

Living with Food Allergy: Allergen Avoidance

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KEYWORDS

• Food allergy • Avoidance • Management

The primary treatment of food allergy is to avoid the culprit foods. This is a complex undertaking that requires education about reading the labels of manufactured products, understanding how to avoid cross-contact with allergens during food preparation, and communicating effectively with persons who are providing allergen-safe meals including relatives and restaurant personnel. Successful avoidance also requires a knowledge of nuances such as appropriate cleaning practices, an understanding of the risks of ingestion compared to skin contact or inhalation, that exposure could occur through unanticipated means such as through sharing utensils or passionate kissing, and that food may be a component of substances that are not ingested such as cosmetics, bath products, vaccines and medications. Here we review the necessary tools of avoidance that physicians and medical practitioners can use to guide their patients through the complexities of food avoidance.

IDENTIFYING AND PREPARING SAFE FOODS

Patients and parents must become adept in label reading, meal preparation, and communicating their needs to other cooks and food preparers. Consultation with a registered dietitian may be helpful to ensure nutritional adequacies when multiple foods are excluded from the diet.^{1,2}

Food Labeling

In the United States, the Food Allergen Labeling and Consumer Protection Act (FALCPA) of 2004 went into effect from January 1, 2006. This law requires that the 8 major allergens, including milk, egg, peanut, tree nuts, fish, crustacean shellfish, wheat, and soy, be declared on ingredient labels using plain English words. The common names used to identify the foods may be listed within the ingredient list or in a separate statement (eg, “Contains...”) in a type size no smaller than that used

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in the list of ingredients. The law also requires that the specific type of allergen within a category be named, such as almond (tree nuts) or cod (fish). FALCPA applies to foods manufactured in the United States as well as to packaged foods that are imported for sale and subject to regulation by the US Food and Drug Administration (FDA). FALCPA does not apply to meat, poultry, certain egg products (eg, whole eggs), or raw agricultural foods, such as fruits and vegetables.

Product labeling laws in other countries, such as Canada, Europe, Australia, and New Zealand, vary by terms, definitions, and food allergens (<http://www.foodallergens.info/Manufac/Guidelines.html>). For example, the European Union defines 12 major allergens, including all gluten-containing products (wheat, rye, barley, oats, spelt, and their hybridized strains), celery, mustard, and sesame seeds, as well as sulfites. Canada, Australia, and New Zealand also identify sesame and sulfites as allergens.

The FALCPA applies only to 8 major allergens. Other foods, such as sesame, may still be listed using ambiguous terms, such as flavors or spices, and may not be included in the "Contains..." statement. In addition, noncrustacean shellfishes, such as clams and scallops, are not included in the act. The manufacturer may need to be contacted to specify ingredients in some cases when vague terms are used to describe ingredients categorically rather than individually.

Updates on FALCPA are available from the Center for Food Safety and Applied Nutrition, a branch of the FDA.³ The legislation was designed to help reduce allergic reactions and simplify allergy management.⁴ However, FALCPA does not require the FDA to establish a threshold level for any food allergen. Thus, an allergen must be declared even when trace amounts of protein that are unlikely to trigger an allergic reaction are included. Hence, soy lecithin, a fatty substance commonly used as an additive, must be disclosed as soy under the FALCPA, although lecithin is considered to have little allergenicity.⁵ However, soy oil and other highly processed and refined vegetable oils are potentially exempt because protein is removed from while processing.

The FALCPA does not regulate the use of advisory labeling, including statements describing the potential presence of unintentional ingredients in food products resulting from the manufacturing of the ingredients or the preparation and packaging of the food. Phrases that are used to indicate possible cross-contact with allergens include "may contain," "processed in a facility with," and "manufactured on shared equipment with." Advisory labeling terms also vary by country; for example, the United Kingdom uses "not suitable for allergy sufferers." These terms are applied voluntarily at the manufacturers' discretion. Unfortunately, advisory labeling is widespread; one study found that 17% of 20,241 supermarket products had such labeling.⁶ There are obvious benefits to advisory labeling, but its use may be too broad, limiting choices for some less sensitive food-allergic individuals. There are reports indicating that allergic individuals sometimes choose to ignore the advisory statements.^{7,8} Presumably, consumers making such choices generally tolerate those foods; nevertheless, serious reactions from cross-contact have been reported.⁹

Risk of cross-contact seems to be calculated by the consumer based on label terminology.⁷ A survey of more than 600 shoppers, primarily parents of children with food allergy and consumers with food allergy, revealed that products labeled "made in a facility that processes peanut" were more likely to be purchased over those labeled "may contain peanut." However, when samples of 179 products with advisory labeling for peanut were assayed, 7% of the products were found to have detectable peanut protein. Detection of peanut protein, however, did not correlate with how the warning was stated. Thus, consumers should be educated that risk level cannot be stratified according to wording (eg, "packaged in a facility" or "manufactured on

shared equipment” does not indicate less risk of allergen exposure than “may contain traces of”).

Products with milk advisory labeling have also been evaluated for contamination levels.¹⁰ Detectable milk was found in 42% of 81 products, a much higher incidence than that mentioned earlier for peanut.⁷ Dark chocolate products carried particularly high risk; among 18 dark chocolate items, 78% had detectable milk protein. The amount of milk in one serving of these products was estimated to range between 0.027 and 620 mg of milk. As a reference, 1 mL of cow’s milk contains about 33 mg of milk protein.

Another recent study¹¹ examined products with advisory labeling for milk, egg, or peanut, as well as similar products without any advisory declaration, including products labeled as using “Good Manufacturing Practices.” Allergenic residue was found in 5.3% of products with advisory labeling and 1.9% of products without advisory statements. A higher percentage of foods from small companies was contaminated when compared with that from large companies (5.1% vs 0.75%), although this percentage included products with allergen amounts that were arguably less than the threshold levels (which themselves have not been substantively defined). Notably, peanut was not detected in any of the 120 products tested without advisory labels.

Teenagers and young adults with food allergy are particularly less likely to heed advisory labeling. In one study, among 174 adolescents and young adults with food allergy, 42% were willing to eat foods labeled as “may contain.”¹²

The question remains for many practitioners and patients alike: do these foods with advisory labeling need to be avoided? Patients should be educated that the wording does not correlate with the degree of risk. Based on the studies outlined, there is a small but definite risk of allergen exposure in a minority of products with advisory labeling, with the exception of dark chocolate products, which demonstrated higher risks for milk protein contamination. For practical purposes, however, complete avoidance is most prudent. An improved understanding of the minimal dose needed to provoke an allergic reaction among individuals and within the population would help guide the food industry to develop more precise labeling practices.¹³

Managing Meals—Both Within and Outside the Home

Many factors may play into the individual’s and family’s decision to keep the allergenic food in or to exclude it completely from the home. These factors may include the ease of removal of the allergen from the home, the effect of such removal on other members of the family, the sensitivity of the food-allergic individual, and personal preference of the family. Regardless of the choice, principles of avoidance of cross-contact must be reviewed carefully with patients and families, so that they are able to make informed decisions on how to manage their households (**Box 1**).

Being able to dine outside the home is an important element for socialization. Restaurants can present challenges for food-allergic individuals.¹⁶ Preparation and clear communication are important aspects of the process when food preparation is under someone else’s purview. In order to assess food allergy knowledge in the food service industry, a study used telephone questionnaires, which were administered to 100 employees (eg, managers, servers, chefs) of various restaurants and food establishments in the New York City area.¹⁷ Only 22% provided correct responses to all 5 questions (true or false) about food allergy. Misconceptions included believing that fryer heat would destroy allergens, that it was safe to consume allergens in small amounts, and that removal of allergen from a finished dish (eg, picking off nuts) was safe. Most employees responded that they considered a buffet safe if kept clean. Despite this response, more than 90% rated themselves as being at least

Box 1

Tips for food allergen avoidance tips at home

Utensils, cookware, glassware, storage containers, and other food preparation equipment

Thoroughly clean before preparing or serving safe meals

Prepare safe meal first to avoid inadvertent cross-contact

Be aware of the potential for cross-contact with utensils, for example, a knife used to prepare peanut butter and jelly by a nonallergic child could introduce peanut allergen into an otherwise safe jar of jelly and subsequently cause a reaction in a peanut-allergic sibling eating the jelly.¹⁴ Similarly, the same knife with peanut butter (unclean) may be placed in the dishwasher, where a young child may later come upon it while the dishwasher is open

Designate specific containers for use by the allergic person only. For example, avoid sippy cup mix-ups by using a specific cup for the allergic child or using an obvious label

Refrigerator/freezer and kitchen pantry

Keep food containers covered/sealed to prevent spill contamination

Assign a specific shelf or cabinet for safe foods. Consider using color codes or tags for easy identification

Behaviors of family members

Wash hands before and after meals but particularly before serving allergen-free meals and after ingestion of allergen

Confine food consumption to specified dining areas or create allergen-free zones within the home

Wipe down surfaces after preparation and ingestion of meals^a

For young children, unsafe foods should be kept out of reach both at the dinner table and when storing foods

^a Studies have investigated only peanut butter, but cleaning tabletops with several standard cleansers was sufficient for removal of the peanut allergen.¹⁵ Household cleaners (except dish-washing liquid) and commercial wipes effectively removed peanut allergens from tabletops. Both liquid and bar soaps, but not alcohol-based antibacterial gels, removed peanut allergens from adults' hands.

“comfortable” in providing a safe meal to a food-allergic customer. Therefore, patients should not assume that restaurant personnel understand food allergy or know what steps must be taken to guarantee that a meal is safe. Instead, consumers should review issues of cross-contact, potential hidden ingredients, and the nature of allergy with the relevant personnel preparing and serving their food; all persons handling the food should be involved. This review could prevent errors, such as a preparation worker adding butter to a food that appears dry. See **Box 2** for additional strategies.

Special considerations for travel

Allergic reactions to peanut and tree nuts have been reported on commercial airliners.^{18–20} Studies of these events have relied on self-reported reactions to ingestion, skin contact, and inhalation, which inherently have biases. The degree of risk is thus very difficult to ascertain, but travelers with food allergies should avoid eating potentially unsafe airline foods, as with any restaurant-prepared meal. Bringing along allergen-free foods would be a safer option. Those traveling with young children may wish to inspect crevices around their seats for residual foods that might be picked up and ingested by toddlers. Some airlines may provide additional accommodations when requested in advance (eg, a flight where peanuts are not served).

Box 2**Tips for eating out****Before (prepare)**

Check the menu online to determine if there are feasible meal options

Call ahead to gauge the restaurant's ability and willingness to accommodate customer's needs

Carry preprinted cards with information about allergens and warnings about cross-contact (http://www.faiusa.org/?page_ID=D52D2E0F-0925-3542-FBD667C23A000523)

Carry emergency medications, especially epinephrine

During (communicate)

Communicate clearly and directly about food allergy. At a restaurant, the communicating personnel includes the wait staff, chef, and/or manager

Ask about ingredients and method of preparation. Do not trust ingredient lists on menus at face value

It is best to speak directly to the person making the food

High-risk places for cross-contact (avoid)

Buffets

Ice cream parlors

Bakeries

Asian restaurants (for peanut and tree nut allergies¹⁶)

Seafood restaurants (for fish and shellfish allergies)

Deep fryers, in which oil is reused for different foods and thus may be contaminated by previously cooked foods

Potlucks and parties where homemade dishes come from a variety of sources/preparers

Patients may be directed to <http://www.foodallergy.org/section/managing-food-allergies>, http://www.faiusa.org/?page=living_with_food_allergies, and <http://cofargroup.org> as resources.

Vacation choices, including all-inclusive resorts, cruises, and international travel, are circumstances in which advance planning is highly advised because these are situations in which others prepare most of, if not all, the meals. Potentially less-risky alternatives include accommodations where self-cooking is possible, that is, choosing rooms with kitchenettes, or to ship safe foods ahead to the vacation destination, if economically feasible.

ALLERGEN AVOIDANCE***Nuances of Exposure Risks***

The standard of care for the management of food allergy has been strict allergen avoidance. This advice is based on the possibility that exposure could result in allergic reactions.^{21,22} However, thresholds of clinical reactivity can vary dramatically among allergic individuals, and even within the same individual.^{23–26} In addition, there has been the notion that strict avoidance hastens allergy recovery, but there are limited supportive data on this hypothesis. Recent studies challenge the assumption that strict avoidance is required.²⁷

Studies now demonstrate that most children (70%–75%) with egg and milk allergies^{28,29} tolerate extensively heated forms of these foods when baked into foods (ie, muffins, waffles). The practitioner should be aware that these studies were performed using recipes outlining a defined amount of allergen cooked at a specific temperature for an exact duration. It is more difficult to know the amount of allergen in commercially prepared foods, which may also vary among batches.

But severe reactions were noted among those patients^{28,29} who did not tolerate the extensively heated forms of those foods. In fact, 20% to 35% of those who reacted to extensively heated egg or milk received epinephrine during these physician-supervised food challenges. Exposure to extensively heated forms of milk and egg is not advisable outside a medically supervised setting because of these risks.

There are exceptions for which strict avoidance is not necessarily prescribed despite a diagnosis of food allergy. In pollen-food allergy syndrome (oral allergy syndrome), heat, acid, and proteases break down the unstable allergen, allowing the ingestion of cooked and processed forms without symptoms. Allergists often allow patients with this syndrome to ingest the food³⁰ if symptoms are mild and limited to the mouth and throat.

Accordingly, clinician experience and discretion is imperative in tailoring avoidance recommendations to the patient's specific situation and degree of sensitivity.

Route of allergen exposure

The route of exposure plays a key role in the risk and severity of the allergic response. Food-allergic reactions predominantly occur following ingestion. It is important to emphasize to patients that life-threatening reactions (involving respiratory or cardiovascular systems) overwhelmingly occur with ingestion when compared with skin or casual airborne exposures. Even in the most highly sensitive individuals, skin or inhalational exposures typically induce limited reactions.^{31,32} Misunderstanding this concept is likely to arouse anxiety.

In one study, 1 g of peanut butter was applied for 15 minutes to the intact skin of 281 children who were skin prick test positive to peanut.³³ The allergen challenge was positive in 41% of children, meaning 1 or more hives were present at the site. None of the children experienced a systemic reaction. The study was then extended with blinded placebo-controlled oral challenges within a subset of children. In the contact-positive group, 82% of children reacted to ingesting peanut (including some with life-threatening anaphylaxis), whereas in the contact-negative group, 50% reacted. This result suggests that contact urticaria to peanut is not uncommon among peanut-allergic children. Its presence, in fact, may indicate a higher likelihood of symptoms with ingestion. However, skin contact alone did not induce any systemic reactions in this cohort. Conceivably, perceived systemic reactions to contact exposures (without obvious ingestion) may be explained by inadvertent contact with the food leading to subsequent transfer of allergen from the hands to the mouth or other mucosal surfaces. Alternatively, symptoms may occur from anxiety of exposure.

Inhalational exposures must be differentiated from smells or odors of food. In a double-blind placebo-controlled study, 30 children with clinical histories of severe peanut allergy were challenged by being near and smelling peanut butter.³¹ A 6-sq in area of peanut butter was placed 12 in from the children's faces for 10 minutes. No symptoms developed with smelling peanut butter, although there was a respiratory reaction to the placebo inhalant attributed afterward to anxiety.

Box 3**Pearls for allergen avoidance: answers to common questions from patients****Milk**

Cow's milk and goat's milk are more than 90% cross-reactive.

Sheep's milk is not a safe alternative.

Shellfish is occasionally dipped in milk to reduce odors.

Kosher pareve products may contain small amounts of milk protein.

Egg

Measles-mumps-rubella vaccines may be given safely to egg-allergic individuals (and is recommended by the American Academy of Pediatrics).

Influenza vaccines may contain a small amount of egg, but recent studies indicate that they may be safely administered in graded doses to most children with egg allergy.^{46–48}

Varicella (chicken pox) vaccines do not contain egg.

Peanut

Peanut is a legume (in the same family as beans such as soy). More than 90% of peanut-allergic individuals tolerate soy⁴⁹ as well as other legumes. But an exception is that there is a risk of cross-reaction between peanuts and lupine.

Having peanut allergy is associated with developing a tree nut allergy.

Studies⁵⁰ show that most allergic individuals can safely eat peanut oil that has been highly refined (but not cold-pressed, expeller-pressed, or extruded peanut oil).

Tree nuts

Cashews and pistachios are highly cross-reactive.⁵¹ Mortadella may contain pistachios.

Walnuts and pecans are highly cross-reactive.⁵¹

Almonds and hazelnuts are cross-reactive.⁵¹

Coconut is characterized by the FDA as a tree nut, but allergy is uncommon.

Nutmeg, water chestnuts, and butternut squash are not tree nuts.

Fish and shellfish

Fish and shellfish proteins can become airborne during cooking.

Having an allergy to fish or shellfish is not a contraindication to the use of radiocontrast material.

Noncrustacean shellfish (eg, clams, mussels, oysters, squid) do not have to be identified under FALCPA.

Soy

Soybean, soy, and soya are interchangeable.

Most individuals allergic to soy can safely eat soy lecithin, which contains a trace amount of detectable soy protein.^{52,53}

Most allergic individuals can safely eat soybean oil that has been highly refined (not cold-pressed, expeller-pressed, or extruded soybean oil).

Wheat

Spelt is considered allergenically similar to wheat.

Sesame seed

Allergies to other seeds (eg, poppy, sunflower, pumpkin, rapeseed, and flaxseed/linseed) are much less common than sesame allergy.

People who are allergic to one type of seed do not necessarily need to avoid all others, but individuals should consult their physician.

In contrast to odors, aerosolization of food particles can occur with cooking (boiling, steaming, frying) or processing (grating, shredding, grinding), which in turn may trigger symptoms. Food allergens are proteins (as opposed to fats or carbohydrates); thus, airborne food proteins can induce allergic reactions. In contrast, smell from a noncooking food, such as peanut butter, results from airborne volatile organic compounds given off continuously by foods; these compounds are not allergenic. In highly sensitive individuals, inhalational contact with aerosolized food proteins can induce asthmatic or respiratory reactions^{32,34} and sometimes skin symptoms. These individuals should avoid situations in which aerosolized food may be inhaled, for example, being near steam and vapors from cooking or being in close proximity to grinding or other handling of the allergenic food.

The clinician should reassure patients and their families that contact and inhalational exposures, compared with ingestion, carry very low risk for inducing life-threatening reactions. Moreover, inhalational exposures to aerosolized food proteins should be differentiated from smells or odors. It has already been well established that the quality of life of families and patients with food allergy is significantly affected,^{35–39} and thus, the practitioner can play a key role in allaying disproportionate fears, hence reducing anxiety.

A type of casual exposure that could result in systemic symptoms is contact with saliva through shared utensils and straws or by kissing. Food-allergic individuals should be warned that exposure may occur through kissing, specifically passionate kissing. Studies indicate that 5% to 16% of patients report reactions from kissing.^{40,41} In order to determine the time course of peanut protein in saliva after a meal of peanut butter, one study used Ara h 1 as a marker protein.⁴² Of 36 individuals, 30 had detectable levels of Ara h 1 at 5 minutes after ingesting 2 tablespoons of peanut butter. Of these 30 subjects, 26 (87%) had undetectable levels of the protein after 1 hour without any interventions (detection limit, 15–20 ng/mL). None had detectable levels several hours later following a subsequent peanut-free meal.

Interventions after a peanut butter meal were assessed in the same study, including brushing teeth, brushing and rinsing, rinsing, waiting then brushing, and waiting then

Table 1 Nonfood items in which food ingredients may be found	
Nonfood Items	Potential Allergens
Vaccines	Milk, chicken, and gelatin proteins Egg (see Box 3)
Medications	Lactose: Some dry powder inhalers are prescribed for asthma, ⁵⁴ although the level of milk protein contamination, if any, is unknown Oral medications (check labels, specifically inactive ingredients) Egg lecithin: propofol (general anesthetic) Risk of a reaction is presumed to be low Soy lecithin: certain inhalers Risk of a reaction seems very low ^{4,5} Egg lysozyme (enzyme found in egg white): nasal decongestants ⁵⁵
Cosmetics	Milk, tree nut oils, wheat, and soy ^{56,57}
Modeling Dough	Wheat
Finger Paints	Egg white
Latex Gloves	Casein (used as antistick agent) ⁵⁸
Alcoholic Beverages	Egg, cow's milk, and seafood (used as clarifying agents) Tree nut flavoring

chewing gum.⁴² None of these interventions consistently resulted in undetectable levels, although detected levels were lower than the threshold levels reported to trigger reactions ($<17 \mu\text{g}$ of peanut protein per 5 mL of saliva). The immediate interventions were less effective than those involving a waiting period. Results may also vary with other allergens or forms of peanut. There is one case report of a mild reaction to peanut (lip swelling and perioral pruritus) despite a 2-hour wait, brushing teeth, rinsing, and chewing gum.⁴³

Food-allergic reactions from blood transfusions or semen are theoretically possible. Individual case reports can be found in the literature.^{44,45} Possible explanations for allergic reactions include the reduction of plasma fractions in blood prepared for transfusion and recent ingestion by partners of large amounts of the allergen before intimate contact.

Additional pearls regarding allergen avoidance are provided in **Box 3**.

FOOD ALLERGENS IN NONFOOD ITEMS

Nonfood items may contain food ingredients, such as medications, vaccines, cosmetics, and craft supplies. See **Table 1** for specific examples.

SUMMARY

The everyday task of food avoidance presents challenges and uncertainties. Those affected by food allergy are constantly gauging risks associated with buying prepackaged foods, eating at restaurants, attending social functions, traveling, and other activities of daily life. US labeling laws have, for the most part, facilitated the ability to avoid allergens in packaged foods under FDA regulation, although interpretation of advisory labeling is more complex. Eating outside, at restaurants in particular, requires direct communication between the consumer and the food preparer. Care must be taken to avoid cross-contact. Patients must be aware of food allergens in unanticipated sources, such as vaccines and medications. Patients should be reminded that salivary transfer, which can occur through shared utensils and straws or passionate kissing, is also a concern. Implementing these tools of avoidance is essential to avoid serious allergic reactions, which can be life threatening. Medical practitioners play a key role in guiding patients through the difficulties of food avoidance.

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