

The transforming power of proximity food challenges

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"My heart breaks for Jimmy. He sits at a table by himself during lunch at school. Just the smell of peanut butter makes his lips tingle and his throat close up." "Susan* is really worried that if someone handling peanut butter accidentally touches her, she will die." (*These names have been changed.)*

In recent years, food allergy has become a problem that affects the physical health and emotional well-being of individuals and their families. As many as 15 million people in the United States have food allergies, with nearly 6 million of them being children.¹ Both medical and lay publications (www.foodallergy.org) reiterate the prevalence and effect of food allergy and attempt to educate practitioners and patients on appropriate management.^{2,3} Patients and families are informed that every 3 minutes a food allergy reaction sends someone to the emergency department and every 6 minutes the reaction is anaphylactic.¹ They learn that more than 15% of school aged children with food allergies have a reaction at school,⁴ that almost half of fatal food allergy reactions are triggered by food consumed outside the home,⁵ and that, of the food allergens, peanuts are most commonly associated with severe allergic reactions.⁶ They are educated that failure to promptly treat food anaphylaxis with epinephrine is a risk factor for fatalities.^{2,5}

Although it is essential for patients and families to be aware of the possibility of anaphylaxis occurring in any setting, misinformation regarding the triggers of anaphylaxis is widespread. These myths force patients and families to live in a perpetual state of alarm, causing significant disruption in their daily activities. Often, patients, especially younger children, become psychologically conditioned to a degree of avoidance that may be unnecessary given their true sensitivity. Families with food allergies already

experience significant impairment in their quality of life,⁷ and these fears and anxieties further worsen the burden of the disease. Patients and families bring these concerns about anaphylaxis to the allergist's office seeking validation and redress. With an increasing number of professional and educational settings desirous of accommodating the food allergic individual, it becomes imperative to define the degree of individual patient sensitivity to the food allergen.

Common concerns brought forth by food allergic individuals relate to the possibility of casual (airborne and contact) exposure to allergens triggering severe or anaphylactic reactions and anxiety about being in unavoidable exposure situations. Occasionally, a personal history of limited exposure (ie, touching peanut butter) eliciting a reaction is narrated. These fears and experiences not only cause significant impairment of quality of life^{3,7} but also result in the institution of disproportionately stringent measures in schools and other settings (eg, insistence on major food allergen-free tables and peanut-free schools).

Because the current literature on this topic is confusing, it is understandable that this issue creates consternation. Circumstantial evidence demonstrates that peanut sensitization, possibly even allergy, can occur through the epicutaneous-transcutaneous pathway, particularly in children with underlying risk factors (eg, egg allergy; conditions with altered skin barrier, such as atopic dermatitis and filaggrin deficiency or mutations).^{8,9} Studies also suggest an association between environmental exposure to peanut in early life (eg, peanut creams, peanut protein in house dust, household consumption of peanuts or other nuts) and peanut sensitization and development of allergy.^{10,11} On the other hand, the dual allergen hypothesis postulates that oral exposure to these allergens through the ingestion of allergenic foods early in infancy can, paradoxically, result in the development of oral tolerance.⁸ In addition, Fox et al¹¹ found that children who consumed peanut in infancy were not affected by high household peanut consumption.

Research has revealed that severe reactions to nonaerosolized food allergens, such as peanut (and other) butter, almost always occur through ingestion or contact of the allergen with mucous membranes.^{12,13} The rare case reports of symptoms triggered by

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being in the presence of or smelling peanut butter¹⁴ have been disproven by 2 double-blinded, placebo-controlled studies that evaluated the relevance of casual contact in a systematic manner that did not find any evidence of the occurrence of systemic reactions in allergic children exposed to peanut butter via skin contact and inhalation.^{3,15} Another study was unable to detect the presence of Ara h 1 from participants wearing a personal air collector in the presence of peanut butter, opening shelled peanuts, and opening unshelled peanuts.¹⁶ Needless to say, casual exposure may present a greater risk to preschoolers who could inadvertently ingest the allergens.

Concern has been expressed regarding the unnerving possibility of peanut protein in commercial airlines triggering inadvertent anaphylactic reactions. These concerns stem from a few published surveys of patients self-reporting subjective reactions to peanuts and other foods in commercial airlines. Notably, in these surveys, it is challenging to confidently exclude the possibility of unintentional ingestion or a psychological response.^{12,13} The only study that reported detection of airborne peanut protein measured it from the ventilation filters of 2 commercial airliners after 1 year of use.¹⁷ A recent study performed at our center found an absence of airborne peanut allergen in peanuts taken from different airlines and during activities that mimic real life.¹⁸ Air was sampled under various conditions, such as boiling peanuts, removing raw and roasted peanuts from their shells, spreading peanut butter, pouring peanut flour, and opening peanut-containing packets obtained from different airlines. Reassuringly, no airborne peanut allergen (Ara h 1 or Ara h 2) or whole peanut protein above the lower limit of detection was measured in the peanut preparation collections other than in the following 2 scenarios: removal of the shells of roasted peanut (airborne peanut protein) and boiling peanuts (polyclonal peanut proteins were measured in the water).¹⁸ Of note, the concentration of airborne peanut protein that is necessary to elicit a clinical allergic reaction has not yet been characterized.¹⁸

On the flip side, we recently described peanut allergen in house dust measured from homes that restricted peanuts.¹⁹ In the prospective, cross-sectional study, Ara h 2 levels in homes that completely avoided peanuts were not found to be significantly lower than in homes that did not restrict peanuts. Although the study findings need to be replicated and the nuances explored further, they add to the evidence that small amounts of peanut allergen are present routinely in the environment^{9,10} and that inadvertent casual contact is possibly occurring in a regular manner. Unfortunately, literature on whether household peanut dust exposure in children with peanut allergy predisposes to ongoing or worsening allergy or causes anaphylactic reactions is lacking. Hence, although there continue to be factors that need

further elucidation by the medical and scientific community, it is critical for allergists to provide better-defined information regarding the level of tolerance of food allergic individuals and the parameters within which they can lead their daily lives.

Recognizing this conundrum and the concomitant practical implications for individuals with food allergies, the 2014 Food Allergy Practice Parameter Update states, “Teach patients that ingestion, rather than casual exposure through the skin or close proximity to an allergen, is almost the only route for triggering severe allergic/anaphylactic reactions [Strength of recommendation: Strong; C Evidence].”²⁰

Their recommendation was based on a study by Simonte et al³ on children with peanut allergy (peanut specific IgE level >50 kIU/L or evidence of peanut specific IgE with clinical anaphylaxis, a reported inhalation-contact reaction, or positive double-blind, placebo-controlled oral challenge result to peanut). These children underwent randomized double-blind, placebo-controlled exposures to peanut butter by inhalation (surface area of 6.3 sq in 12 in from the face for 10 minutes) and contact with intact skin (0.2 mL pressed flat for 1 minute). Placebo challenges were performed with a mixture of soy butter and histamine (contact). Scent was masked with soy butter, tuna, and mint (inhalation). Reassuringly, none of the 30 individuals (13 with a history of contact and 11 with inhalation reactions) experienced a systemic or respiratory reaction. Erythema (3 individuals), pruritus without erythema (5 individuals), and wheal-and-flare reactions (2 individuals) developed only at the site of skin contact with peanut butter. On the basis of their results, the authors stated with 96% confidence that at least 90% of highly sensitive children with peanut allergy would not experience a systemic or respiratory reaction from casual exposure to peanut butter.

To alleviate the concerns of those attending the food allergy clinics at Children’s Mercy Hospital and encouraged by the positive outcomes in the published literature, we have been offering the proximity food challenge test to determine the degree of sensitivity to casual airborne or cutaneous exposure. Our approach, using the framework of the Health Promotion Model, is based on the presumption that a successful proximity food challenge allows for enhanced self efficacy and encourages positive health behavior by placing the emphasis back on health rather than on the burden of the disease. The procedure, containing the key elements of the protocol described above, is adapted to be conducted in an office setting. In brief, a history is taken to elicit the nature of the concerning trigger (contact or inhalation), the food allergen preparation (eg, almond butter), and the scenario (eg, sitting at a table where others are ingesting peanuts, unintentional contact). A physical examination is performed to ensure absence of symptoms or signs (eg, urticaria) that could confound the interpretation of the



Figure 1. Open proximity challenge.

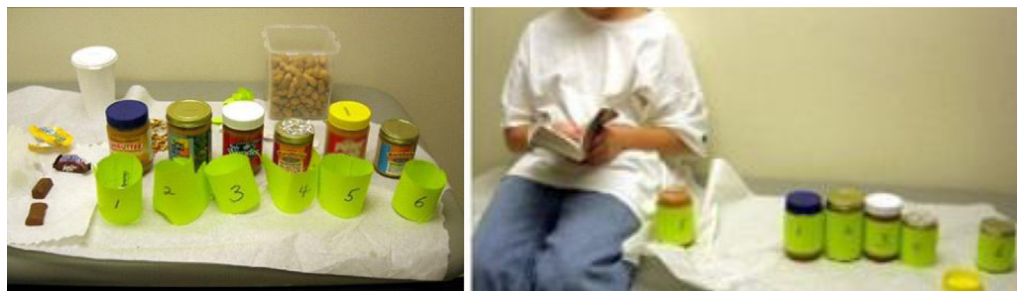


Figure 2. Double-blind, placebo-controlled proximity food challenge.

test results. Epinephrine and other supportive measures to treat anaphylaxis are kept available.

After verbal consent was obtained, the physician or nurse opens a jar that contains the suspect allergen (often peanut butter) in the room. While conversing, the clinician brings the jar increasingly closer to the child. If there is no reaction after 10 minutes to the airborne proximity testing, the physician nurse proceeds to contact challenge testing. A dab is applied on intact skin of the volar surface of the arm, and the patient is monitored (Fig 1). Five minutes later, the food allergen is washed off with soap and water. In situations where there is heightened anxiety secondary to the perception of occurrence of a previous reaction, an attempt to mimic the provocative scenario is undertaken in a double-blind, placebo-controlled fashion (Fig 2).

Foods or butters tested in the proximity food challenges in our clinics include almond, cashew, peanut, sunflower, soy, walnut, and cow's milk. Our experience has mirrored those of Simonte et al,³ with no patient experiencing a systemic reaction and only 1 having a hive at the site of application. Although the patients and families are initially apprehensive about the challenge, and it adds an additional half hour to 1 hour to their clinic visit time, they express relief at the conclusion of the procedure.

Although ingestion of food allergens can trigger severe reactions and avoidance is strongly recommended, the relevance of exposure through inhalation or skin contact is ill understood and remains an area of concern for individuals with food allergies. The observations that most individuals with food allergy have not experienced reactions in common settings^{3,4} and skin testing with the allergen rarely leads to systemic reactions, combined with the practice parameter recommendations²⁰ and our center's experience, should provide comfort to these families.

We advocate that allergists have an obligation to understand these nuances and offer clinical options that can make their patients' lives better. We recommend that allergists offer patients and families the option of undergoing proximity food challenges, when applicable, during their clinic visit. This procedure allows families a new alternative for evaluating food sensitivity and enables them to undergo exposure to the suspect food allergen in a controlled and safe setting. It also helps re-create the provocative scenario and helps them understand the type of reaction to expect with similar exposure in the future. Above all, it alleviates fears of the families and allows the individual to integrate in the social fabric of the community. Allergists should continue to advocate caution regarding inadvertent ingestion and contact of the food allergen with mucous membranes or disrupted skin and to support current school and community policies that protect individuals with food

allergies, while awaiting definitive research findings that will shape future public policy.

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