SUPPLEMENT ARTICLE

Maternally Reported Food Allergies and Other Food-Related Health Problems in Infants: Characteristics and Associated Factors

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ABSTRACT

OBJECTIVE. Our goal was to identify the frequency, demographics, and diagnostic characteristics associated with maternally reported food allergies and other food-related health problems among infants aged ≤1 year.

METHODS. We analyzed data from the 2005–2007 Infant Feeding Practices Study II, a longitudinal survey of 2441 US mothers of healthy singletons from pregnancy through their infant's first year. Doctor diagnosis and symptoms-based criteria were used to identify a probable-food-allergic group from maternal reports of infant health problems with food.

RESULTS. More than one fifth of the 2441 mothers reported that their infant had a food-related problem; 6% (n = 143) had a probable food allergy, and 15% (n = 359) had other food-related problems. Forty percent of the infants with a food-related health problem were evaluated by a doctor. Gastrointestinal symptoms were more commonly reported in early infancy compared with skin-related symptoms, which were reported in later infancy, and 27% received medical treatment for the symptoms. Characteristics associated with increased incidence of probable food allergy included family histories of food allergy and type 1 diabetes, gestational diabetes, living in rural or urban areas, being black, and being male. Among all infants with a food-related health problem, the majority experienced their first problem by 6 months of age. Foods recognized to be major allergens were most commonly reported as the source of an allergy.

CONCLUSIONS. Food-related problems occurred at a high frequency in the first year of life. A better understanding of the demographics, family history, disease manifestations, and diagnoses may provide insight into public health efforts to minimize or prevent food allergies in infancy and to help differentiate food-allergic problems from nonallergic food problems in this age group. *Pediatrics* 2008;122:S105–S112

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Key Words
food allergy, food hypersensitivity, food intolerance, diet, infants

Abbreviation
IFPS—Infant Feeding Practices Study

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ADVERSE REACTIONS TO foods, which include food allergy, food hypersensitivity, and food intolerance, can result in potentially serious health complications. In particular, immunoglobulin E–mediated food allergies are a leading cause of anaphylactic events treated in hospital emergency departments and can be fatal.[1,2] For reasons that are not well understood, the prevalence of food allergies has been increasing steadily, especially in infants and young children.[3,4] US prevalence estimates of clinically apparent food allergy in this young population are reported to be 6% to 8%, compared with 2% in adults.[5,6] Food allergies are an important component of the allergic march[7]; it is now recognized that food allergies often precede, and potentially promote, development of other important allergic diseases, such as allergic rhinitis and asthma.[8–10] Thus, research efforts aimed at understanding environmental factors, disease manifestations, and other diagnostic features characteristic of food allergies, in relation to other food-related health problems, at this critical infancy stage, may provide important information for public health initiatives to prevent food allergies.

To date, epidemiologic food-allergy studies of infants have reported incidence rates of 19% to 35% in parentally reported cases of food allergy[11–16] and 2% to 8% in cases of objective diagnosis by food challenge.[11,14,15] This disparity between parentally reported cases of food-allergic problems and diagnosed cases is likely attributable to differences in perceptions of what food allergy means and difficulties in recognizing symptoms or other historical characteristics of food allergies in the infant population.[17] In this latter regard, relatively few epidemiologic data are available on demographic or diagnostic characteristics that may differentiate food allergies from nonallergic food problems in these populations.

The Infant Feeding Practices Study II (IFPS II) design afforded us the opportunity to collect maternally reported cases of food-allergic complaints in infants and to evaluate these complaints in relation to other maternally reported

measures such as doctor diagnosis, diagnostic methods, treatments, and presence of allergic-type symptoms. Using criteria based on doctor diagnosis and symptoms, we identified a probable-food-allergy group and an other-food-problem group and evaluated differences between the 2 groups. Specifically, the study examined demographic and family-history factors and characterized symptoms, onset age, and responsible foods that may potentially differentiate food allergies from other food-related health problems.

METHODS

Study Design

The IFPS II is a longitudinal mail survey of pregnant women who gave birth to a healthy singleton of ≥35 weeks' gestation and were followed until their infant was 1 year old. The sample was drawn from a nationally distributed consumer panel, with data collected in the years 2005–2007. Prenatal questionnaires were sent at approximately the third trimester of pregnancy, a short telephone interview was conducted at about the time of the infant's birth, and 10 postnatal questionnaires were sent approximately monthly (except for months 8 and 11), corresponding with the age of the infant. Sample sizes for the different questionnaires varied from ~1800 to 3000. The study was approved by the US Food and Drug Administration Research Involving Human Subjects Committee. Details of the study methods are provided elsewhere in this supplement.[18]

Sample

The main sample for this analysis is mothers in the IFPS II who answered at least 1 question asking if their infants had experienced a health problem caused by food. Questionnaires to ascertain a history of food problems or allergies were sent to all mothers in the study when infants were ~4, 9, and 12 months old. The sequence of these questionnaires was designed to coincide with the timing of when most infants were eating only a milk-based diet, shortly after most infants had been exposed to a limited variety of foods, and again when they were probably eating a more diverse diet. On the 4-month questionnaire, mothers were asked if their infant had experienced a problem caused by food, such as an allergic reaction, sensitivity, or intolerance. These latter terms were not specifically defined. In the 2 later questionnaires, the mothers were asked to report only food-related problems that the infant had experienced since the last time the question was asked.

We used 3 sets of information (doctor visit or evaluation, food-allergy diagnosis, and/or certain symptoms) to identify infants with food allergies, known as the probable-food-allergy group. The probable-food-allergy group was defined as all infants who either visited a doctor and received a diagnosis of food allergy or who did not visit a doctor but had food-related symptoms of swollen eyes or lips or hives at any age. Although many different types of symptoms are associated with food allergy, certain symptoms such as diarrhea, wheezing, and eczema may commonly manifest in infants for other reasons.[17] Therefore, only symptoms suggestive of urticaria and angioedema were used to identify additional cases of food allergy for this study, because these symptoms are those most consistently and commonly reported to be present in immunoglobulin E–mediated food allergies.[6,19–22] Infants with a food-related problem not deemed to be a probable food allergy were identified as the other-food-related-problem group.

Variables

Basic demographic information included mother's education, race, household income, and population density. From household income, a poverty index ratio was determined by the ratio of household income to the appropriate poverty-threshold values for family size used by the US Census Bureau. We analyzed 2 categories (<185% and ≥185% of the poverty index ratio) because the former is the criterion used for eligibility for the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). We included 3 categories of population density: rural, suburban or urban. Rural was defined as a nonmetropolitan statistical area, suburban was defined as the noncentral area of a city of any size, and urban was defined as a central city of any size.

The prenatal questionnaire asked about the mother's age, the presence and number of other siblings in the household, whether the mother had gestational diabetes during the current pregnancy, and whether anyone in the family had a history of food allergy, other allergy (ie, asthma, eczema, or environmental), type 1 diabetes, or obesity. In addition, the mothers were asked how many cigarettes they smoked per day while pregnant and how many other people smoked inside their home on most days. The neonatal questionnaire collected information about type of delivery and infant gender.

The mothers who responded that their infants had experienced a problem caused by food were asked for details about the problem, including whether the infant reacted the first time the food was eaten, whether the problem was caused by food the infant ate or food the infant was exposed to through breast milk, and the age of the infant when the problem first occurred. Other questions asked whether the infant was taken to a doctor because of the food-related problem, about the type of food-allergy testing performed, and whether the infant was diagnosed as having a food allergy by a medical doctor. The mothers were asked to check (from a defined list) all symptoms observed in the infant as a result of the food-related problem, how the symptoms were treated, and what food(s) caused the problem. The results presented for these variables were summarized across all questionnaires unless otherwise specified.

Statistics

SAS software (SAS Institute, Inc, Cary, NC) was used for all analyses. Procedures included frequencies and cross tabulations with the χ^2 test. Some data were analyzed cross-sectionally for the 3 questionnaires that included the questions about food-related problems, and other data were summarized across questionnaires.

TABLE 1 **Percentage of Infants Experiencing Each Symptom as a Reaction to a Food-Related Problem, According to Questionnaire Month and Diagnosis**

Symptom	Month 4 ($N = 249$)			Month 9 ($N = 203$)			Month 12 ($N = 198$)		
	Diagnosed Allergy ($n = 51$)	No Doctor Visit ($n = 134$)	Doctor Visit, No Allergy Diagnosed ($n = 64$)	Diagnosed Allergy ($n = 48$)	No Doctor Visit ($n = 112$)	Doctor Visit, No Allergy Diagnosed ($n = 43$)	Diagnosed Allergy ($n = 58$)	No Doctor Visit ($n = 107$)	Doctor Visit, No Allergy Diagnosed ($n = 33$)
Gassiness/cramps	78.4	64.2	68.8	37.5	33.9	41.9	34.5	28.0	39.4
Irritability	64.7	44.8	68.8	47.9	26.8	20.9	32.8	24.3	33.3
Diarrhea	39.2	11.9	18.8	25.0	21.4	11.6	32.8	33.6	27.3
Vomiting	37.3	12.7	25.0	31.3	13.4	23.3	29.3	17.8	24.2
Constipation	35.3	17.9	31.3	10.4	12.5	14.0	12.1	4.7	9.1
Colic	33.3	20.2	35.9	10.4	2.7	4.7	8.6	1.9	12.1
Congestion	29.4	4.5	6.3	18.8	3.6	0.0	13.8	4.7	12.1
Rash/eczema	27.5	12.7	20.3	50.0	42.0	48.8	53.5	44.9	39.4
Sleeplessness	25.5	14.2	17.2	16.7	5.4	16.3	15.5	8.4	24.2
Blood in stool	15.7	1.5	7.8	8.3	0.0	4.7	5.2	1.9	3.0
Coughing	15.7	0.0	3.1	10.4	0.9	0.0	15.5	0.9	6.1
Runny nose	9.8	3.0	3.1	14.6	1.8	4.7	20.7	4.7	9.1
Asthma/wheezing	7.8	0.8	0.0	8.3	0.0	4.7	10.3	0.9	9.1
Trouble breathing	5.9	0.8	1.6	6.3	0.0	2.3	8.6	0.0	9.1
Hives/welts	3.9	3.0	6.3	29.2	17.9	16.3	36.2	22.4	12.1
Swollen eyes/lips	3.9	1.5	0.0	12.5	3.6	0.0	22.4	6.5	6.1
Flushing	2.0	0.8	3.1	2.1	3.6	7.0	12.1	5.6	0.0
Loss of consciousness	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spitting up	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RESULTS

Analysis of Food-Related Health Problems

Of the 2441 mothers who answered the question on whether their infant had a food-related problem any time in the infant's first year, 60% completed all 3 questionnaires that asked detailed questions about problems with food. The 4-month questionnaire was the first one on which detailed allergy questions were asked, and 76% of the sample answered this questionnaire and at least 1 of the 2 later (the 9- or 12-month) questionnaires. Among all respondents, 502 infants (20.6%) were reported to have had a problem caused by food.

Of the 502 infants with a food-related health problem, 40.0% received a doctor diagnosis, and 24.5% had been tested for a food allergy. Among those tested for food allergy, the methods of testing were food-elimination trials (56.9%), food-challenge tests (19.5%), in vitro diagnostic tests (18.7%), diagnostic skin testing (13.8%), intestinal study (7.3%), and other diagnostic procedures (17.9%) (data not shown). From the food-related health data, 3 doctor visit/diagnosis categories were identified: doctor visit and diagnosed food allergy (19% [$n = 95$]), no doctor visit (60% [$n = 301$]), and doctor visit, not diagnosed as food allergy (21% [$n = 106$]) (data not shown).

Among infants with food-related problems, 49.7% were reported to have had a reaction on the first known exposure to the food. Also, most (86.5%) problems were reported to occur when the infant ate the food directly, whereas 26.7% were reported to occur via breast milk exposure; thus, in some cases, the problems occurred from both exposures (data not shown). Questions regarding medical treatment for the symptoms of food-related health problems showed that 26.8% of affected infants received some type of treatment for their symptoms. Nearly half of these infants (13.3% of those affected) were treated with an antihistamine. Fewer than 3% of the affected infants were prescribed an epinephrine kit, treated with epinephrine, treated in a hospital, or treated by emergency medical technicians (data not shown).

Table 1 lists all symptoms associated with maternally reported food-related problems in infants according to the questionnaire month category, doctor visit, and diagnosis as food allergy. For the 9- and 12-month groups, the mothers were asked to report only reactions the infant had experienced since the previous questionnaire; therefore, the results reflect symptoms from any new food-related health problem in the reporting period. For the later reporting periods, there was no double entry of the same individual or symptom unless new symptoms were reported in relation to food(s) previously reported to cause a reaction or mothers specifically reported that similar symptoms continued to cause problems in the successive period(s). In the infants' first 4 months, most mothers reported gassiness and cramps associated with their infant's food-related problem. More than one third of the infants with a diagnosed food allergy were reported to have irritability, diarrhea, vomiting, and constipation. In general, infants diagnosed with a food allergy were more likely to have respiratory system symptoms (congestion being the most common) than those who visited a doctor but had no diagnosed allergy. Also, mothers were more likely to report skin-related symptoms, including hives/welts, swollen eyes/lips, and rash/eczema for older infants. Hives/welts and swollen

eyes/lips were more commonly found in the diagnosed-food-allergy group.

Probable-Food-Allergy Group

The probable-food-allergy group included all infants with a doctor-diagnosed food allergy and those with a food-related problem who were not taken to a doctor for the problem but were reported to have food-related swollen eyes/lips or hives/welts at any time in the study. In total, this allergy cohort comprised 143 infants, representing 28.5% of infants with food-related problems group and 5.9% of all infants in the sample. All other infants with a food-related health problem (n = 359 [14.7% of all infants in the sample]) were included in the other-food-related-problem group. We did not analyze or evaluate the possibility that food problems reported at ≤4 months were outgrown or became nonproblematic by 1 year of age.[23]

Bivariate associations between demographic and family-history characteristics and the food-related-problem categories were calculated (Table 2). With the criterion of $P < .05$, education, race, population density, infant gender, and family history of food allergy and obesity were associated with food-related health problems. The characteristics associated with a higher percentage of both food-related problems were mothers with a college degree, relative to lower education, and family history of food allergy, relative to no family history of food allergy. The characteristics associated with a higher percentage of infants in the probable-food-allergy group only were black race, relative to white and Hispanic race; not living in suburban areas, relative to rural or urban areas; and male gender, relative to female gender. The characteristics associated with a higher rate of infants in the other-food-related-problem group but not the probable-food-allergy group included white race, relative to black or Hispanic race, and a family history of obesity, relative to no such family history.

Dichotomized analyses for probable-food-allergy group versus all other infants (combining other-food-related problem and no food-related problem) revealed a significantly higher probable food allergy for black race (P = .02), rural or urban residence (P = .01), male gender (P = .01), maternal gestational diabetes (P = .04), family history of food allergy ($P < .001$), and family history of type 1 diabetes (P = .02). The P value for family history of other atopy was .058 (data not shown).

The probable-food-allergy group was compared with the other-food-related-problem group in relation to age of presentation of problems (Fig 1). Nearly 30% of the infants in both groups were reported to have food problems that began by the age of 1 month, and most infants experienced their first problem by 6 months of age. In general, infants in the other-food-related-problem group seemed to experience problems earlier than those in the probable-food-allergy group. Data presented are for the 438 infants with a food-related problem, excluding those with missing data regarding age at first problem. However, this analysis was also conducted by using only the 392 infants whose mothers completed the 4-month questionnaire and at least 1 of the 9- or 12-month questionnaires so that all infants would have an opportunity to be in either the younger or older age groups. The results were nearly identical.

The type of foods reported to cause a problem were analyzed over the 12-month study period according to the questionnaire month categories (Table 3). In general, foods recognized to be major food allergens for young children[5] were more commonly reported as the source of the problem in the probable-food-allergy group at all time points. Estimated 12-month prevalence rates to common allergenic foods based on this group were 3.8% for cow's milk, 1.4% for soy, 1.1% for egg, 0.6% for peanut, and 0.5% for wheat. Cow's milk, including infant formula that contains cow's milk, was the most commonly reported food cause for problems with foods in all periods. Soy, including infant formula containing soy, was the next most commonly reported food in both groups at 4 months. Problems with fruits and vegetables were commonly reported in both groups throughout the study period. Problems with egg increased specifically in the probable-food-allergy group after month 4, and egg was the second most common source of food allergen by 12 months of age.

DISCUSSION

From a nationally distributed sample of >2400 infants in the United States, we analyzed and described maternally reported food-related problems at 3 periods during the first year of life and provided a recent estimate of food-related problems and food allergy. We found a 1-year prevalence rate for all food-related problems of 20.6% in this population. The majority of infants experienced their first food-related health problem by 6 months of age. Forty percent of these infants (or 8% of the total infant population) were taken to a doctor for the food-related problem. Using information on doctor diagnosis and analysis of symptoms, we identified a probable-food-allergy group, which represented approximately one third of the infants with food-related problems and 5.9% of all the infants.

This study used novel criteria for identifying infants with a probable food allergy on the basis of reports of doctor-diagnosed food allergy or food-related problems without a doctor visit and presenting with specific symptoms of urticaria and/or angioedema. From these criteria, we determined an incidence rate of probable food allergy at 1 year of 5.9%. Although somewhat higher than rates reported with objective challenge measures for food allergy,[14–16] this rate is consistent with reported prevalence rates of 6% to 8% in children[5,6] and corroborates the notion that most food allergies begin as part of the allergic march within the first year of life.[7] From the food-cause data, our estimated 1-year frequencies for probable allergies to milk, egg, and peanut are consistent with those in published reviews.[5,23,24] The higher frequency of probable soy allergy (1.4%) in our sample compared with national frequencies[5] may have occurred because the greatest percentage of infants with food-related problems began having problems in the first 6 months, when common foods consumed are milk- or soy-based infant formulas. Although we did not specif-

TABLE 2 **Food-Related-Problem Group, According to Demographic, Maternal, and Family-History Characteristics**

	Total, %	Probable Food Allergy, %	Other Food-Related Problem, %	No Food-Related Problem, %
Total ($n = 2441$)[a]		143 (5.9)	359 (14.7)	1936 (79.4)
Mother's age ($P = .39$)				
18–24 y	20.1	5.7	12.0	82.2
25–34 y	63.1	6.0	15.1	78.9
≥35 y	16.8	5.6	16.4	78.0
Education ($P = .05$)				
High school or less	19.3	5.4	11.5	83.1
Some college	39.0	5.3	13.9	80.9
College graduate	41.7	6.5	16.8	76.7
Race ($P = .04$)				
White	89.7	5.6	15.3	79.1
Black[b]	4.2	12.5	10.4	77.1
Hispanic	6.1	5.1	11.6	83.3
Percent poverty ($P = .21$)				
<185%	39.7	6.3	13.2	80.5
≥185%	60.3	5.6	15.7	78.8
Population density ($P = .01$)				
Rural	18.8	7.6	14.4	78.0
Suburban[b]	50.0	4.4	16.1	79.5
Urban	31.1	7.1	12.8	80.1
Gender of infant ($P = .02$)				
Male[b]	49.4	7.1	13.6	79.3
Female	50.6	4.7	15.7	79.6
Type of delivery ($P = .71$)				
Vaginal	71.5	5.7	14.5	79.8
Cesarean	28.5	6.3	15.3	78.4
Gestational diabetes ($P = .12$)				
Yes[b]	7.2	10.0	14.4	75.6
No	92.8	5.9	15.2	78.9
Parity ($P = .20$)				
Only child	29.4	6.3	17.0	76.8
1 sibling	40.7	6.3	13.9	79.8
≥2 siblings	29.9	4.9	13.7	81.4
Any smoking in home ($P = .96$)				
Yes	16.7	5.8	14.8	79.4
No	83.3	6.1	14.5	79.4
Family history				
Food allergy ($P < .0001$)				
Yes[b]	28.1	9.3	19.9	70.8
No	71.9	4.5	12.9	82.6
Other atopy ($P = .13$)				
Yes[c]	22.0	7.7	15.4	76.8
No	78.0	5.5	14.6	79.9
Type 1 diabetes ($P = .06$)				
Yes[b]	5.1	11.3	14.2	74.5
No	94.9	5.7	14.8	79.5
Obesity ($P = .01$)				
Yes	51.2	6.5	16.5	77.0
No	48.8	5.3	12.6	82.2

The P values are based on χ^2 tests of independence between each variable and the 3 categories of food problems.

[a] The sample size for each characteristic category does not always add up to 2441 because of missing data.

[b] Dichotomized analyses revealed a statistically significant association ($P < .05$) between infants with probable food allergy and all other infants.

[c] Dichotomized analyses revealed that $P = .058$ between infants with probable food allergy and all other infants.

ically evaluate this question, this soy-problem group could have also represented a reported population, in 14% to 25% of cases,[25,26] of milk-allergic infants who become cosensitized to soy when switched to soy-containing foods or formula. This study also revealed that a high percentage of infants had reactions to fruits and vegetables, consistent with the results of other studies of infant populations.[11,13] However, most reactions to fruits or vegetables occurred equally or more frequently in the other-food-related-problem group compared with the probable-food-allergy group, a finding which corroborates another study's conclusion that revealed that most

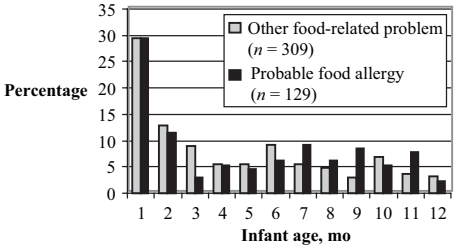

FIGURE 1
Percentage of infants experiencing their first problem with food.

infants with reported allergic problems to fruits and vegetables had negative food challenge results.[11]

Because diagnosis of food allergy at this young age may be difficult, we also compared and reported differences between the probable-food-allergy group and a group of infants with other food-related problems. It was generally difficult to distinguish between these 2 groups in the early months of life according to food sources and temporal pattern of reporting, because both showed reactions primarily to milk and soy and, in 30% of the cases, problems began in the first month of life. After 4 months, the probable-food-allergy group showed problems with foods more typical of major allergenic sources. With regard to family-history variables, a family history of food allergy, a well-documented variable associated with incidence of food allergy in children,[20,27,28] was associated with problems in either group. Although a biparental family history of atopy, which is more closely associated with development of food allergy,[29] was not ascertained, our near-significant association ($P = .058$) between family history of other atopy and probable-food-allergy group incidence supports recommendations for including infants with any family history of atopy in food allergen prevention programs.[28] Also, the association of probable food allergy with male infants is consistent with findings seen in other epidemiologic studies that evaluated incidences of atopic conditions of asthma/wheezing[30,31] and eczema[32,33] in young children.

Some rather surprising findings of our study are the associations between type 1 diabetes and gestational diabetes with incidence of food allergy and the inverse relation between suburban, compared with urban or rural, residence and reporting of the probable-food-allergy group. There has been a debate as to whether type 1 diabetes, or other T-helper type 1 T-cell–mediated disorders, may be protective for T-helper type 2–mediated disorders such as allergy.[34] Studies have examined coexistence of type 1 diabetes and allergy, and the results have been inconclusive.[35,36] Our study's finding of an association between the probable-food-allergy group and family history of type 1 diabetes, suggesting a common genetic predisposition between disorders at opposite T-cell inflammatory spectrums, adds to this debate. Likewise, the potential link between gestational diabetes in the mother and probable-food-allergy group is novel and needs additional evaluation. Finally, although the protective effect of rural exposure factors on the incidence of allergic disorders has been well documented,[37] the protective effect limited to only suburban lifestyle in our study needs additional corroboration.

A potentially important public health finding of our study is the discrepancy between the reporting of food-related health problems and actual doctor visits and/or diagnosis. It was determined that 60% ($n = 301$) of the infants were not taken to the doctor for their food problems, and of those who did, not all had a procedure performed to diagnose the food allergy. The significance of this finding is twofold. First, most mothers are not consulting health professionals for food problems in their children and, thus, may be making uninformed decisions regarding dietary intake and restrictions for their infants. Second, a lack of objective determination

TABLE 3 **Percentage of Infants in the Probable-Food-Allergy Group Versus Those in the Other-Food-Related-Problem Group Who Reacted to Each Food, According to Questionnaire Month**

Food	Month 4		Month 9		Month 12		Total Sample Prevalence Based on Probable-Food-Allergy Group)
	Probable Food Allergy ($n = 58$)	Other Food-Related Problem ($n = 160$)	Probable Food Allergy ($n = 74$)	Other Food-Related Problem ($n = 128$)	Probable Food Allergy ($n = 88$)	Other Food-Related Problem ($n = 110$)	
Cow's milk	94.8	71.9	54.1	33.6	58.0	45.5	3.8
Soy	32.8	20.6	21.6	5.5	15.9	5.5	1.4
Wheat	6.9	1.3	6.7	4.7	10.2	1.8	0.5
Peanut	6.9	1.9	5.4	0.8	9.1	4.6	0.6
Fruit	5.2	6.3	21.6	24.2	14.8	19.1	1.2
Egg	5.2	3.1	12.2	1.6	26.1	10.9	1.1
Vegetable	1.7	15.0	20.3	21.1	8.0	10.0	0.9
Other grain	1.7	3.1	9.5	15.6	5.7	2.7	0.4
Meat[a]	1.7	0.0	2.7	3.1	0.0	2.7	0.1
Sesame	1.7	0.0	0.0	0.8	1.1	0.9	0.1
Tree nut	0.0	1.3	1.4	1.6	2.3	1.8	0.1
Fish	0.0	0.6	1.4	0.0	2.3	2.7	0.1
Other	19.0	23.8	20.3	25.8	14.8	22.7	1.3

[a] Beef, chicken, or turkey.

of food allergies by health professionals may lead to improper diagnosis and/or overestimation of food allergies in infants and unnecessary placement of infants on restrictive diets. Highly restrictive diets are low in calories or can severely limit intake of food sources of nutrients and may interfere with growth.[38,39] Moreover, the difficulties of following strict food-allergen practices can cause psychosocial effects that have a considerable impact on the quality of life of children and their caregivers.[40] Therefore, it is important for mothers to be informed and to receive a proper diagnosis of food allergy for their infants to avoid dietary indiscretions.

This study has some important limitations. First, the criteria for selecting the probable-food-allergy group from parentally reported cases of food-related problems have not been validated. Estimation of the food-allergy-diagnosis group may be biased by the mothers' actions in taking their infant to the doctor, possibly as a result of reading the questionnaire or by their interpretation of statements made by the doctor, especially in the many cases in which diagnosis was not associated with a diagnostic procedure. Also, because a majority (60%) of the infants with food problems were not taken to a doctor, a significant component of our probable-food-allergy group estimation was based on maternally reported symptoms. In this regard, to achieve the highest specificity for allergy, we restricted our criteria to only the most commonly reported allergic symptoms in studies (ie, those suggestive of urticaria and angioedema). Thus, cases of food allergy presenting with other symptoms in this no-doctor-visit category were likely underestimated. At the same time, because the specificity of angioedema and/or urticaria as explicit complaints for food allergies is unknown, we may have overestimated cases of food allergy by using these symptom criteria as well. Third, although nationally distributed, the IFPS II sample is not nationally representative[18] and, therefore, is limited in ascribing prevalence estimates to the US population. Fourth, our data on the probable-food-allergy group do not discern whether other important food-allergic-type disorders presenting in early childhood, such as celiac disease and allergic eosinophilic gastropathies,[17] were present in this group. Fifth, information on other potentially relevant environmental exposures tied to incidence of atopic disorders, such as pet ownership,[37] was not asked and is missing from this data analysis.

Despite these limitations, the strengths of the study include the large and nationally distributed sample, the prospective study design with a short time frame over which mothers were asked to recall information, and additional detailed questions, relative to most population surveys in this age group, to ascertain probable allergy (eg, doctor diagnosis, etc) in all cases of reported food problems. It should be noted that the food-related-problem incidence of our population (20.6%) is within the range, although at the lower end, of most reported incidences from infant study populations in Scandinavia, the United Kingdom, and the United States (19%–35%).[11–15] Also, the ratio of overall incidence of food-related problems to the probable-food-allergy group rate (20.6:5.9) for our study is 3.5 and falls within the 3- to 15-fold range of variability expected between parentally reported cases and those that are eventually confirmed by food challenge.[11,14,15] Assessments of the parentally reported food-problem complaints with additional historical criteria, therefore, may have some value in minimizing overestimations of food-related allergic problems in population surveys. Additional development and validation of symptom criteria to maximize identification of cases of food allergies in reported data for which little objective information is available is needed.

CONCLUSIONS

This study identifies an incidence rate of food allergies and other food-related health problems in US infants similar to those reported in older children and suggests that the onset of food allergies likely begins before the age of 12 months. Because food-related health problems occur frequently in this population and important dietary decisions resulting in unnecessary restrictions may be made during this period, it is important to differentiate food-allergic from other nonallergic manifestations. Our results show patterns of demographic and family-history associations observed when these 2 groups were compared. More research is needed to understand which factors influence the appearance of these associations so that the risk of food allergy in infants can be reduced.

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