 hour recall). Estimated prevalence excluding those with reported consumption of these foods is included in Table 1.

Among adults, self-reported food allergy was more common in women, in those with a higher household education level, and in those of Non-Hispanic black race/ethnicity (Table II and Supplementary Table E3). Among children, there were no significant differences in prevalence by gender or household education level, but food allergy was more prevalent in Non-Hispanic Black children than in other race/ethnicities. In both adults and children, food allergy was more common among subjects with asthma or allergic rhinitis and increased in prevalence with increasing severity of asthma (Table II and Supplementary Table E4).

Our analysis is limited in that it is based on self-report, which has been shown to overestimate the true prevalence of oral food-challenge (OFC) confirmed food allergy.(3) Furthermore, the question asked here, “Do you have any food allergies?” is broad and may be answered affirmatively by subjects who have had other adverse reactions to foods, such as lactose intolerance or gluten sensitivity, rather than true IgE-mediated disease. We expected this to be a more significant problem for milk and wheat allergy than for peanut, tree nut, fish, or shellfish allergy. However, we found that a similarly high percentage of subjects (25–35%) with self-reported milk, fish, and shellfish allergies reported recent consumption of these foods. It is possible that individuals with a true IgE-mediated allergy to one fish or shellfish may have admitted to eating a fish or shellfish to which they were not allergic, but we would expect this to be a small number of participants. The percentage of subjects with self-reported peanut allergy who admitted to recent consumption was considerably less, although peanut consumption was assessed by a 24-hour rather than 30-day dietary recall.

Recently, a Canadian study compared prevalence estimates based on self-report of peanut, tree nut, shellfish, fish, or sesame allergy to either a convincing history of an IgE-mediated reaction or self-reported physician diagnosis and found little difference.(4) Following this

example, we also estimated the prevalence of peanut, true nut, fish, or shellfish allergy only among adults, and found that the estimated prevalence decreased from 9.72 to 3.49%, which is more consistent with previously reported estimates of overall food allergy when confirmed by OFCs.(5) This is still likely an overestimate of true food allergy to these foods, especially given that many with self-reported food allergy admitted to recently eating that food.

Despite these limitations, our estimated prevalences of 8.96% overall and 6.53% among children are similar to previously reported values.(6, 7) Our estimate for children is also consistent with the recent estimated prevalence of 5.1% from the National Health Interview Survey 1997–2011.(8) Our estimated prevalence of 9.72% among adults is higher than the 6.56% recently reported by Soller *et al*, (6) but, as above, this value decreased to 3.49% when only including peanut, tree nut, fish, and shellfish allergy, which is more likely to represent true IgE-mediated disease. Our estimated prevalences for self-reported peanut, tree nut, fish, and shellfish allergy in adults are furthermore consistent with recently reported Canadian values.(6) Our estimate of peanut allergy prevalence is similar to, though slightly lower than, that reported by Sicherer *et al* from a nationwide telephone survey,(9) which may be explained by the higher response rate in the NHANES survey.

Our findings further support previous observations that food allergy appears to be more prevalent in black children than other races/ethnicities. Through national telephone surveys, self-reported shellfish allergy was found to be more prevalent in African Americans,(10) and a study examining food allergen-specific IgE demonstrated that non-Hispanic blacks were more likely to be sensitized to food allergens than other races/ethnicities,(11) though the reasons for these disparities remain unclear.

Overall, our results highlight the need for more sophisticated methods, such as validated questionnaires, to perform wide-scale epidemiologic evaluations of food allergy.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations

| | |
|---------------|--|
| NHANES | National Health and Nutrition Examination Survey |
| OFC | Oral Food Challenge |
| CI | Confidence Interval |

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Table I

Self-reported prevalence of food allergy in the United States

| | Children | Adults | Total Study Population | New Study Population* |
|-------------------|------------------|------------------|------------------------|-----------------------|
| All Foods | 6.53 (5.69–7.37) | 9.72 (8.94–10.5) | 8.96 (8.32–9.60) | 7.64 (7.03–8.24) |
| Milk | 1.94 (1.43–2.44) | 2.64 (2.15–3.13) | 2.47 (2.10–2.85) | 1.62 (1.32–1.92) |
| Shellfish | 0.87 (0.56–1.17) | 2.04 (1.70–2.38) | 1.76 (1.49–2.03) | 1.33 (1.12–1.53) |
| PN | 1.16 (0.83–1.49) | 0.89 (0.61–1.17) | 0.95 (0.72–1.19) | 0.86 (0.65–1.07) |
| TN | 0.52 (0.26–0.79) | 0.87 (0.61–1.13) | 0.79 (0.59–0.98) | N/A |
| Egg | 0.64 (0.41–0.86) | 0.51 (0.37–0.65) | 0.54 (0.42–0.66) | N/A |
| Wheat | 0.29 (0.11–0.47) | 0.63 (0.42–0.84) | 0.54 (0.38–0.71) | N/A |
| Fish | 0.43 (0.13–0.73) | 0.46 (0.33–0.59) | 0.45 (0.34–0.57) | 0.29 (0.20–0.37) |
| Soy | 0.25 (0.14–0.37) | 0.35 (0.17–0.53) | 0.33 (0.18–0.47) | N/A |
| Corn | 0.28 (0.09–0.47) | 0.22 (0.09–0.35) | 0.24 (0.12–0.35) | N/A |
| PN/TN | 1.42 (1.03–1.81) | 1.47 (1.08–1.86) | 1.46 (1.13–1.79) | 1.38 (1.06–1.70) |
| PN/TN/SF | 2.06 (1.61–2.51) | 3.26 (2.79–3.73) | 2.97 (2.58–3.36) | 2.50 (2.15–2.86) |
| PN/TN/F/SF | 2.29 (1.79–2.80) | 3.49 (3.00–3.99) | 3.21 (2.80–3.61) | 2.62 (2.26–2.99) |
| Other | 2.83 (2.30–3.35) | 4.49 (4.02–4.96) | 4.09 (3.72–4.47) | N/A |

Values reported as % (95% CI)

* Study population after excluding those reporting allergy to peanut, shellfish, fish, and milk with recent consumption of the culprit food

PN = peanut; TN = tree nuts; SF = shellfish; F = fish

Table II

Self-reported prevalence of food allergy by demographic characteristic*

| | Children | p value | Adults | p value | Total Study Population | p value |
|--------------------|------------------|---------|------------------|---------|------------------------|---------|
| Overall | 6.53 (5.69–7.37) | | 9.72 (8.94–10.5) | | 8.96 (8.32–9.60) | |
| Gender | | | | | | |
| <i>Male</i> | 6.08 (5.23–7.06) | 0.19 | 8.21 (7.40–9.11) | 0.0001 | 7.68 (7.03–8.39) | 0.0001 |
| <i>Female</i> | 7.00 (5.83–8.39) | | 11.1 (9.99–12.4) | | 10.2 (9.22–11.2) | |
| Education | | | | | | |
| < <i>College</i> | 5.89 (4.76–7.27) | 0.30 | 7.75 (6.81–8.81) | <0.001 | 7.31 (6.55–8.15) | <0.001 |
| <i>College</i> | 6.83 (5.76–8.08) | | 11.2 (10.0–12.4) | | 10.1 (9.16–11.2) | |
| Income | | | | | | |
| < <i>1.75 x PL</i> | 6.21 (5.40–7.13) | 0.42 | 9.06 (8.18–10.0) | 0.13 | 8.21 (7.48–9.01) | 0.02 |
| <i>1.75 x PL</i> | 6.77 (5.62–8.13) | | 9.99 (9.06–11.0) | | 9.30 (8.55–10.1) | |
| Race | | | | | | |
| <i>White</i> | 6.34 (5.21–7.69) | 0.03 | 9.64 (8.56–10.8) | 0.24 | 8.96 (8.03–9.97) | 0.04 |
| <i>Black</i> | 8.13 (6.54–10.1) | | 11.1 (9.76–12.7) | | 10.3 (9.16–11.9) | |
| <i>Hispanic</i> | 5.16 (4.26–6.22) | | 8.48 (7.28–9.87) | | 7.38 (6.42–8.49) | |
| Asthma | | | | | | |
| <i>No</i> | 5.19 (4.54–5.92) | <0.0001 | 8.55 (7.80–9.36) | <0.0001 | 7.76 (7.15–8.42) | <0.0001 |
| <i>Yes</i> | 13.9 (10.7–17.7) | | 17.0 (14.9–19.4) | | 16.2 (14.5–18.0) | |
| AR | | | | | | |
| <i>No</i> | 5.88 (5.16–6.69) | <0.0001 | 8.14 (7.39–8.97) | <0.0001 | 7.57 (6.97–8.23) | <0.0001 |
| <i>Yes</i> | 11.9 (9.27–15.2) | | 17.5 (15.3–20.0) | | 16.5 (14.5–18.8) | |

Values expressed as % (95% CI)

PL = poverty level

AR = Allergic Rhinitis

* P value determined by Pearson chi-squared test