

Mixed-up nuts: identification of peanuts and tree nuts by children

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Background: Peanuts and tree nuts frequently cause severe allergic reactions. Nut avoidance is the key treatment, and accurate identification of nuts is essential for successful avoidance.

Objectives: To determine the age at which nut-allergic and nonallergic children can accurately identify various nuts and whether nut-allergic children can identify nuts they should avoid.

Methods: A "nut box" was constructed containing samples of 11 common nuts and pine nuts. Nut-allergic and nonallergic children were asked to identify the nuts, and their responses were compared and correlated by age. Nut-allergic children were asked to identify the nut(s) that they should not eat.

Results: One hundred children (37 allergic and 63 nonallergic) were enrolled. The mean number of nuts correctly identified was only 2.7 per child and increased with age, but there was large variation. Fifty-nine children identified 2 or fewer nuts. Peanuts in the shell were identified most often (89% of children), followed by peanuts out of the shell (52%). Other nuts were identified less commonly, ranging from 32% for pistachios to 0% for Brazil nuts. Nut-allergic children were not better able to correctly identify tree nuts and were less able in the case of peanuts. Of the nut-allergic children, 10 (27%) could not identify the peanut or tree nut to which they were allergic.

Conclusions: In general, children, including those who are allergic to nuts, can identify few nuts. This lack of recognition could put them at increased risk for unintentional ingestion. As part of an overall educational plan, nut-allergic children should be taught not only to avoid but also to identify the nut to which they are allergic.

Ann Allergy Asthma Immunol. 2006;97:73-77.

INTRODUCTION

Allergies to peanuts and tree nuts are among the most common food allergies in patients of all ages, and they seem to be increasing, particularly in children.¹ Allergic reactions to nuts can be severe, and most fatal food allergy reactions are caused by nuts.² Despite the availability of autoinjectable epinephrine and the promise of future therapies,^{3,4} strict avoidance of the offending nut remains the cornerstone of nut allergy management.

The most basic requirement to avoid unintentional ingestions in food-allergic individuals is the ability to recognize the foods to which they are allergic. Although this may be a challenge even in adults, children may have an especially difficult time identifying foods to which they are allergic and, therefore, may be at increased risk of avoidable allergic reactions. Using a "nut box" containing samples of peanuts and common tree nuts, we determined whether and at what age nut-allergic and nonallergic children reliably identified these foods.

METHODS

A "nut box" was constructed, and samples of several common nuts were fastened to its base (Fig 1). The nuts used were

peanuts in the shell, peanuts out of the shell, cashews, pecans, pistachios (mixed shelled and unshelled), hazelnuts (filberts), almonds and slivered almonds, Brazil nuts, macadamia nuts, and walnuts. Pine nuts were also included. Except for peanuts and pistachios, all the other nuts were unshelled, and the pistachio was in its natural color, not dyed red. The box was covered with a clear acrylic top to allow for easy viewing and to prevent unintentional exposure to the nuts.

A prospective convenience sample of children younger than 21 years with no known neuropsychiatric conditions or developmental delay was tested. Each child was first asked, "Do you see any peanuts in this box?" and was instructed to point to the peanut. They were then asked, "Do you see any other peanuts in this box?" and again were asked to point to the nut. This question was repeated until the child indicated that there were no more peanuts. Then, the child was asked to name each nut in the box. Their responses, as well as demographic data and whether they had a peanut or tree nut allergy and if so to which nut, were recorded. Children with nut allergies were also asked to identify which nuts they could or could not eat. Non-English-speaking children were allowed to identify the nuts in English or their native language. This study was approved by the Childrens Hospital Los Angeles investigational review board.

Data Analysis

The proportion of patients in the nonallergic and nut-allergic groups who correctly identified the different nuts was compared using the χ^2 test. The relationship between age and number of nuts correctly identified was analyzed using the

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Received for publication September 26, 2005.

Accepted for publication in revised form October 17, 2005.

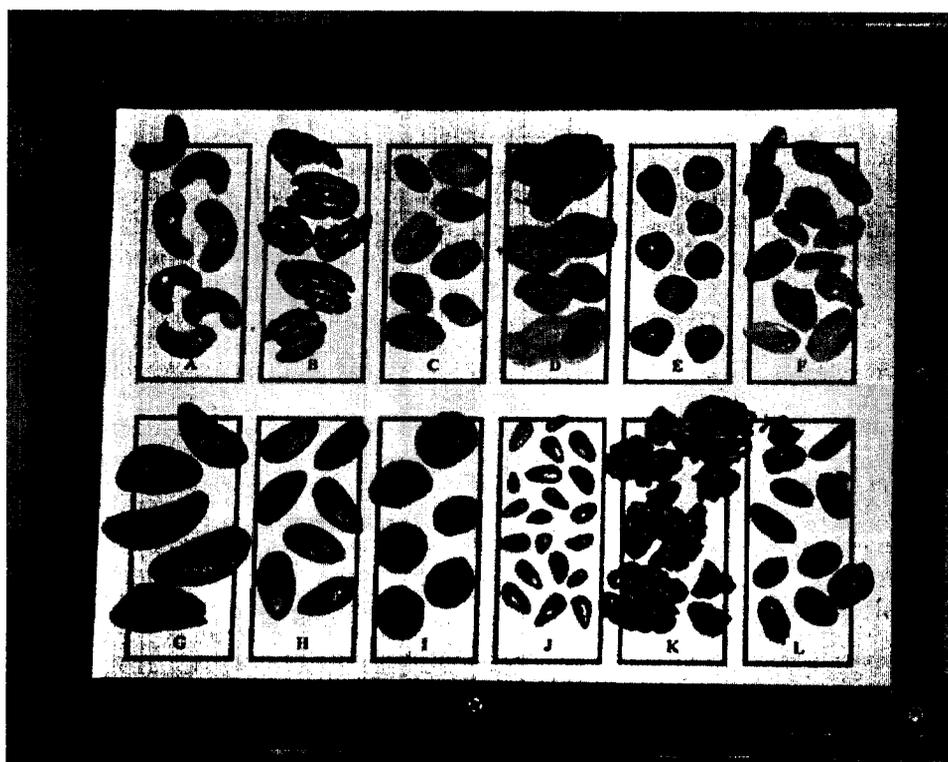


Figure 1. The "nut box" was used to test children's ability to identify various nuts: cashews (A), pecans (B), pistachios with and without the shell mix (C), peanuts in the shell (D), hazelnuts (filberts) (E), slivered almonds (F), Brazil nuts (G), almonds (H), macadamia nuts (I), pine nuts (J), walnuts (K), and peanuts out of the shell (L).

Pearson correlation coefficient. $P < .05$ was considered statistically significant.

RESULTS

One hundred children were tested (mean age, 9.8 years; age range, 4–19 years; 53 males). Two additional 3-year-old children were tested but could not comprehend the instructions and are not included in the data. Of the 100 patients, 37 (mean age, 8.5 years; age range, 4–18.5 years; 19 males) had peanut or at least 1 tree nut allergy diagnosed by history and radioallergosorbent testing or skin prick testing. The distribution of nut allergies was as follows: peanuts only, 23 patients; peanuts and 1 or more tree nuts, 5; all nuts (peanuts and tree nuts), 5; 2 or fewer tree nuts but no peanuts, 3; and 3 or more tree nuts but no peanuts, 1.

Overall, the mean number of nuts per child that were correctly identified was only 2.7. There was no difference in the mean number between nut-allergic and nonallergic children (2.3 vs 2.9; $P = .61$). However, there was a large variation with age, and, as expected, older children in general identified more nuts correctly, although there were large variations (Fig 2). The nut-allergic and nonallergic groups identified more nuts as they got older, but there was better correlation in the nut-allergic group ($r = 0.82$) than in the nonallergic group ($r = 0.52$) ($P < .001$ for both). Ten

children (9 of whom were 5 years or younger), did not correctly identify peanuts or any tree nuts. An additional 28 children identified only peanuts in the shell correctly. Twenty-one children identified only 2 nuts correctly, including 13 who identified only peanuts with and without the shell and 8 who identified peanuts in the shell plus either cashews or pistachios. There was no difference in any of these results between girls and boys ($P = .75$).

There was marked variation in the ability of children to identify different types of nuts (Table 1). Peanuts in the shell were most recognizable, correctly identified by 89% of the children. Peanuts out of the shell were the next most recognizable (52%). Very few children recognized some of the more uncommon tree nuts (hazelnuts, 2%, and macadamia nuts, 3%), and no child correctly identified Brazil nuts. Although in most cases there was no significant difference between nut-allergic and nonallergic children, nut-allergic children were less likely to correctly identify peanuts out of the shell (29.7% vs 65.1%; $P < .001$) and peanuts in the shell (81.1% vs 93.7%; $P = .052$), although this may in part be explained by the slightly older age of the nonallergic group. Several children incorrectly identified many of the tree nuts as peanuts. The tree nuts that were most commonly incorrectly called peanuts were pistachios ($n = 13$) and cashews ($n = 8$). Of note, 21 children said that "all" were peanuts.

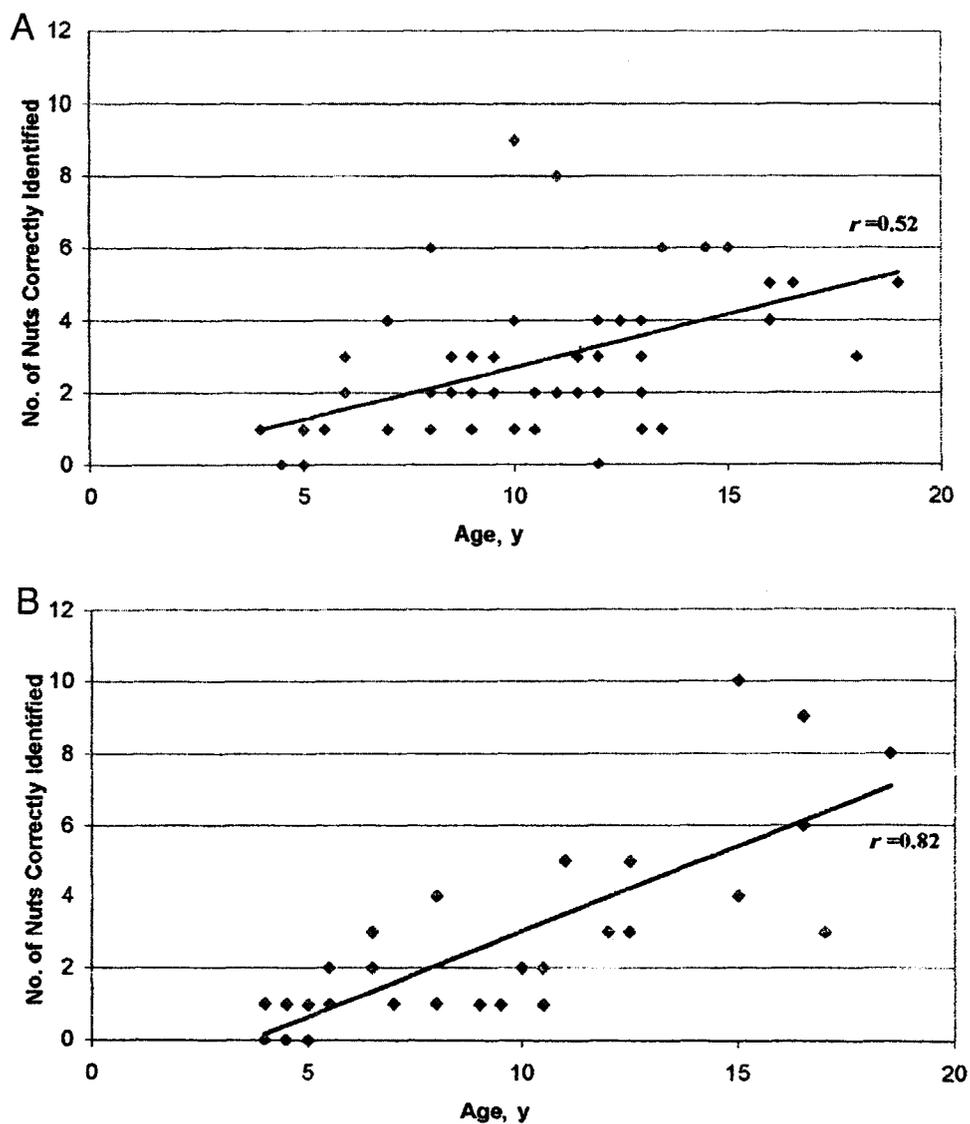


Figure 2. Age vs number of nuts correctly identified in nonallergic (A) and nut-allergic (B) adolescents.

Of the 37 nut-allergic children, 27 (73%) correctly indicated the nut they should avoid by specifically identifying the nut(s) to which they were allergic (12 children) or by stating that they would not eat any of the nuts (15 children). Ten nut-allergic children (27%) indicated that they could eat 1 or more nuts to which they were allergic. Six of these 10 patients identified only peanuts in the shell as the nut to avoid, not recognizing peanuts out of the shell.

DISCUSSION

Allergic reactions to peanuts and tree nuts are often serious and even life threatening. In a review of fatalities due to food anaphylaxis, Bock et al² found that nuts (mostly peanuts) were responsible for 30 of 32 fatal food allergy

reactions. Most of these fatalities (26 of 30) were in individuals who knew that they were allergic to the nut but for various reasons ingested that food nonetheless. It is estimated that peanut-allergic patients will, on average, have at least 1 unintentional peanut exposure every 3 years; during a 10-year period, 75% will have had unintentional exposure to peanuts.⁵ New treatment modalities, such as anti-IgE³ and DNA vaccination,⁴ hold promise for the future therapy of food allergies. However, it is likely that patients will continue to be required to actively avoid ingesting the foods to which they are allergic. Children may forget the reaction they experienced in the past, or they may remember the acute reaction but not recognize the causal relationship between the food they ate and the

Table 1. Total, Nonallergic, and Nut-Allergic Patients Who Correctly Identified Various Nuts

Type of nut	Patients correctly identifying nut, %			P value*
	Nonallergic	Nut-allergic	Total	
Peanuts in the shell	93.7	81.1	89.0	.052
Peanuts out of the shell	65.1	29.7	52.0	.006
Pistachios	38.1	21.6	32.0	.09
Cashews	23.8	27.0	25.0	.72
Almonds	25.4	21.6	24.0	.67
Walnuts	17.5	18.9	18.0	.85
Pecans	9.5	10.8	10.0	.84
Slivered almonds	7.9	10.8	9.0	.63
Macadamia nuts	3.2	2.7	3.0	.89
Hazelnuts	1.6	2.7	2.0	.70
Brazil nuts	0	0	0	.99

*Nonallergic vs nut-allergic patients.

allergic reaction. Therefore, most children must be taught to recognize and to avoid the food to which they are allergic.

The results of this study indicate that most children cannot identify most common tree nuts, even when presented to them in their most recognizable form, whole and intact. Nuts are more commonly present in foods in small pieces, and these would be recognized even less often. Peanuts in the shell were the most recognizable nuts, but most of the other nuts were poorly recognized. Nearly 60% of the children in this study identified only 2 or fewer nuts correctly. Many tree nuts were misidentified as peanuts, and it seemed as though *peanut* was used as a generic term for any nut by many children. There was greater recognition of tree nuts in older children, yet there were many older children who could not identify most tree nuts. Children who had nut allergies were not more likely to identify more nuts. In fact, in the case of peanuts, they were less able to identify them. It is possible that the parents of peanut-allergic children did not allow peanuts in their homes and that their children, therefore, never had the opportunity to learn to recognize them. A large proportion of nut-allergic children in this study (27%) could not recognize the nut that they were allergic to or said it would be all right for them to eat the food. Although it is recommended that nut-allergic children live in a nut-free home, many of these parents expressed surprise and dismay that their children could not recognize the critical nuts and, even worse, would eat them.

Most nut-allergic children (73%), however, stated that they would not eat the nut to which they were allergic. Of these, more than half did not necessarily recognize the specific nut to which they were allergic but rather avoided "all nuts." Only 12 of 37 children could specifically identify their allergenic nut and said that they would not eat it. Especially for younger children, teaching them to avoid all nuts may be the best method to prevent future allergic reactions. This may be especially valid for children younger than 5 years because 9 of 10 children who could not identify any nuts were 5 years or younger.

Limitations of this study include the fact that nut recognition testing occurred in a controlled setting. Nuts are rarely presented whole and in such an easily recognizable form as with the nut box. In reality, nuts are present in many foods as small pieces or as unrecognizable contaminants and thus would not be recognized even by those who know what the nut looks like intact.

Much has been written about banning nuts from schools and airplanes in an effort to protect nut-allergic children.⁶⁻⁹ This raises concerns about shifting the responsibility of preventing potentially fatal reactions from the allergic child into the hands of an ever-changing group of "strangers," who often have limited knowledge of the child in particular or of nut allergies in general.¹⁰ This study shows that many nut-allergic children lack the nut recognition skills that could protect them from future reactions. Although adults need to have a large role in protecting children with food allergies, the best strategy would incorporate actively teaching the affected child to recognize nuts so that he or she will be protected in every environment regardless of the skill of adult caretakers. Visual devices, such as the nut box used in this study, may be useful teaching aids for patients with allergies. More emphasis is needed on educating families and children in nut avoidance.

REFERENCES

1. Sicherer SH, Muñoz-Furlong A, Sampson HA. Prevalence of peanut and tree nut allergy in the United States determined by means of a random digit dial telephone survey: a 5-year follow-up study. *J Allergy Clin Immunol.* 2003;112:1203-1207.
2. Bock SA, Muñoz-Furlong A, Sampson HA. Fatalities due to anaphylactic reactions to foods. *J Allergy Clin Immunol.* 2001; 107:191-193.
3. Leung DYM, Sampson HA, Yunginger JW, et al. Effect of anti-IgE therapy in patients with peanut allergy. *N Engl J Med.* 2003;348:986-993.
4. Roy K, Mao HQ, Huang SK, Leung HW. Oral gene delivery with chitosan-DNA nanoparticles generates immunologic protection in a murine model of peanut allergy. *Nat Med.* 1999;5: 387-391.

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5. Vander Leek TK, Liu AH, Stefanski K, Blaker B, Bock SA. The natural history of peanut allergy in young children and its association with serum peanut-specific IgE. *J Pediatr*. 2000;137:749–755.
 6. James JM. Airline snack food: tension in the peanut gallery. *J Allergy Clin Immunol*. 1999;104:25–27.
 7. Muñoz-Furlong A. Food allergy in schools: concerns for allergists, pediatricians, parents and school staff. *Ann Allergy Asthma Immunol*. 2004;93:S47–S50.
 8. Bahna SL. Man shall not live by peanut alone! *Pediatrics*. 1998;102:148–149.
 9. AAAI Board of Directors, American Academy of Allergy, Asthma and Immunology. Anaphylaxis in schools and other childcare settings. *J Allergy Clin Immunol*. 1998;102:173–176.

10. Sicherer SH, Furlong TJ, DeSimone J, Sampson HA. The US Peanut and Tree Nut Allergy Registry: characteristics of reactions in schools and day care. *J Pediatr*. 2001;138:560–565.

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Answers to CME examination—*Annals of Allergy, Asthma & Immunology*, July 2006 Fiocchi A, Assa'ad A, Bahna S. Food allergy and the introduction of solid foods to infants: a consensus document. *Ann Allergy Asthma Immunol*. 2006;97:10–21.

1. d (see Gartner et al⁶)
2. e (no such National Institutes of Health guidelines exist)
3. b (see Fergusson et al,²⁸ Forsyth et al,³⁰ Lucas et al³¹ Saarinen and Kajosaari,³² and Zutavern et al³³)
4. c (<http://www.fda.gov/bbs/topics/NEWS/2005/NEW01281.html>)
5. e (in the present article)
6. d (see Boyano-Martinez et al¹⁴¹)
7. d (see Solensky R¹⁵⁰)