

Food allergy

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The gastrointestinal barrier is exposed to an extremely heterogeneous group of proteins which depends on the age of a given individual. Infants ingest proteins from fewer sources. These food sources consist of mother's milk and/or commercial formulas based on bovine milk or soybean proteins. In older children and adults, dietary proteins are derived from meat, poultry, and fish (42.3%); dairy products (21.2%); flour and cereal products (18.6%); dry bean, peas, nuts, and soya products (5.4%); vegetables (6.2%); eggs (4.9%); and fruits and miscellaneous sources (1.4%) (1). Commercially processed proteins used as food ingredients include: casein and whey from bovine milk, gelatin and collagen from animal tendons and hides, soy protein isolates from soybeans and gluten from the flours of wheat, corn, and oats (8).

Dietary proteins are obtained in part from heterologous animal species. These proteins are theoretically capable of eliciting immune re-

sponses. Interestingly, this places the need to digest and absorb these substances without an adverse immune response in conflict with the need to recognize and respond to infectious organisms. There are many mechanisms designed to protect against uptake of antigens and direct the proteins to sites of digestion. Despite these non-specific as well as antigen-specific mucosal barrier mechanisms that limit antigen uptake, there is both experimental and clinical evidence to suggest that intact antigens and antigen fragments presented via the gastrointestinal tract gain access to host tissues. These observations seem directly applicable to the understanding of food reactions. While the small quantities of intact antigens that enter the system are not relevant to nutrition, they are potentially antigenic and therefore capable of stimulating host effector responses on subsequent exposure (Table 1) (6). However, it seems likely that additional factors must be involved in the induction of adverse reactions to

Table 1
Characteristics of purified water-soluble food antigens

Allergen	Source	MW	Composition	Characteristics
Antigen M	Codfish	12,328	113 amino acids to 1 glucose	A parvalbumin; chelates calcium; relatively acid- and protease-resistant
Antigen II	Shrimp	38,000	96% protein, 4% carbohydrate	Heat-stable
Peanut I	Peanut	-	91% protein, 9% carbohydrate	Relatively acid- and protease-resistant
Soybean trypsin inhibitor	Soybean	20,500	Polypeptide chain, two disulfide bridges	Relatively acid- and protease-resistant

foods since the vast majority of humans show no adverse effects from a limited intestinal permeability to antigenic material. Thus, in a relatively few individuals, immunologic responses appear to be accompanied by adverse side effects such as the production of tissue injury by immune complexes, IgE-dependent mechanisms (5) and delayed hypersensitivity (9).

Adverse reactions to foods can be either immediate or delayed. Immediate reactions to foods appear due to the production of food specific IgE in some predisposed individuals (2, 3, 4). Interactions between food antigen and specific IgE leads to a pathologic process mediated by mast cells and basophils (7). The food antigens involved are those more likely to survive the process of digestion by virtue of their intrinsic properties. Delayed reactions to food are more diverse both in their expression and the biologic mechanisms involved. Pathogenesis in these diseases depends upon such factors as the state of maturity of the gastrointestinal system and infections that disrupt the integrity of the gastrointestinal barrier.

It is perhaps surprising that adverse reactions to foods are not more frequent. Survival is dependent upon food ingestion which of necessity is a continual process. Mechanisms to regulate digestion and to regulate immune responses are complex, interrelated, and difficult to comprehend. For these reasons, the belief that many more diseases might be related to, or influenced by adverse responses to foods has long been attractive. The search for such associations should continue, with sufficient scientific skepticism to assure that valid observations result.

In all probability, adverse reactions to foods will increase with time. Much of this will be directly related to two factors: the need to feed a growing population with protein from increasingly diverse sources, and the development of

new and novel techniques to process and preserve foodstuffs. In the first case, potential reactors are simply exposed to more antigens to which they may respond. In the second instance, new antigens are created capable of eliciting adverse reactions. The potential for a real increase in the number of adverse reactions to foods is accompanied by an increasing public awareness of the reality that reactions to foods can occur. These factors will undoubtedly combine to heighten scientific interest in reactions to foods in the future.

REFERENCES

1. Allison, R. G. (ed): An evaluation of the potential for dietary proteins to contribute to systemic disease. Life Sciences Research Office, Federation of American Societies for Experimental Biology, Bethesda, MD, P. 2. 1982.
2. Atkins, F. M., Steinberg, S. S., Metcalfe, D. D.: Evaluation of immediate adverse reactions to foods in adults. I. Correlation of demographic, laboratory, and prick skin test data with response to controlled oral food challenge. *J. Allergy Clin. Immunol.* 75, 348, 1985.
3. Atkins, F. M., Steinberg, S. S., Metcalfe, D. D.: Evaluation of immediate adverse reactions to foods in adults. II. A detailed analysis of reaction patterns during oral food challenge. *J. Allergy Clin. Immunol.* 75, 356, 1985.
4. Bock, S. A., Lee, W. Y., Remigio, L. K., May, C. D.: Studies of hypersensitivity reactions to foods in infants and children. *J. Allergy Clin. Immunol.* 62, 327, 1978.
5. Jarrett, E. E.: Immunoregulation of IgE responses: the role of the gut in perspective. *Ann. Allergy* 53, 550, 1984.
6. Metcalfe, D. D.: Food allergens. *Clin. Rev. Allergy* 3, 331, 1985.
7. Sampson, H. A., Jolie, P. L.: Increased plasma histamine concentration after food challenges in children with atopic dermatitis. *N. Engl. J. Med.* 311, 372, 1984.
8. Satterlee, L. D.: Proteins for use in foods. *Food Technology* 35, 53, 1981.
9. Strober, W., Falchuk, Z. M., Rogentine, G. B., et al.: The pathogenesis of glutensensitive enteropathy. *Ann. Intern. Med.* 83, 242, 1975.

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