

Moving Past “Avoid All Nuts”

Individualizing Management of Children with Peanut/Tree Nut Allergies



Brian Schroer, MD^{a,*}, Jaclyn Bjelac, MD^b

KEYWORDS

- Peanut allergy • Tree nuts • Unnecessary avoidance • Food allergy prevention
- Collaborative decision making

KEY POINTS

- Avoiding tree nuts in patients with peanut allergy is a choice that needs to be made by the family after being counseled about the benefits and risks of the potential decisions.
- In patients who are at high risk for developing food allergies, unnecessary food avoidance may increase the risk for patients to become allergic to that food.
- Families should decide whether they desire screening for food sensitization before ingestion of the food.
- The main goal for allergists and families should be to prevent food allergies.
- Prevention of food allergies requires a collaborative approach to safely allow families to introduce allergenic foods in children who are at high risk.

CASE PRESENTATION

Emily is a 9-month-old patient who presents to the clinic for evaluation of possible peanut allergy. She has a history of early-onset moderate eczema, which has been well controlled with skin hygiene measures and twice-weekly application of prescription strength topical steroid ointment. Two weeks before the allergy visit she ate peanut for the first time. She ingested 2 bites of peanut butter mixed with applesauce and developed almost immediate hives on her face, chin, and neck. She was then noted to sneeze. Her mother wiped off her face and gave her diphenhydramine. Her mother reports that 15 minutes after ingestion, Emily had a single episode of emesis. No further symptoms developed, and hives and sneezing resolved within 45 minutes of onset. They have since continued to avoid peanuts. When they come to the office, her

Disclosure: The authors have nothing to disclose.

^a Akron Children's Hospital, 130 West Exchange Street, Akron, OH 44022, USA; ^b Cleveland Clinic Children's Hospital, 9500 Euclid Avenue, A3, Cleveland, OH 44195, USA

* Corresponding author.

E-mail address: bschroer@akronchildrens.org

Immunol Allergy Clin N Am 39 (2019) 495–506

<https://doi.org/10.1016/j.iac.2019.07.004>

0889-8561/19/© 2019 Elsevier Inc. All rights reserved.

immunology.theclinics.com

parents report that Emily has never ingested a tree nut. They have read on social media that many parents are introducing tree nuts to their children with eczema or other food allergies, stating that doing so would prevent tree nut allergy. Before testing for peanut, the doctor had a conversation with the family that included a discussion of whether or not patients with peanut allergy have to avoid all nuts, and what testing may be appropriate during this visit.

This article covers the evidence for why recommendations to avoid all nuts in someone with a single nut allergy are changing, and reviews options for select nut introduction in children with peanut or tree nut allergy.

AVOIDING ALL NUTS IF ALLERGIC TO 1

Peanut and tree nut allergies are among the most common causes of food allergy in the United States,¹ and food allergy significantly affects quality of life for children and their families.² Historically, it was common for a child with 1 food allergy to undergo additional testing to other common food allergens, even without a history of reaction. The justification was presumably to prevent the children from having a reaction to other foods the first time they were consumed in an unsupervised setting. Although this approach was intended for patient protection, there was a high potential for unnecessary avoidance of food given the possibility of false-positive testing.³ In patients with peanut allergy, tree nut allergy testing before introduction has been common. Expert opinion has been to have all peanut-allergic patients avoid tree nuts despite the lack of a history of a reaction to tree nuts.⁴ This recommendation was based on anecdotal reports of peanut-allergic children reacting to tree nuts because of cross-contact with peanut.⁵

PEANUTS VERSUS TREE NUTS

Peanuts are a legume. Although their name contains the word nut, they differ botanically from tree nuts such as cashew, pistachio, walnut, pecan, almond, hazelnut, and Brazil nuts. Despite differing taxonomy, previously published reports suggest a 30% chance of cosensitization and potential for a reaction to tree nuts in peanut-allergic children.⁵ With this information, historically many patients with peanut allergy were advised to avoid tree nuts. This form of patient protection has typically been done without a conversation with the family about whether it was an option to learn how to identify tree nuts, read labels, and search for manufacturers of tree nuts that do not have potential cross-contact with peanut.

Recent articles suggest that the rates of coallergy to tree nuts in peanut-allergic patients may be lower than previously reported.⁶ The HealthNuts prospective study from Australia shows that children who had peanut allergy at 1 year old had a 27% chance of having challenge-confirmed tree nut allergy at 6 years old.⁷ So far, the evidence for avoiding all tree nuts in someone diagnosed with peanut anaphylaxis has been based on expert opinion with little evidence to support a single correct approach.⁸ It should also be noted that, in peanut-allergic or tree nut-allergic children, introduction of specific nuts to which the child is not allergic may improve quality of life and allow dietary expansion.⁹

WHY NOT AVOID ALL NUTS IF ALLERGIC TO 1?

At the moment, the practice of avoiding all nuts if allergic to 1 is changing for many reasons. Some of the impetus for changing this practice is the recognition that both skin prick testing (SPT) and serum specific IgE (sIgE) testing lead to many false-

positives.¹⁰ These tests have a high negative predictive value and a poor positive predictive value. In all patients, a history of any prior reaction or tolerance of ingestion of a typical serving remains the ultimate test. Using tests alone to diagnose tree nut allergy increases the risk that patients are avoiding these tree nuts unnecessarily.

RISK OF UNNECESSARY AVOIDANCE?

In 2015, the Learning Early About Peanut (LEAP) trial changed management of food allergy by showing that early introduction of peanut and ingesting it 3 times per week significantly decreases the risk of becoming allergic in children deemed to be at high risk of developing peanut allergy.¹¹ All patients in the trial were at high risk for food allergies because of having either moderate to severe eczema or egg allergy. One group of children who had negative allergy skin prick tests to peanut ate peanut early, leading to an 86.1% relative risk reduction for becoming allergic. The other group of children LEAP studied had positive skin or blood testing but passed a peanut ingestion challenge. In this group, eating peanut early and often led to a relative risk reduction for developing a peanut allergy of 70.0%.¹¹ Although there is only 1 study showing this benefit in peanut, studies have shown that early introduction of egg in high-risk individuals can decrease the risk of developing egg allergy.¹² Looking at these studies a different way, this same evidence suggests that unnecessarily avoiding allergenic foods such as peanut or egg in children who are not clinically allergic may contribute to developing allergies to those foods.

EATING ALLERGENIC FOODS TO PREVENT FOOD ALLERGY

The evolving knowledge that unnecessary food avoidance may be a factor contributing to development of food allergy has led many allergists to realize that their goal should be to facilitate introduction of allergenic foods into the diets of children who are at high risk for becoming allergic. There are data to support early introduction of selected allergenic foods in the diet that show both efficacy for egg and peanut introduction and a lack of harm with this approach for milk, wheat, sesame, and whitefish in a normal-risk population.^{13,14} However, such data are lacking for tree nuts.⁸ Prevention of tree nut allergy would be an important goal because most patients who develop a tree nut allergy never outgrow it.¹⁵ In the absence of specific evidence showing benefit or risk for early introduction of foods beyond egg and peanut, it is necessary for allergists to have a relationship-centered discussion with families of patients with food allergy about how to safely introduce other allergenic foods.¹⁶

HOW TO INTRODUCE ALLERGENIC FOODS IN HIGH-RISK CHILDREN

Publication of the LEAP study results, multiple society guidelines have been published regarding how to implement early peanut introduction. However, there are many questions about how to implement this evidence at a population level. One controversy centers on the necessity of prescreening before introduction of peanut. Recommendations differ between guidelines. In the United States, the National Institute of Allergy and Infectious Diseases (NIAID)/National Institutes of Health recommend prescreening using either SPT or IgE testing before peanut introduction in select children.¹⁷ The recommendations from the British Society of Allergy and Clinical Immunology (BSACI) do not recommend routine prescreening when introducing peanut, even in high-risk children.¹⁸ The Australian Society of Clinical Immunology and Allergy (ASCIA) guidelines written in 2016 state that introduction of foods such as egg, peanut, and tree nuts should not be delayed and do not mention prescreening even a high-risk

population, suggesting those patients at high risk discuss their preferred approach with their doctors.¹⁹

TESTING BEFORE INGESTION

The most notable potential benefit in recommending preintroduction screening evaluation is minimizing the number of children who react to peanut in an unsupervised setting at the time of first introduction at home. However, there are known and potential risks of routinely recommending prescreening before introduction of peanut or other allergenic foods, even in high-risk populations. The known risk is the cost of screening.²⁰ A study from Australia on the feasibility of implementing LEAP-style peanut introduction in the high-risk group estimated that 16% of the population would require screening before peanut ingestion.²¹ Of these high-risk patients, their data show that 13.4% would require an in-office challenge if all with SPT wheals of 3 to 7 mm were challenged. Another risk is that prescreening in selected populations may still miss patients who are already allergic. The same study showed that screening these patients would still miss an estimated 23% of children with peanut allergy in the lower risk group.²¹ Their data also suggest that introduction of peanut without prescreening in the high-risk group is safe because, in the 185 high-risk infants who introduced peanut on their own (a self-selected population) before 12 months of age, only 1 had symptoms consistent with possible anaphylaxis. That patient is reported to have passed an in-office challenge 2 months later.²¹

An unknown risk is that children who would have introduced peanut into their diets before publication of such guidelines are deterred from doing so by a lack of resources or experts who are able to adequately implement prescreening recommendations.²⁰ In addition, it is not clear how many patients who are screened and found to have positive skin or blood testing are offered and then actually undergo food challenges, even if the results indicate a low risk of clinical allergy.²⁰ The investigators suggest that prescreening potentially, “results in a paradoxical effect, where over proscriptive [sic] guidelines to support early introduction have the opposite effect and increase the risk of food allergy in later life.”²⁰ The cost-effectiveness, benefits, and risks of routine prescreening before introduction of foods such as peanut require extensive prospective studies to answer many remaining questions. These studies would be necessary for tree nuts as well.

CASE EXAMPLE

Applying this concept to Emily, it is possible that prescreening for tree nut could paradoxically lead to tree nut allergy. Suppose that her family had been planning to give Emily safe forms of tree nuts and she is not clinically allergic. However, because of her peanut allergy, she is screened and found to be positive to walnut/pecan and cashew/pistachio at low levels. As a result of this testing they are told to avoid the walnuts/pecans, and cashews/pistachios until a physician-supervised in-office challenge can be accomplished. Because of a multitude of factors, including time constraints, fear, and costs related to the visit, they do not schedule a challenge. At follow-up 4 years later, they describe a recent reaction to walnuts involving full-body hives and vomiting after eating a few bites of a walnut-containing brownie. In this scenario, it could be argued that the screening may have contributed to the development of tree nut allergy because nut avoidance prevented the development of tolerance. The potential for risk of developing an allergy when avoiding tree nuts in patients who are sensitized without clinical allergy is not known.

DISCUSSION WITH FAMILIES ABOUT TESTING BEFORE INTRODUCTION

Although the guidelines noted earlier can be useful to assist in deciding whether to perform preintroduction screening for peanut, there are currently no published guidelines addressing this question for other commonly allergenic foods. The investigators of LEAP and other leaders in food allergy research discuss that there remains significant debate about the risks and benefits for screening before ingestion of peanut.²² Because of this uncertainty, any decision to test for foods other than peanut in high-risk children is not supported by any evidence or clinical guidelines. Therefore, the decision about prescreening for tree nuts should be made as a joint decision of the family and the clinician.

CASE UPDATE

Before testing to peanut, Emily's family was given a few choices about whether to test for tree nuts simultaneously. This discussion included characterizing the skin tests as being very good at showing that she is not allergic if the tests for tree nuts are negative, but that a positive test does not necessarily means she is allergic. They are informed that any positive skin testing would be followed by in vitro testing, and potentially may lead to a several-hour in-office food challenge. Using a collaborative dialogue, they are given options for introduction of tree nuts in the peanut-allergic child at home.¹⁶

Emily's parents question the potential for a reaction to tree nut should they try them at home. They are told that up to 30% of peanut-allergic patients develop a tree nut allergy by 6 year old, and that although 31% of peanut-allergic children are sensitized to tree nuts at 1 year of age, it is unclear how many of these children are allergic.⁷ It is important to also discuss the potential that unnecessary avoidance of tree nut has the potential to increase the risk of allergy.²³ Emily's parents are asked about their comfort with introducing tree nuts at home without testing, because it has been shown that anxiety modulates food selection in peanut-allergic patients. This conversation will clarify the family's perspective and facilitate an agreed-on plan of action.²⁴

Based on this discussion, the family is asked to choose from a few options (**Fig. 1**):

1. Introduce tree nuts without prescreening before introduction
2. Perform prescreening with SPT or in vitro sIgE testing for tree nuts before introduction
3. Avoid all tree nuts in addition to peanut regardless of testing

IMPLEMENTING WHAT THE FAMILY WANTS

After discussion, many families elect to pursue introduction of tree nuts without screening for sensitization. This option may be selected by families who wish to liberalize their children's diets to include a variety of peanut alternatives, and who wish to avoid testing. It is important to assess the family's commitment to doing the introduction.

An alternative approach is to introduce tree nuts to the peanut-allergic child, with preintroduction testing. More risk-averse families may choose testing as a means to risk stratify further before introduction. Families should be permitted to make a decision regarding such testing following a discussion of the characteristics of currently available methods. This discussion should emphasize the low false-negative rates but also high rates of false-positives seen with both percutaneous and in vitro methods.¹⁰ Specifically, peanut allergens do have some cross reactivity with tree nut allergens and therefore the tree nut allergy tests can be positive because of the peanut allergy but do not necessarily mean the child is allergic.²⁵ Before testing is accomplished, it is

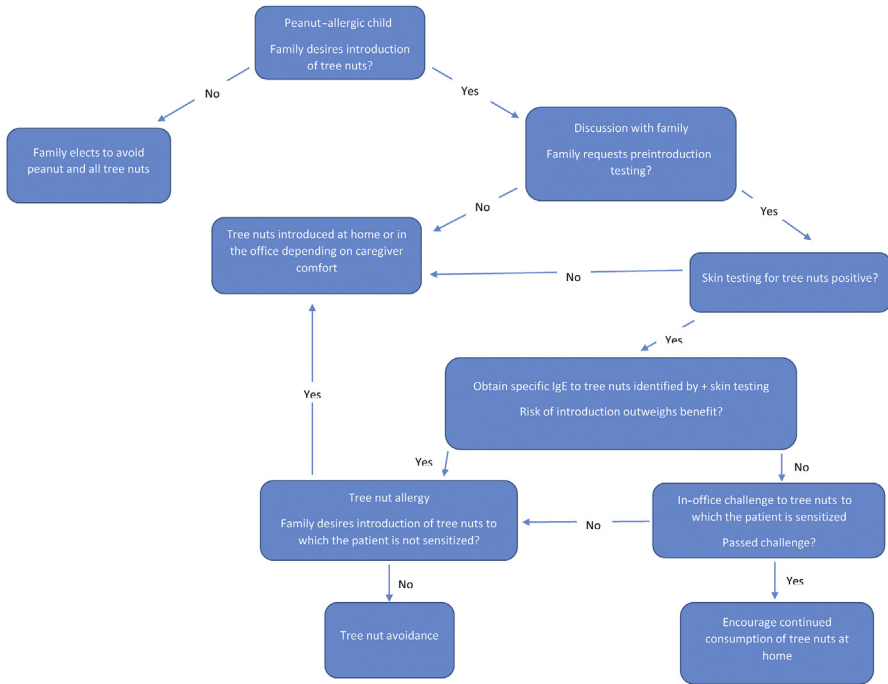


Fig. 1. Decision tree for deciding how to introduce tree nuts in a food-allergic child.

necessary to discuss with the families what will be recommended should the results be negative or positive. They should be counseled that negative testing indicates a low but not zero risk of reaction, and that a positive test would require additional evaluation and introduction of the food during an in-office oral food challenge. Clinicians should also discuss that risk stratification for positive testing is complicated by lack of population-based cutoffs for skin or serum testing to tree nuts.⁶

Avoidance of all tree nuts in addition to peanut is an option selected by some families. Families may choose this path for a variety of reasons, and understanding their perspective is important to implementing their preferences. Some families have concerns regarding peanut cross-contact with a given tree nut, and want to avoid all nuts because of the potential increased risk of accidental exposure to peanut. Although the published rate of peanut contamination in snack foods with precautionary allergy labeling ranges from 0.9% to 32.4%, peanut contamination in nonsnack items is far less common.⁹ Particularly in very young children, families may wish to pursue this approach until the child is old enough to verbalize reaction symptoms or be able to question food contents. Prescreening for sensitivity would not be required at this time but could be considered in the future should the family pursue tree nut introduction.

Regardless of their decision, every effort should be made to assist the family in choosing a path with which they are comfortable, because reservations are likely to result in failure to introduce the food at home.

AFTER TESTING TO TREE NUTS

Should skin testing be pursued and sensitivity to 1 or more tree nuts be identified, a physician-supervised in-office challenge should be pursued. If desired, serum sIgE

allows further risk stratification before the in-office challenge. Because cutoff values for tree nuts are not as well established as for peanut, and without a history of a reaction, an in-office physician-supervised food challenge should be offered to the tree nuts in question unless a high level of sensitivity suggests the risk would outweigh the benefit. The decision to undergo the challenge should be made in a collaborative fashion, discussing the benefits and potential risks. In patients with multiple positives to tree nuts, the possibility of multiple in-office challenges can be a barrier for patients and families. Cross reactivity has been identified among the tree nuts,^{9,25,26} and this can be used to perform challenges to 2 or more tree nuts on a given challenge day.²⁷

If allergy is diagnosed to 1 or more tree nuts, again the family is faced with the decision of whether to avoid all tree nuts, or just the tree nuts to which the child is allergic. The family should be encouraged to allow their child to consume tree nuts to which they are not allergic if desired, following counseling on the necessity of obtaining tree nuts not contaminated with the known allergen.

If testing is done and is negative, the family should be asked to relay the results of the at-home challenge. If any reactions occur, they should return for a follow-up for evaluation and management for this tree nut allergy.

CASE UPDATE: EMILY’S FAMILY DECISION

When presented with these 3 options, Emily’s parents decide to pursue testing only to peanut. They are comfortable that they can recognize and treat a reaction because they have self-injectable epinephrine and they were told they will receive further education on how to recognize and treat a reaction at the end of the visit. Skin testing to peanut was positive at 6 × 27-mm wheal/flare and her sIgE to peanut is 5.67 kU/L with Ara h 2 of 4.54 kU/L. Based on her reaction and confirmatory testing, Emily is diagnosed with peanut allergy. The family is educated on avoidance measures, and a food allergy action plan is reviewed. When being instructed on how to introduce tree nuts, they are told to do an at-home graded introduction of a tree nut. Once the nuts have been introduced without reaction, they are instructed to have Emily ingest them regularly, at least weekly, even though the allergist admits there is no published guidance on how often the tree nuts need to be eaten for tolerance to be maintained.

AFTER THE VISIT: INTRODUCTION AT HOME

When testing is not pursued, guidance should be provided to families on how to safely introduce the tree nuts at home. There is no clear guidance on how to do this. It is reasonable to suggest an at-home graded-dose challenge similar to the recommendations for at-home peanut introduction. Patients can use finely chopped or butter forms of tree nuts that can be mixed with age-appropriate foods such as fruit purees. A small amount can be eaten and then monitored for a set period of time. When no reaction occurs, the clinician can recommend various options, including slow introduction of a serving or a multiple-step graded-dose challenge based on the family’s preferences. The family should be told to do this introduction on a day when they are not distracted so that they can recognize and treat any reactions. By having a dialogue about how to introduce tree nuts at home, patients can ask questions and the clinician can identify and address any barriers to tree nut introduction.

ADDRESSING QUESTIONS AND CONCERNS

At the end of a clinic visit, the family’s ability and comfort with implementing these options should be assessed using open-ended questions. If people initially indicated

they did not want testing but then say that they are not likely to introduce any tree nuts at home without risk stratification, then testing should be discussed again. Other common questions or concerns that arise include, but are not limited to: how to find tree nuts that are not contaminated by peanut, whether any peanut residue can be washed off tree nuts, how to recognize various tree nuts, what to tell schools or restaurants, how to give children these tree nuts regularly, whether any future siblings need to be tested before peanut or tree nut introduction, what to do if another sibling in the family has a tree nut allergy, and what needs to be done for an older child with peanut allergy who has always avoided tree nuts. A theme of this topic is that there remains little evidence and few guidelines about how to answer these questions.

PEANUT CROSS-CONTACT IN TREE NUTS

When it comes to finding tree nuts that do not contain any peanut protein or residue from cross contact, parents should be advised that all individually packed forms of tree nuts need to be assessed on a case-by-case basis. As is the case with most food allergies, it is imperative for families and patients to be able to read labels and understand the need to avoid products that use precautionary labels. The need to avoid precautionary labels may significantly limit the ability of families to find forms of peanut-free tree nuts. That situation has led some people to inquire about the effect of buying potentially contaminated nuts and washing any peanut residue off. Although it is possible that water rinses may remove peanut allergen, no study has been done to prove that this is a safe option.

MIXED-UP NUTS

There is evidence that both allergists and patients with food allergies have trouble visually identifying different tree nuts. Patients should be told that learning how to recognize different tree nuts is beneficial when eating some tree nuts but avoiding others²⁸ (Fig. 2, Table 1). All caregivers for these children should be educated about how to avoid the allergenic foods and how to safely serve the tolerated tree nuts. They should be counseled that many restaurant and food service workers have little training in food allergen identification and avoidance strategies.²⁹ Asking schools or teachers



Fig. 2. Identification of various tree nuts in relation to peanut. (A) Almond. (B) Brazil nut. (C) Cashew. (D) Pistachio. (E) Filbert. (F) Pine nut. (G) Pecan. (H) Walnut.

Table 1
Nut allergy co-occurrence

Primary Nut Allergen	Most Common Co-occurring Nut Allergens
Pecan ^a	Walnut, ^a peanut
Pistachio ^a	Cashew ^a
Hazelnut	Macadamia nut
Brazil nut	Macadamia nut

^a In the referenced study, 16.7% of cashew-allergic children were not allergic to pistachio, although only 2.8% of children allergic to pistachio were not allergic to cashew. Nearly 30% of children allergic to walnut were not allergic to pecan, although just 6.1% of pecan-allergic patients were not allergic to walnut.

Data from Brough HA, Caubet J, Mazon A, et al. Abstract 0124: Peanut, tree-nut and sesame seed allergies: do children allergic to a nut or sesame seed need to avoid all nuts? Special Issue: Abstracts from the European Academy of Allergy and Clinical Immunology Congress, 17–21 June 2017, Helsinki, Finland. Allergy European Journal of Allergy and Clinical Immunology; Volume 72, Issue S103: pages 103-104.

to understand that a child has to avoid peanut but can eat tree nuts requires individual and specific discussions and should be done on a case-by-case basis. Because of these issues, it may be best if patients limit the ingestion of nonallergenic nuts to the home, where trusted caregivers know what foods to avoid and what is safe to ingest.

HOW OFTEN DO THEY NEED TO EAT TREE NUTS?

Whether all of these tree nuts need to be ingested regularly, and, if so, how often, remains a question. It may be assumed that patients should be told to ingest tree nuts 3 times per week, similar to what is recommended by the NIAID for peanuts. If this is the case, then eating almonds, hazelnuts, cashews, pistachios, pecans, walnuts, and peanuts multiple times weekly may be difficult to implement on a routine basis. In the United States, walnut, pecan, cashews, and pistachios cause the most tree nut allergies.³⁰ Focusing regular ingestion on the most common tree nuts to cause allergy may facilitate regular ingestion of those nuts. One option that can make it easier to give multiple nuts at 1 time is using multinut butters. By using a multinut butter, 1 serving covers all of the nuts that need to be eaten regularly. To decrease expense, patients are sharing recipes for home production of multinut butters on food allergy support groups on social media. Commercially prepared multinut butters are also available.

TESTING SIBLINGS

When prescreening children whose siblings are known to be peanut allergic, families should be counseled that the current NIAID practice parameter does not recommend prescreening testing in siblings of patients with peanut allergy. It is necessary to understand the family's perspective, assess for any questions or barriers to feeling comfortable to introduce without testing, and then provide specific information to address these concerns. If the family continues to have reservations about introduction without such testing, then testing before introduction should be offered.

TREE NUTS IN THE HOUSE WHEN OTHER PEOPLE ARE ALLERGIC

Another concern expressed by many families is reservations about the presence of peanut or tree nuts in the home as a potential risk to the allergic child. This concern

may be in the context of continued family consumption when the patient is allergic, or may be related to the recommendation that children at high risk for development of food allergy consume allergenic foods in a home with a nut-allergic sibling. Education about the routes of exposure that are necessary to produce a reaction and the ways of preparing food that prevent reactions is important to alleviate unnecessary fear.³¹ Families should be counseled that having an allergy does not necessitate removal of a given food from the home. This decision must be made by the family considering their preferences.

OLDER CHILDREN WITH PEANUT ALLERGY

The case example presents the scenario of introducing tree nuts in a young child whose risk for preexisting tree nut allergy is lower than in older children.⁷ Many older children with peanut allergy have been avoiding tree nuts either because of direct instructions not to eat them or they simply avoided them out of preference. If those patients and families want to introduce tree nuts, there is likely more risk for them to react. Again, there is no evidence or guidance about how to do this. In older children, prescreening with skin or blood testing before introduction should be considered. Providing the information that there is more risk in older children will allow the clinician and the family to make a more informed decision about testing before introduction. It remains necessary to have a similar discussion with the family about the characteristics of the testing, and what would be the next steps based on the results.

CASE UPDATE: FOLLOW-UP

Emily presents for follow-up 3 months after the initial visit. Her parents have introduced a variety of tree nuts without reaction, and she now enjoys mixed-nut butter a few times a week. They have continued to avoid peanut in all forms, and have no new food allergy concerns.

SUMMARY

Patients and families who experience a diagnosis of 1 nut allergy have a great deal to learn. Allergists must be a resource for the families to make informed decisions about the options for introducing nuts to which their children are not allergic. They can assist them in making a decision by understanding their preferences and goals. Whatever choice the family makes is the correct decision. Allergists need to allow families to make these decisions by having discussions with them before allergy testing to foods that have not caused a reaction. As new information in food allergy emerges, safe liberalization of the diets of a peanut-allergic or tree nut-allergic children to include other nuts should be offered.

REFERENCES

1. NIAID-Sponsored Expert Panel, Boyce JA, Assa'ad A, et al. Guidelines for the diagnosis and management of food allergy in the United States: report of the NIAID-sponsored expert panel. *J Allergy Clin Immunol* 2010;126(6 Suppl):S1–58.
2. Greenhawt M. Food allergy quality of life and living with food allergy. *Curr Opin Allergy Clin Immunol* 2016;16(3):284–90.
3. Sampson HA, Aceves S, Bock SA, et al. Food allergy: a practice parameter update 2014. *J Allergy Clin Immunol* 2014;134(5):1016–25.
4. Burks AW. Peanut allergy. *Lancet* 2008;371(9623):1538–46.

5. Sicherer SH, Sampson HA. Peanut allergy: emerging concepts and approaches for an apparent epidemic. *J Allergy Clin Immunol* 2007;120(3):491–503 [quiz: 504].
6. Couch C, Franxman T, Greenhawt M. Characteristics of tree nut challenges in tree nut allergic and tree nut sensitized individuals. *Ann Allergy Asthma Immunol* 2017;118(5):591–6.e3.
7. McWilliam V, Peters R, Tang MLK, et al. Patterns of tree nut sensitization and allergy in the first 6 years of life in a population-based cohort. *J Allergy Clin Immunol* 2018. <https://doi.org/10.1016/j.jaci.2018.07.038>.
8. Bird JA, Parrish C, Patel K, et al. Prevention of food allergy: beyond peanut. *J Allergy Clin Immunol* 2019. <https://doi.org/10.1016/j.jaci.2018.12.993>.
9. Brough HA, Turner PJ, Wright T, et al. Dietary management of peanut and tree nut allergy: what exactly should patients avoid? *Clin Exp Allergy* 2015;45(5):859–71.
10. Chan ES, Cummings C, Canadian Paediatric Society, Community Paediatrics Committee and Allergy Section. Dietary exposures and allergy prevention in high-risk infants: a joint statement with the Canadian Society of Allergy and Clinical Immunology. *Paediatr Child Health* 2013;18(10):545–54.
11. Du Toit G, Roberts G, Sayre PH, et al. Randomized trial of peanut consumption in infants at risk for peanut allergy. *N Engl J Med* 2015;372(9):803–13.
12. Ierodiakonou D, Garcia-Larsen V, Logan A, et al. Timing of allergenic food introduction to the infant diet and risk of allergic or autoimmune disease: a systematic review and meta-analysis. *JAMA* 2016;316(11):1181–92.
13. Perkin MR, Logan K, Tseng A, et al. Randomized trial of introduction of allergenic foods in breast-fed infants. *N Engl J Med* 2016;374(18):1733–43.
14. Peters RL, Neeland MR, Allen KJ. Primary prevention of food allergy. *Curr Allergy Asthma Rep* 2017;17(8):52.
15. Fleischer DM, Conover-Walker MK, Matsui EC, et al. The natural history of tree nut allergy. *J Allergy Clin Immunol* 2005;116(5):1087–93.
16. Windover AK, Boissy A, Rice TW, et al. The REDE model of healthcare communication: optimizing relationship as a therapeutic agent. *J Patient Exp* 2014;1(1):8–13.
17. Togias A, Cooper SF, Acebal ML, et al. Addendum guidelines for the prevention of peanut allergy in the United States: report of the National Institute of Allergy and Infectious Diseases-sponsored expert panel. *Ann Allergy Asthma Immunol* 2017;118(2):166–73.e7.
18. Stiefel G, Anagnostou K, Boyle RJ, et al. BSACI guideline for the diagnosis and management of peanut and tree nut allergy. *Clin Exp Allergy* 2017;47(6):719–39.
19. Joshi PA, Smith J, Vale S, et al. The Australasian Society of Clinical Immunology and Allergy infant feeding for allergy prevention guidelines. *Med J Aust* 2019. <https://doi.org/10.5694/mja2.12102>.
20. Turner PJ, Campbell DE, Boyle RJ, et al. Primary prevention of food allergy: translating evidence from clinical trials to population-based recommendations. *J Allergy Clin Immunol Pract* 2018;6(2):367–75.
21. Koplin JJ, Peters RL, Dharmage SC, et al. Understanding the feasibility and implications of implementing early peanut introduction for prevention of peanut allergy. *J Allergy Clin Immunol* 2016;138(4):1131–41.e2.
22. Fisher HR, Keet CA, Lack G, et al. Preventing peanut allergy: where are we now? *J Allergy Clin Immunol Pract* 2019;7(2):367–73.
23. du Toit G, Sayre PH, Roberts G, et al. Allergen specificity of early peanut consumption and effect on development of allergic disease in the learning early about peanut allergy study cohort. *J Allergy Clin Immunol* 2018;141(4):1343–53.

24. Papadopoulos A, Elegbede CF, Ait-Dahmane S, et al. Tree nut allergy and anxiety related factors modulate food consumption behaviour in peanut-allergic patients: results of the MIRABEL survey. *Regul Toxicol Pharmacol* 2018;99:191–9.
25. Chan ES, Greenhawt MJ, Fleischer DM, et al. Managing cross-reactivity in those with peanut allergy. *J Allergy Clin Immunol Pract* 2018. <https://doi.org/10.1016/j.jaip.2018.11.012>.
26. Brough HA, Caubet J, Mazon A, et al. European Academy of Allergy and Clinical Immunology (EAACI) Congress 2017: Abstract 0124. Presented July 20, 2017. *Allergy European Journal of Allergy and Clinical Immunology* Volume 72, Issue S103 Special Issue: Abstracts from the European Academy of Allergy and Clinical Immunology Congress. Helsinki, Finland, June 17–21, 2017. p. 103–4.
27. Van Erp FC, Knulst AC, Kok IL, et al. Usefulness of open mixed nut challenges to exclude tree nut allergy in children. *Clin Transl Allergy* 2015;5:19.
28. Hostetler TL, Hostetler SG, Phillips G, et al. The ability of adults and children to visually identify peanuts and tree nuts. *Ann Allergy Asthma Immunol* 2012; 108(1):25–9.
29. Young I, Thaivalappil A. A systematic review and meta-regression of the knowledge, practices, and training of restaurant and food service personnel toward food allergies and Celiac disease. *PLoS One* 2018;13(9):e0203496.
30. McWilliam V, Koplin J, Lodge C, et al. The prevalence of tree nut allergy: a systematic review. *Curr Allergy Asthma Rep* 2015;15(9):54.
31. Sheehan WJ, Taylor SL, Phipatanakul W, et al. Environmental food exposure: what is the risk of clinical reactivity from cross-contact and what is the risk of sensitization. *J Allergy Clin Immunol Pract* 2018;6(6):1825–32.