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# Food allergy: practical approach on education and accidental exposure prevention

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## KEY WORDS

*food allergy; accidental exposure; allergen avoidance; food labelling; cross-contact*

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## Summary

*Food allergies are a growing problem and currently the primary treatment of food allergy is avoidance of culprit foods. However, given the lack of information and education and also the ubiquitous nature of allergens, accidental exposures to food allergens are not uncommon. The fear of potential fatal reactions and the need of a proper avoidance leads in most of the cases to the limitation of leisure and social activities. This review aims to be a practical approach on education and accidental exposure prevention regarding activities like shopping, eating out, and travelling.*

*The recommendations are focused especially on proper reading of food labels and the management of the disease, namely in restaurants and airplanes, concerning cross-contact and communication with other stakeholders.*

*The implementation of effective tools is essential to manage food allergy outside home, avoid serious allergic reactions and minimize the disease's impact on individuals' quality of life.*

## Introduction

A food allergy is defined as a reproducible and specific immune response that occurs on exposure to a given food, leading to adverse health effects (1). In most of the cases, this response is mainly IgE mediated (2). The signs and symptoms of food allergic reactions may be mucocutaneous (like eczema, hives or edema of glottis and tongue), gastrointestinal (like diarrhea, vomiting or abdominal pain), respiratory (like wheezing or shortness of breath) and cardiovascular (like low blood pressure and loss of consciousness) (1). In food allergic patients, anaphylaxis, an acute, severe and systemic reaction, can be potentially life-threatening if not appropriately treated (3).

Although the prevalence of food allergy is not well known, recent studies show that approximately 5% of adults and 8% of children have food allergies (4). Foods are one of the leading identifiable causes of anaphylactic reactions (5,6) and the first

one in the pediatric age in Portugal (7-9). The most common food allergies are to cow's milk, egg, peanuts and nuts, fish, shellfish, wheat and soy, and these foods account for 90% of food allergic reactions (10). Currently, the primary treatment of food allergy is avoidance of the involved foods (1,11-14). Additionally, in case of anaphylaxis, the first-line treatment is intramuscular injection of epinephrine (3).

Lack of information and education, and also the ubiquitous nature of some allergens (like milk or egg) (15,16), can contribute to accidental dietary exposures to be not uncommon (17,18). Education is particularly needed in terms of food labels' reading given that misinterpretation of food labels is a common cause of accidental ingestion (11,19,20). On the other hand is pivotal that food industry makes an effort directed toward the complete, accurate and unambiguous labelling of food (19,20). Proper labelling and reading are both crucial to the success of avoidance diets (11,20,21).

A Portuguese study with 69 children with food allergy was conducted to identify the frequency and to characterize accidental food exposures. The results have shown that 68.1% failures in the eviction diet occur with accidental exposure, and about one third of them (36.8%) occurred at home (22). Accordingly to other studies, parents have reported that children reactions generally occur in familiar locations such as home or school (5,23). Nevertheless, a significant number of reactions begins to occur in places like restaurants and other catering establishments (5,13,24), particularly in the case of adults (23). This fact points for an important role of the *world outside home* in food allergy patient's daily life.

From this perspective, literature suggests that anaphylactic reactions are more common in adolescents and young adults probably because they start to take responsibility for making their food choices preferably outside the home (25-28).

Another important issue regarding food allergy is the heavy emotional burden that is brought to these patients (25,29-32). The fear of reactions and the need of a proper avoidance leads in most of the cases to the limitation of leisure and social activities with a wide impact on quality of life (5,22,30,33,34). For example, a considerable percentage of food allergic individuals that have suffered an allergic reaction in a restaurant generally decided to avoid dining out (35). Accordingly, food allergic individuals also limit their vacations given that traveling abroad presents a potential risk (36). Approximately 30% of passengers that have an in-flight reaction reported they no longer fly and 40% decided do not eat any food served on board (37). Thus, commitment and education of the patients, their families and also third parts which provide food is crucial to live safer in community and minimize the impact of the disease (12,14,28). In a study of *Worth et al.*, eating out, travelling and food labelling were the areas where food allergy patients considered needing more information (32). Therefore, this review aims to be a practical approach on education and accidental exposure prevention, inside and outside the home (shopping, eating out, and travelling).

### Labeling and shopping

Shopping is the first barrier for food-allergy individuals. When food allergic patients go shopping, they should know that it is crucial to spend time to read properly the labels of every food product. A study with nut-allergic individuals has reported that these consumers spend 39% more time identifying proper foods than other consumers (38).

A considerable proportion of accidental exposures are attributed to inappropriate labeling, failure to read labels, and ignoring precautionary statements (39). This issue is particularly alarming if we regard that checking food labelling is one of the most used strategies by patients for food allergy management (32).

Then food allergic individuals depend on clear and consistent labeling of food allergens (38-40) and also on proper education about how to read labels to improve confidence and compliance (1,12,34,39).

At present, efforts have been made in terms of food allergen labelling legislation. Current EU legislation requires the clearly declaration of any of the 14 regulatory allergens (cereals containing gluten, crustaceans, eggs, fish, peanuts, soybeans, milk and products thereof, nuts, celery, mustard, sesame seeds, sulphur dioxide and sulphites, lupine, and molluscs) when used as ingredient of prepacked foods (41,42).

However, food allergic individuals should note that this legislation is effective only in the European Union, and therefore products bought in other countries could be covered by different legal labelling (43). Another important issue is that allergens may be described in numerous different ways on the food product labels (34,44). This is particularly relevant if we take in account that studies have reported that food allergic consumers are unable to correctly identify and recognize products which contained food allergens (45,46).

Thereby, for example, label ingredients that an individual should be aware in case of a milk allergy include casein, whey, ghee, curd, lactalbumin, lactoglobulin, lactulose, lactose (12,34). Consumers should also note that lactose free products could contain milk protein (47) and that milk from others mammals than cow is not suitable too (11). In case of egg, it may be described as albumin, emulsifier, livetin, ovomucoid, ovalbumin, lysozyme or avidin (34). Natural flavors are another concerning question as they could refer to peanuts, tree nuts, milk, or any other food (12). Although food allergen labelling laws could be a great contribute to make food choices easier, they still do not regulate other issues such as the potential presence of hidden allergens due to cross-contact (48). A substance is a hidden allergen when it is unrecognized or not declared on the product ingredient label (49).

The labelling that concerns the potential presence of unintentional ingredients, for example due to cross-contact in processing lines, is generally described as precautionary allergen labelling (PAL), for example "may contain", and it is applied voluntarily by the food industry (11,43,48,50,51). This statements should only be applied if it is considered that there is an actual risk of allergen cross-contact thorough a risk management plan (20,43,52). The requirement to manage potential contamination regarding the protection of food allergic consumers is covered through European Commission Regulations 178/2002 and 852/2004, despite current legislation does not cover the PAL's use (43).

The widespread use of this PAL is frequently reported, and it is known to limit the choices for food allergic individuals and to lead these individuals to sometimes choose to miss the PAL

(21,40,43,51,53). Indeed, some food allergic consumers suspected that PAL is used merely to avoid litigation and that, given the high prevalence of these labels, total avoidance is almost impossible (26,43,54,55). Concerning that cross-contact is unpredictable and that threshold of clinical reactivity can vary among individuals, misunderstanding about PAL lead to risk-taking (13,14,43) and has been found to contribute to deaths from anaphylaxis (54). Yet, some studies have reported that some of products with PAL actually have traces of the cited allergen, so, and given this risk, the avoidance of products with PAL should be recommended for the consumer with food allergy (1,56-57). Although PAL was introduced to ensure the safety of the consumers with food allergy, currently this labeling seems to not fulfill patients' needs. Regarding this, in addition to the patient responsibility, through the avoidance of the products with PAL, there should be a stronger commitment from the food industry in order to reestablish PAL credibility. The proper education of the stakeholders in production chain and also the standardization of the industrial processes, including risk assessment and communication could be significant tools. Additionally, the support of the governmental authorities in the process as well as the creation of legislation that covers the use of PAL could also be important.

Regarding other practical aspects of buying products, food allergic consumers must pay attention to prepackaged meals, juices and alcoholic beverages (may contain milk, nuts) and also nonfood products (like pet food, dental products, cosmetics and non-prescription medicines) (34). Allergens may also have unexpected sources. For instance, milk may be an ingredient of candies, ice-creams, chocolates, ham, sausages and processed meats, canned tuna fish, cereals, crackers and biscuits (34). Egg may be found in candies, pastry, sauces baked goods, meatballs, breaded meats and commercial egg substitutes (15,34).

Another misconception is that patients do not need to read a label each time they bought a product (58), especially if the consumption is common. Food industry may alter the products' formulation without advice, so it is very important that patients read ingredient labels every time they purchase a product (34,48).

Costumers ought to also pay attention to online shopping, because the label information is not always available or updated (47). Finally, food allergic patients shouldn't buy a product if they have doubts about their composition and safety (34).

## **Eating out**

### *Schools*

Food allergy is a common issue in school setting (59), and the risk of reactions at schools is a major concern for parents of chil-

dren with food allergy (5). Parents should ensure that children bring safe snacks from home and understand the risk of trading or accept food (27).

Regarding the school role, there are some additional measures, like providing food allergy education as part of science curriculum (60). It is also important to teach that it is wrong to tease or bully people with food allergies (61). Additionally, school can inform children about programs like *Be a PAL: Protect A Life™* which can help them learn how to be a good friend to people with food allergies (62).

Other resolutions can be to provide, when possible, individually wrapped food, clearly labeled food products or to designate an allergy-friendly seating during meals (open to any child with safe food) (63,64). Daily menus with allergen information shall be provided to the families (28,64). Hence, food allergens shouldn't be used in craft projects if there is a food allergic child in the class (63) and non-food incentives shall be used as prizes or gifts (64).

Younger children should be more supervised, especially in terms of cleaning practices (63) and responsible persons ought to be designated to manage the rapid and proper access to epinephrine auto-injectors (one of these should belong to the cafeteria staff) (64). Appropriate food handling procedures in canteens is also crucial to avoid accidental exposures and, given that, it is important that cafeteria / food service staff receive proper training (28,63).

Additionally, it is pivotal to provide adequate information to school personnel like teachers, substitute teachers and field trip personnel (5,28,29,63). A directed handbook about food allergies edited by a government authority, like the one made in Portugal (65), could be an important tool.

### *Family and Friends' houses*

Eating out also includes eating at family or friends houses and this is a frequently disrupted activity for food allergic individuals (29). Eating in a friend's house is particular important to adolescents, as they realize that difficulty of socializing with friends is one of the main effects of having an allergy (29,32). Given that, family and friends of food allergic individuals should receive information about the disease and allergen avoidance tools and be properly trained to deal with emergencies (29,66).

### *Restaurants*

Restaurants also point challenges for food allergic costumers (18,28,50,67) and some individuals count it as a principal restriction in their daily routine (54).

In a study of Worth et al, 37% of the food allergic respondents said that the question that concerned them most was the limitation of not being able to go to restaurants (32). To minimize

the potential risks, food allergic individuals can take some measures as always carrying epinephrine auto-injector (if it was previously indicated by a physician), communicating with chef / restaurant manager about food allergy and their needs regarding the ingredients and cooking methods (11, 28), and being aware of restaurants that present a particular danger like Asian food restaurants (68), ice cream shops, bakeries and seafood restaurants (69), considering the food allergens. Buffets could also be a problem for food allergic individuals essentially due to the risk of cross-contact (44, 50, 69).

### Communication

Having meal away from home requires a proper searching about the conditions of a restaurant, and consequently a direct communication between the consumer and the restaurant personnel (11,28,70). Wanich et al. identified, in a study, communication problems for both client and restaurant personnel (35). So, in every visit to a restaurant, patients and their families must know how communicate about food allergy and their needs regarding the ingredients and cooking methods (11,28).

Carrying a *chef card*, that outlines the foods that require avoidance and other information, is another important and common strategy (47). Additionally, they should chose a day and time when restaurant staff is not busy, so they could be more alert and attentive (69).

Food allergic costumers shall prefer simple dishes (for example baked potato instead of purée), avoid sauces or garnishes and be careful with desserts (44,68,69). On the other hand, food allergic costumers need all the restaurant staff to be proper informed and trained about food allergy (44, 68). Regarding this, studies have stated a particularly worrying discrepancy between the personnel's knowledge about food allergy and their comfort level in providing a safe meal (67,71,72).

Restaurants should have their menu as complete as possible, regarding the food allergy questions (73). For instance, an *apple cake* should be described as *apple cake (with nuts)* or *cottage pie* should be described as *cottage pie (chicken, puree, egg)* (74).

Additionally, it is very important to develop updated standardized recipes that include identification of food allergens and also potential of cross-contact based on restaurant and cooking procedures and HACCP implemented (75).

According with the EU legislation - Regulation (UE) n. 1169/2011, that came into force in December 2014, the clear identification of the 14 "major allergens" is mandatory, according to Annex II. This Regulation establishes the general principles, requirements and responsibilities governing food information, and in particular food labelling, including labelling of certain substances causing allergies. It states that the provision of food information shall pursue a high level of protection of consumers' health and interests, by providing a basis for final

consumers to make informed choices and to make safe use of food. Given that, it also lays down the means and procedures to guarantee the right of consumers to information, and shall apply to food business operators at all stages of the food chain, including foods delivered by mass caterers, foods intended for supply to mass caterers, and food served by transport undertakings when the departure takes place on the territories of the Member States to which the Treaties apply (41).

Besides the obligation to provide allergen / information in a visible and legible way (41), if they are asked for, restaurant staff should give clear information on potential allergens and complete disclosure of the dishes' ingredients (even if there was a *secret one*) (44,73). Another fundamental rule in food allergy is never guessing. If the employee does not have the total assurance of the ingredients, he must notify the customers and help them to choose another dish (44,73). Furthermore, it is important that restaurant personnel ensure the total cleanliness of the table and chairs (including highchairs) as for skin contact with residual food can provoke a reaction (44,73). Moreover, the table chosen for these costumers should be as far as possible from the kitchen in terms of avoiding inhaled contact with cooking vapors and out of the operational way (44).

### Service

Regarding service in restaurants, cross-contact is a main problem (28,44), especially because these establishments have constraints that increase the risk: large variety of allergenic foods in the same and generally constrained facility, constant sharing of surfaces and utensils, and simultaneous preparation of many dishes (51).

Cross-contact happens when a food that isn't an allergen or does not contain itself any allergen, comes into contact with an allergenic food. As a result, their proteins will mix and a food that was *safe* for an allergic individual then becomes risky (34,69). Cross contact can occur directly (when one food is placed above another) or indirectly (through hands or cooking utensils) (34,44). A practical scenario could be serving to a shellfish allergic individual a chicken that was grilled and handled with the same utensils that were used to cook a shrimp (34).

Cross-contact is a serious concern for people with food allergies, given that it is one of the main sources of undeclared or hidden allergens (51,74). Anibarro et al. have reported that hidden allergens accounted for 21% of all food allergic reactions (49). Additionally, in a restaurant, cross-contact is more likely to lead to high-dose exposures than at home, which may cause more severe reactions (51).

Regarding this issue, staff must be instructed about food preparation and service techniques to avoid cross contact (49). For instance, they should not use the same utensils to prepare, cook, plate and distribute of different meals. Water in which foods

are cooked and oils used in fried foods shouldn't be shared, too (44,69). Staff should also pay attention to the cleanness of all the utensils (including those used to wash or clean), tableware, storage containers and fridge / freezer, kitchen bench and kitchen appliances (grill, microwave, toaster, hand blender and chopper) (11,44,69,73). The hygiene of the employees and their uniforms is another key point and kitchen staff shall use non-latex and clean gloves for working (44).

Whenever possible, meals for food allergic costumers should be prepared first, and it is important to note that all the ingredients, even those used in small amounts (like flour to thicken a sauce or ingredients included in marinades) can provoke a reaction (44). Further, and given that there are some dishes that food allergic patients will certainly avoid (fried and grilled food due to the risk of cross-contact) (69), it is important that the restaurant considers the possibility of other menu options (44). Finally, if an error occurs, the solution is to discard the dish instead of only removing the portion that is believed to be contaminated (44,69,71).

During the service, the plate of a food allergic client should be delivered separately in order to avoid cross-contact and immediately after the preparation (11, 44, 69).

### **Travelling and vacation**

Food allergies affect food allergy individuals' vacations. Food allergic individuals' families commonly restrict the number of vacations they take, and some of these have never vacationed (36,76). The chosen destination is likewise affected, as patients say that they avoid for example Asian countries due the high risk of local cuisine (76). Additionally, food allergic adolescents cited difficulty travelling / going on overnight trips as one of the main effects of having an allergic reaction (32). It is also usual that these individuals avoid mainly ships and planes (36). Concerning this, and given that airplane is frequently needed in everyday context, the issue of safe air travel is particularly anxiety provoking (37,68). Studies have reported that about 10% of the food-allergic passengers have already experienced a reaction onboard (37,77). It was also mentioned that one of the occurring reactions led to emergency landing (77).

Additionally, Comstock described that among 471 patients with peanut, tree nut or seed allergy, 9% reported reactions during a flight, 10% of which had more than one reaction (78).

Regarding in-flight reactions, and given that there are fewer resources in an airplane which could lead to an undertreated reaction (37,79), cabin staff should receive appropriate training about this issue, and airlines ought to implement some measures concerning food allergic passengers' safety and well-being (28,79).

Many North-American airlines have implemented some resolutions as the elimination of the distribution of peanuts during

the flight, concerning the high prevalence of this food allergy. However, and taking into account that nothing prevents other passengers to bring their own snacks on board, the risk of exposure is always present (37,80).

This risk also still present on the "buffer zone" or "peanut free area", another measure that provides a zone reserved for food allergic passengers around which peanut (or other allergen) cannot be consumed (79). In this case, the ventilation system could ensure the dispersion of peanut particles and individuals may have a reaction by inhalation (37,79,80).

For passengers, the approach to eating on an airplane should be the same as that for any restaurant. They should contact the airline before the trip and inform the cabin staff on the day (28,81). It is also important for food allergy passenger to carry their adrenaline kits, in their original packaging, in the aircraft cabin and not into the luggage hold (28,37,80,81). However, since 11th September 2001, an allergic patient can theoretically be denied to use injectable epinephrine in the plane, so all the situations should be clarified with the airline (80,81). Further, it is recommended that patients have a letter written by their physician, containing all the information about their medical conditions and needs (70,80,81). Besides that, food allergy individuals shall ask airline to bring their own food onboard in order to avoid potentially unsafe airline foods (11,68). Another important advice is to inspect the cleanness and the presence of residual foods in the seats, especially in the case of food allergic babies or toddlers (11,81). Additionally, the avoidance of airline pillows or blankets and the request that other near passengers don't consume products with the implicated allergen, could be important tools (37).

At the destination, food allergic individuals should choose accommodations where self-cooking is possible (11,70,76). Chain restaurants could be another option, given that they are likely to use the same ingredients and to follow the same recipe, and that a growing number is allergy-aware (69). It might also be important to take an allergy information card in the host language (28,68,70) and to verify the food allergen labelling laws of their destination country before buying packaged foods (48).

The availability of medical care should be taken into account when food allergic individuals decide their destination and what to eat (68,76).

### **Critical Analysis and Conclusions**

The everyday life of a food allergic individual presents several challenges. These patients are constantly measuring risks associated with going shopping, buying foods, eating at school or in a restaurant, or travelling, in order to avoid an accidental exposure. For effective and personalized food allergen avoidance, essential information is required, as well as adequate training of the patients to understand the labels and to communicate with food

suppliers (20). The implementation of the tools of avoidance suggested by this review is essential to manage food allergy outside home and avoid serious allergic reactions. On the other hand, training for restaurants, schools, food industry and aircraft staff is also desirable, as well as a greater awareness of the disease.

The increasing recognition of the importance of the relationships between well-being and health has changed the way health and diseases are treated (25). Thus, today the intention is to assist and advise the patients in their disease's management, for what concerns a lesser impact on their daily life. Accordingly, one of the NIAID-sponsored expert panel's guidelines is that "*patients with food allergy should be provided with information on food allergen avoidance and emergency management that is age and culturally appropriate*" (1).

However, it is important to note that despite that some of the advices given in this paper are apparently easy to implement, there is a gap in studies regarding the efficacy of this measures. A study of Ewan and Clark is one of the few works that exists regarding the efficacy of an intervention to help patients in peanut allergy management and avoidance. Considering that the management plans have reduced the frequency and severity of reactions, counselling and information about allergen avoidance (understanding labelling, eating in restaurants or travelling abroad) are crucial for food allergic individuals (82). Another study defends the important role of the nutritionist and nutritional therapy in group in this educational process (83).

Additionally, and taking into account that there is also paucity in literature about accidental exposure, studies are needed to get more information about frequency and severity of unexpected allergic reactions to food. This data will be important to direct and optimize strategies to support patients in managing their food allergy; to prevent accidental exposure as much as possible and to increase awareness and knowledge in restaurants, airlines and food industry (13). Further, these results would be very important to provide more confidence and compliance for food allergic individuals to deal with their disease.

Other strategies that could be adopted to ensure the well-being of patients include the development of adapted recipes (34), as well as the creation of specialized restaurants. This strategy assumes particular importance if we take into account that some food allergic adolescents say that they need willpower to resist food they knew they should not be eating. Additionally others say that they often look for enjoyable and safe alternatives so they can feel better (84).

The creation of food products that suits food allergic individual's demands, especially those aimed to be consumed by children could be relevant, too. Moreover, now it is well recognized that the protection of food allergic individuals from accidental exposure and reactions is a shared responsibility (20).

With this review, it is also highlighted that proper and directed tools and more training for restaurant and aircraft staff are desirable, and that it would be important an investment in the development and implementation of effective allergen management strategies for food industry (20,26). The implementation of effective tools is essential to manage food allergy outside home, to avoid serious allergic reactions and to minimize the disease's impact on individuals' quality of life. Additionally, if the right measures are taken, and if all partners work together to ensure and improve the support services for food allergic individuals, these patients can have a normal, healthy and joyous life.

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