

Elimination diets in the diagnosis of atopic dermatitis

STEVE L. TAYLOR

University of Nebraska, Department of Food Science & Technology and Food Processing Center, Lincoln, NE, U.S.A.

One of the approaches to the diagnosis of food-induced atopic dermatitis (AD) is the elimination diet. However, this diagnostic technique is not always reliable, perhaps because the complete elimination of the offending food(s) from the diet is very difficult in some cases. Inadvertent exposures to the offending food(s) may occur through: the possible contamination of other foods through errors in processing or preparation; the unlabelled inclusion of the offending food as an ingredient; failure to eliminate specific foods or ingredients derived from the offending food; cross reactions between closely related foods; transfer of food allergens through breast milk from mother to infant; the existence of multiple sensitivities to foods and other environmental stimuli; and, failure of the patient to adhere to the prescribed elimination diet in uncontrolled settings. Also, the chronic nature of atopic dermatitis and the wide variety of environmental stimuli (both food and non-food) capable of exacerbating the condition indicate that the symptoms will flare and subside spontaneously or in response to non-dietary factors which complicates the diagnostic interpretation of the elimination diet.

Foods are commonly implicated as causative agents of AD in children (1, 2, 3, 4, 5, 6). In a recent review, Sampson (5) indicated that 98 of 160 pediatric patients (61%) with AD were sensitive to specific foods. Food sensitivity was established by double-blind, placebo-controlled food challenge (DBPCFC) for all but 25 foods. Food challenges were not conducted in these 25 instances because of a "convincing history" of severe, anaphylactic reactions to the foods. Evidence of an IgE-mediated food hypersensitivity was obtained for most of these patients including all of the 25 foods not subjected to DBPCFC (5, 7). Eggs, peanuts, cow's milk,

wheat, fish, and soybeans accounted for 90% of the positive reactions in these 98 patients (5). Most of these children (78%) reacted to one or two of the foods included in the DBPCFC with 19% reacting to three foods and only 3 children reacting to four or more different foods. Thus, food-induced AD appears to be rather specific in terms of the number and identity of the implicated foods.

Since foods are common causative agents of AD in children, it would seem intuitively obvious that elimination diets should be useful in the diagnosis of these patients. However, Sampson (5) notes that "historical information and elimination diets were rarely helpful" in the diagnosis of food-induced AD. Instead, Sampson and colleagues (4, 5, 6, 7) have relied heavily on the DBPCFC for the diagnosis of food-induced AD. Prior to the DBPCFC, these investigators use intensive topical treatments and elimination diets to clear symptoms (4, 5). While the DBPCFC is clearly a sound diagnostic procedure which warrants recommendation, the use of elimination diets would be a simpler approach if it were more reliable. If approached with sufficient knowledge, the use of elimination diets in the diagnosis of food-induced AD may be made more reliable. For treatment, Sampson (5) indicates that 17 of his patients have experienced demonstrably fewer symptoms on a specific avoidance diet than patients who fail to adhere to the recommended diet. Obviously, if a specific food is strongly suspected as the causative agent, an elimination diet might allow preliminary confirmation of the diagnosis.

Elimination diets may be constructed in several ways. The elimination diet can be tailored to the suspected sensitivities of the individual patient. This approach is heavily reliant upon

thorough history-taking and strong suspicions about the patient's food and environmental stimuli. These diets are more easily tolerated than the more general elimination diets, so patient compliance is improved. In more difficult cases with complex or inconsistent histories or multiple food and environmental stimuli, a more general approach is often taken to the elimination diets. In the most complicated cases, hydrolyzed casein formulae or elemental diets may be used. In other cases, the diet is restricted to a few foods, such as rice, chicken, and lamb, which are rarely implicated in AD. However, all of the approaches to the construction of effective elimination diets for the diagnosis of food-induced AD are fraught with numerous difficulties which limit their applicability. Several factors may contribute to the lack of reliability of elimination diets in the diagnosis of food-induced AD.

Atopic dermatitis may be caused by more than one food, by other environmental stimuli, or by some combination of these factors. Elimination of all possible stimuli would be quite difficult even for a short period of time. Thus, the physician must attempt to identify suspect foods and other stimuli by taking a comprehensive history. If the physician is able to narrow the number of suspect foods to one or a few, an effective elimination diet is more feasible. Of course, everyone recognizes the difficulty in obtaining thorough and accurate histories. The failures in history-taking probably contribute greatly to the lack of reliability of the elimination diet as a diagnostic approach. The physician simply does not know which foods should be eliminated.

Secondly, the likelihood of an inaccurate diagnosis with the elimination diet approach remains rather high even when the suspect foods can be identified with some success. Sampson (5) showed that his patients were markedly improved on an elimination diet, but they retained some symptoms. Such symptoms would give false positive results when using the elimination diet as a diagnostic tool.

Contamination of the foods in the elimination diet by offending foods can cause misleading results. Foods can easily be contaminated with

suspect foods due to errors during processing and preparation. Errors during processing would include the inadequate cleaning of equipment or the inadvertent use of certain ingredients. Yunginger et al. (8) documented that two adverse reactions to sunflower butter in peanut-allergic individuals were due to inadequate cleaning of the equipment for processing of the butter. The common use of "re-work", pulverized materials from earlier batches in the confectionary and other food industries is another example. Such errors are even more likely to occur during the preparation of the food. The use of the same utensil for several different foods could easily result in contamination of one food with another and inadvertent exposures to a suspect food while trying to adhere to an elimination diet. Patients have also been known to attempt to remove the offending food from a mixture, an obviously ill-advised practice.

Many examples exist of the unlabelled uses of food or food ingredients that could lead to inadvertent exposures to offending foods during elimination diets. Errors in processing and preparation would fall into this category. Restaurant foods are never labelled and exposure could easily occur in restaurants or other food service situations. Yunginger and colleagues (9) have determined that several deaths ascribed to food allergies were associated with unsuspected exposures to offending foods in restaurants or at parties.

The sources of various food ingredients and the presence of the offending allergens in that food ingredient are frequently unknown. Lecithin can be prepared from either eggs or soybeans but its protein or allergen contents are unknown. Peanut oil and soybean oil, while derived from common allergenic foods, do not contain the protein fraction of these oilseeds and are not allergenic (10, 11). Starch, a common food ingredient, can be made from corn, wheat, tapioca and several other sources, but the protein content is again unknown. For the purposes of elimination diets for diagnosis, it would be wise to eliminate all foods and ingredients derived from the suspect food, but it is often quite difficult to ascertain the sources of

specific ingredients of specific foods. For the purposes of avoidance diets for long-term control of symptoms, the wisdom of eliminating specific ingredients needs to be carefully considered on the basis of the likelihood of the presence of protein or allergen and the difficulty of avoidance (12).

Cross-reactions may sometimes occur between closely related foods. The importance of such cross-reactions in food-induced AD remains uncertain. Sampson (5) has identified only one case of cross-reactivity among genetically related foods by DBPCFC despite numerous positive skin tests or RAST among closely related species. Sampson (5) concludes that elimination of all foods within a botanical group is unwarranted in most cases. With other allergic manifestations, the possibility of cross-reactivity may be greater but it has not been carefully evaluated (12). For example, several adult patients with allergies to two common legumes, peanuts and soybeans, have been identified (13), while Sampson (5) indicates that legume-sensitive children with AD are almost never sensitive to both peanuts and soybeans. Cross-reactions are perhaps more likely between the eggs of different birds such as chicken, turkey, duck, and goose (14) and the milk of various species such as cow's milk and goat milk (15). In the absence of data specific to AD, the exclusion of all types of eggs and milk should be advocated in elimination diets where those foods are among the suspected ones.

Allergens may also be transmitted to infants through breast milk (16, 17). Sampson (5) described 6 cases where this was the exclusive route of exposure for infants with AD. When breast feeding is an option for an elimination diet in the diagnosis of food-induced AD, this source of exposure to food allergens deserves careful attention. In cases where breast-fed infants are being evaluated for the causation of AD, the mother's diet should be considered. In these cases, the mother rather than the child should be placed on the elimination diet.

The possible existence of sensitivities to multiple foods and other environmental factors would certainly confound the reliability of the elimination diet as an approach to diagnosis.

Sampson (5) indicates that 56% of his food-sensitive patients were sensitive to more than one food. The identification of suspect foods on the basis of history would become increasingly more difficult as the number of causative foods increased. The construction of a useful elimination diet based on the history obtained from such patients would be quite difficult. In my opinion, this factor is probably one of the most important limitations in the use of elimination diets in the diagnosis of food-induced atopic dermatitis.

Of course, the final caveat concerning elimination diets is patient compliance. The elimination diet is often imposed outside of clinical settings and thus control of the diet rests with the patient or parents. Adherence to the elimination diet in such situations can be a problem (5, 18). Sampson (5) notes that some of his patients fail to maintain an elimination diet even after careful identification of the offending foods.

In summary, elimination diets could be advocated as a preliminary step in the diagnosis of food-induced AD. These diets should be attempted only when a clear and thorough history is available that provides good clues to the identification of suspect foods. The elimination diet must be carefully constructed to avoid certain potentially confounding factors such as hidden sources of the offending food, possible cross-reacting foods, etc. With breast-fed infants, the mother's diet should be a source of possible concern. However, the usefulness of elimination diets is limited by the confounding factors, by problems with patient compliance, and by the frequent existence of multiple food and environmental sensitivities. Thus, the DBPCFC is recommended as a preferred procedure that can be conducted as a follow-up to the elimination diet approach if desired.

REFERENCES

1. Atherton, D. J.: Diet and atopic eczema. *Clin. Allergy* 18, 215-228, 1988.
2. Atherton, D. J., Sewll, M., Soothill, J. F., Wells, R. S. & Chilvers, C. E. D.: A double-blind controlled cross-over trial of an antigen avoidance diet in atopic eczema. *Lancet* i, 401-403, 1978.
3. Berg, T.: Allergological aspects of atopic eczema in children. *Acta Dermatovener. Suppl.* 95, 29-32, 1981.

4. Sampson, H. A.: Role of immediate food hypersensitivity in the pathogenesis of atopic dermatitis. *J. Allergy Clin. Immunol.* **71**, 473-480, 1983.
5. Sampson H. A.: The role of food allergy and mediator release in atopic dermatitis. *J. Allergy Clin. Immunol.* **81**, 635-645, 1988.
6. Sampson, H. A. & McCaskill, C. M.: Food hypersensitivity in atopic dermatitis: evaluation of 113 patients. *J. Pediatr.* **107**, 669-675, 1985.
7. Sampson, H. A. & Albergo, R.: Comparison of results of skin tests, RAST, and double-blind, placebo-controlled food challenges in children with atopic dermatitis. *J. Allergy Clin. Immunol.* **74**, 26-33, 1984.
8. Yunginger, J. W., Gauerke, M. B., Jones, R. T., Dahlberg, M. J. E. & Ackerman, S. J.: Use of radioimmunoassay to determine the nature quantity and source of allergenic contamination of sunflower butter. *J. Food Prot.* **46**, 625-628, 1983.
9. Yunginger, J. W., Sweeney, K. G., Sturmer, W. Q., Giannandrea, L. A., Tieglund, J. D., Bray, M., Benson, P. A., York, J. A., Biedrzycki, L., Squillace, D. L. & Helm, R. M.: Fatal food-induced anaphylaxis. *JAMA* **260**, 1450-1452, 1988.
10. Bush, R. K., Taylor, S. L., Nordlee, J. A. & Busse, W. W.: Soybean oil is not allergenic to soybean-sensitive individuals. *J. Allergy Clin. Immunol.* **76**, 242-245, 1985.
11. Taylor, S. L., Busse, W. W., Sachs, M. I., Parker, J. L. & Yunginger, J. W.: Peanut oil is not allergenic to peanut-sensitive individuals. *J. Allergy Clin. Immunol.* **68**, 373-375, 1981.
12. Taylor, S. L., Bush, R. K., Busse, W. W.: Avoidance diets - how selective should they be? In: Chandra, R. K. (ed.), *Food Allergy* (Nutrition Research Education Foundation, St. John's, Newfoundland, 1987).
13. Herian, A. M., Taylor, S. L. & Bush, R. K.: Identification of soybean allergens by immunoblotting with sera from soy-allergic adults. *J. Allergy Clin. Immunol.* (submitted).
14. Langeland, T.: A clinical and immunological study of allergy to hen's egg white. VI. Occurrence of proteins cross-reacting with allergens in hen's egg white as studied in egg white from turkey, duck, goose, seagull, and in hen egg yolk, and hen and chicken sera and flesh. *Allergy* **39**, 399-412, 1983.
15. Juntunen, K. & Ali-Yrkko, S.: Goat's milk for children allergic to cow's milk. *Kiel. Milchwirt. Forschungsber* **35**, 439-440, 1983.
16. Gerrard, J. W.: Allergies in breast-fed infants. *Clin. Allergy* **2**, 143-149, 1984.
17. Kilshaw, P. J. & Cant, A. J.: The passage of material dietary proteins into human breast milk. *Int. Arch. Allergy Appl. Immunol.* **57**, 8-15, 1984.
18. Nield, V. S., Marsden, R. A., Bailes, J. A. & Bland, J. M.: Egg and milk exclusion diets in atopic eczema. *Br. J. Dermatol.* **114**, 117-123, 1986.