

# Understanding Food Allergy

Surveys show that about one-third of all adults believe they have food allergies.<sup>1</sup> Yet true food allergy is estimated to affect less than two percent of the population.<sup>2</sup> About 4-8% percent of young children are diagnosed with food allergies, most of which are evident in the first years of life and are often outgrown.<sup>3</sup>

Because misunderstanding of food allergy can result in unnecessary food restrictions or in some cases prove to be life threatening, it is important to know the facts about this condition. This issue of *IFIC Review* provides an overview of food allergy including its symptoms, diagnosis and management, and describes how it differs from other sensitivities to food.

## Defining Food Allergy

A food allergy is any adverse reaction to an otherwise harmless food or food component that involves the body's immune system. To avoid confusion with other types of adverse reactions to foods, it is important to use the term "food allergy" or "food hypersensitivity" only when the immune system is involved in causing the reaction.<sup>4</sup>

There are several different types of adverse reactions involving the immune system, which helps the body resist disease. In the case of food allergy, "immediate hypersensitivity" is the most clearly understood. This reaction involves three primary components: food allergens, immunoglobulin E (IgE), and mast cells and basophils.<sup>5</sup>

A food allergen is the part of a food that stimulates the immune system of food-allergic individuals. A single food can contain multiple food allergens, the majority of which are likely to be proteins, not carbohydrates or fats.<sup>6</sup>

People with food allergies produce increased amounts of IgE, which is an antibody in the immune system. When allergic individuals eat certain foods, their immune

systems are stimulated by the food allergens to make IgE specific to that food. Millions of IgE antibodies then circulate in the blood; they bind to blood cells called basophils and enter body tissues where they bind to mast cells.

Basophils and mast cells are specialized cells of the immune system that play key roles in producing allergic reactions. Basophils are phagocytic white blood cells, or cells that engulf and absorb foreign bodies in the bloodstream. Mast cells are found in tissues primarily at sites in the body that come in contact with the environment – such as the skin, lungs and gastrointestinal tract. Basophils and mast cells produce and store various substances such as histamine, which cause allergic symptoms. When IgE antibodies on the surfaces of basophils and mast cells come in contact with food allergens, these cells stimulate the release of mediators such as histamine, prostaglandins and leukotrienes, which are powerful compounds that cause allergic reactions.<sup>7</sup>

## Food Allergy Symptoms

Although allergic reactions can occur to virtually any food, most reactions are caused by a limited number of foods: milk, eggs, fish, shellfish (crustacea and mollusks), soy, wheat, peanuts and tree nuts such as walnuts.<sup>8</sup>

Clinical symptoms of adverse food reactions typically involve the skin, gastrointestinal tract, and respiratory system. These symptoms can occur alone or in combination, with more than one symptom occurring at one time; and in some cases there can be generalized anaphylaxis.

IgE-mediated adverse reactions to food or food allergy usually begin within minutes to a few hours after eating the offending food. But in very sensitive people, simply touching or inhaling the food may produce an allergic reaction.

The most common symptoms of food allergy involve the gastrointestinal tract, beginning with swelling or itching of the lips, mouth and/or throat. When an offending food enters the stomach, nausea, vomiting, cramping and diarrhea may occur. Itching, hives, eczema and redness of the skin are also common symptoms.<sup>9</sup>

Some people may experience sneezing, a runny nose, shortness of breath or other breathing difficulties. Although food allergies can sometimes aggravate asthma, they are not a common underlying cause of this respiratory illness. However, people whose asthma can be triggered by food allergy appear to have an increased risk of severe life-threatening reactions.<sup>10</sup>

Anaphylaxis is a rare but potentially fatal condition in which several different parts of the body experience food-allergic reactions at the same time. Symptoms may progress rapidly and may include severe itching, hives, sweating, swelling of the throat, breathing difficulties, lowered blood pressure, unconsciousness and can even lead to death.<sup>11</sup>

Symptoms of food allergy are highly individualistic, varying in terms of degree, time of onset, location and amount of food eaten. Symptoms can vary within the same person as well as among populations.

### **Food Allergy Diagnosis**

Diagnosing a food allergy may not be difficult if symptoms are consistent. For example, the diagnosis of peanut allergy may be quite obvious in a young child who develops vomiting and hives after eating peanuts on different occasions.

But since there can be many different causes of food-related illness, it is important to consult a board-certified allergist or other qualified health professional to determine whether the symptoms are related to food allergy or another medical disorder.

Diagnosing a food allergy begins with a thorough medical history to identify the suspected food; the amount eaten to cause a reaction (to determine the severity of the sensitivity); the amount of time between food consumption and development of symptoms; how often the reaction occurs; and other detailed information. A complete physical examination and selected laboratory tests are conducted to rule out underlying medical conditions not related to food allergy.<sup>12</sup>

A diary of foods eaten and a record of symptoms over a specified time may also be useful in the diagnosis of food allergies. Although a food diary cannot prove a cause and effect relationship, it can suggest an association between a specific food and a person's symptoms which otherwise may go unrecognized.

## **The Big 8 Food Allergens**

The eight most common food allergens cause more than 90 percent of all food allergic reactions. The top eight food allergens are:

- milk
- eggs
- fish
- soy
- shellfish (crustacea and mollusks)
- wheat
- peanuts
- tree nuts (e.g. walnuts)

Elimination diets are used both in the diagnosis and treatment of food allergy. Suspected foods are completely eliminated or restricted from the diet for several weeks to determine whether ongoing symptoms resolve. If improvement is seen, then suspected foods may be introduced one at a time to observe whether symptoms recur. Elimination diets should be tried only under medical supervision to ensure objective evaluation of symptoms and to avoid malnutrition.<sup>13</sup>

Several tests are available to determine if a person's immune system is sensitized to a specific food. In prick-skin testing, a diluted extract of the suspected food is placed on the skin, which is then scratched or punctured. If no reaction at the site occurs, then the skin test is negative and allergy to the food is unlikely. If a bump surrounded by redness forms within 15 minutes, similar to a mosquito bite, then the skin test is positive and the person may be allergic to the tested food. Blood tests known as the radioallergosorbent test (RAST) or the enzyme-linked immunosorbent assay (ELISA) can provide similar information to that obtained by the skin test.<sup>2</sup>

If the medical history, physical examination and skin or laboratory tests suggest a food allergy, and if the reactions to the food are not severe, then the doctor may conduct a food challenge. In a food challenge, increasing doses of the suspected food are given until the individual develops symptoms or tolerates a normal portion.<sup>12</sup>

In some instances, increasing portions of the suspected food are eaten under medical supervision. In other cases, a "blind food challenge" is used to try to determine which food causes the allergy. With "blind challenges", a sample of the suspected food is hidden in another food or disguised so that expectations of the patient and/or the doctor will not influence the results. Individuals with histories of severe reactions are rarely challenged.<sup>12</sup>

Two controversial diagnostic methods are cytotoxic testing and symptom provocation testing, in which a dose of the food extract is placed on the tongue or injected. These methods are expensive and unreliable in detecting true food allergy and should be avoided.<sup>14</sup>

### **Food Allergy Management**

Once a food allergy is diagnosed, the only proven therapy is to avoid the offending food. A diet or eating plan to eliminate the offending food must be developed carefully. Each elimination diet must take into account the individual's ability to tolerate the offending food, the need to avoid nutritional deficiencies, the ease of following the diet and other factors.<sup>13</sup> A registered dietitian can provide valuable assistance in meal planning and in suggesting alternative foods or ingredients.

To successfully follow an elimination diet, individuals must become adept at reading food labels. By law, a list of ingredients in each food product must be listed on the label. Labels should be checked each time the food is consumed, as product formulations sometimes change. Specific information about food ingredients or manufacturing is also available from food companies by contacting them at the address or phone number on the label.<sup>15</sup>

Dining out can still be a pleasant experience for food-allergic individuals, provided they inquire thoroughly about ingredients and preparation of menu items. Party-goers may offer to bring a dish they know they can safely enjoy.

In some cases, strict adherence to an elimination diet appears to promote the process of outgrowing a food allergy. After rigorously following allergen-free diets for one to two years, about one-third of older children and adults in one study were no longer sensitive to the original-offending foods. Allergies to peanuts, nuts, fish and shellfish, however, may last a lifetime.<sup>16, 17</sup>

Food-allergic individuals should have a plan in place for handling situations in which they accidentally eat a food to which they are allergic, since allergic reactions occasionally can be fatal. Unfortunately, in many cases, fatalities due to anaphylactic reactions to foods occur when individuals think they are safe. One study showed that food-allergic individuals who died as a result of fatal food allergy-induced anaphylaxis occurred because the individuals were caught off-guard and were not prepared to handle a severe reaction.<sup>18</sup> So, those with histories of significant reactions need to be instructed on the administration of epinephrine (adrenaline), a medicine used to help stimulate the heart and relax the lungs in the event of a severe reaction.

Syringes with premeasured doses of epinephrine are available from drugstores with a prescription from a board-certified allergist. These syringes are loaded with epinephrine for self-injection, are easy to use, and should always be carried by individuals with a history of severe allergic reactions. Oral antihistamines may be helpful in treating mild reactions, but the early administration of epinephrine can be life saving. Medical-alert bracelets or necklaces can also be worn to quickly alert medical personnel or other caretakers if the food allergic person is found unconscious.<sup>15</sup>

Currently no drugs are available to alter the long-term course of food allergy. Allergy shots, which are useful in desensitizing some people to pollen and other environmental allergens, are not recommended to treat food allergy and may be dangerous because they carry the potential risk of serious anaphylactic reactions.<sup>19</sup> The only way to prevent an allergic reaction is avoidance of the offending food. Unlike an allergy to pollen or pet hair, for instance, there are no shots to ward off symptoms. It has been particularly hard to study some food allergies because of the potential danger of inducing a severe reaction in a food-allergic person.

Studies on gene therapy for peanut allergy are now underway. While these methods have been used only in animals<sup>20</sup> the results look promising for reducing the severity of allergic reactions, or in some people, eliminating the allergy completely. There are also human trials being conducted using anti-IgE treatment for peanut allergy. Anti-IgE treatment is not intended to be a cure. But, scientists hope the drug can control the molecule that causes severe reactions, so patients who accidentally eat peanuts might experience only mild, rather than life-threatening symptoms. If successful, these methods can be extended to other foods besides peanuts.

### **What to do if a Food Allergy is Suspected**

When a food allergy is suspected, that food should be avoided until a doctor is consulted. A number of unpleasant symptoms can occur after eating food that are caused by medical conditions other than food allergy. If symptoms are associated with food allergy, then evaluation by a board-certified allergist may be helpful.

## Other Causes of Food Reactions

Some adverse reactions to foods do not involve the immune system and are known as “food intolerances”. There are various types of food intolerances such as food poisoning, metabolic reactions to food and some unexplained causes of food adverse reactions.<sup>7</sup>

Food poisoning occurs when foods containing toxins are consumed. In some instances, food poisoning can mimic an allergic reaction. For example, in scombroid fish poisoning, spoiled tuna or other fish contain large amounts of histamine produced by contaminating bacteria. When the spoiled fish is consumed, symptoms develop that closely resemble an allergic reaction to food.<sup>21</sup>

In metabolic reactions to food, the body cannot adequately digest a portion of the offending food. For example, people with lactose intolerance are deficient in the intestinal enzyme, lactase, which is needed to digest the milk sugar, lactose. When milk or other dairy products are consumed, these individuals develop nausea, gas and diarrhea.<sup>5</sup>

Non-allergic food reactions can also occur as a result of other health problems, such as when a child with viral gastroenteritis subsequently develops lactose intolerance. In other instances, the mechanisms for these reactions are unknown. Psychological factors may play an important role in some cases.<sup>5</sup>

Another type of reaction to food is called “food idiosyncrasy.” Food idiosyncrasy is an abnormal response to a food or food substance. The reaction can resemble or differ from symptoms of true food allergy. Idiosyncratic reactions to food are quantitatively abnormal responses to a food substance or additive differing in its physiologic or pharmacologic effects. This type of response resembles a hypersensitivity reaction but does not involve the immune system as seen in food allergy reactions. Sulfite sensitivity or sulfite-induced asthma is an example of a food idiosyncrasy that affects small numbers of people in the population. However, sulfite-induced asthma can potentially be life threatening.<sup>22</sup> (For further discussion on sulfites, see “Food Ingredients and Food Allergy” section.)

## Facts about Food Allergy

**FACT:** Although anyone can develop a food allergy, the ability to become allergic is inherited. Children with one allergic parent have about twice the risk of developing food allergy than children without allergic parents. If both parents are allergic, a child is about four times more likely to develop food allergy than if neither parent is allergic.<sup>23</sup> Many children with food allergies also show sensitivities to inhaled allergens such as dust, cat dander and pollen.<sup>24</sup> In addition, people who develop food allergies often have histories of respiratory allergies such as allergic nasal symptoms or asthma.

**FACT:** A mother's diet during pregnancy does not cause food allergy in her infant. Most studies show the maternal diet during pregnancy has little influence on sensitization of the infant to foods.<sup>23</sup> Sensitization of the infant in the womb has been shown only in rare instances. Thus, a mother-to-be should not restrict her diet in attempts to prevent food allergy in her offspring.

**FACT:** Although there are many reasons to promote breastfeeding during the early months of life, its effectiveness in preventing food allergy in infants is controversial. Some studies show breastfeeding has a protective effect against food allergy, while others show it only delays the time until food allergy eventually appears.<sup>23,25</sup> Food allergens consumed by lactating mothers have been found in minute quantities in their breast milk.<sup>26</sup> It is believed that many infants who have allergic reactions on their first known ingestion of a food were actually sensitized by previous exposure to small amounts of the food allergen in their mothers' breast milk.<sup>27</sup>

**FACT:** Most food allergy reactions are not life threatening. In fact, most cases of allergic reactions to food are relatively mild. But a small percentage of food-allergic individuals have severe reactions that can be life threatening. In one study of severe allergic reactions to foods, most of the fatalities occurred away from home. All of the individuals involved accidentally ate a food to which they knew they were allergic. Other factors found in the study that contributed to the fatal reactions included a history of asthma, denial of symptoms, delay in obtaining medical treatment and the failure to administer epinephrine quickly after the reaction began.<sup>28</sup>

## Food Ingredients and Food Allergy

Many different types of food have been identified as allergens for some people. However, misinformation about allergic reactions to different food ingredients can sometimes cause unnecessary food avoidance. Current scientific knowledge about some of the most common ingredients is summarized below.

### **Food additives**

Food additives have been used for many years for five main reasons: to maintain product consistency; to improve or maintain nutritional value; to maintain palatability and wholesomeness; to provide leavening or control acidity and alkalinity; and to enhance flavor or impart desired color. Although most Americans consume a wide variety of food additives daily, only a small number have been associated with reactions. These reactions are not usually caused by an allergic response to the additive, but are examples of food intolerance.<sup>7</sup>

### **FD&C Yellow No. 5 (tartrazine)**

FD&C Yellow No. 5 (tartrazine) is used to color beverages, candy and other foods. Scientists have concluded the color additive may cause hives in fewer than one out of 10,000 people.<sup>29</sup> There is no scientific evidence that FD&C Yellow No. 5 provokes asthma attacks or that people who react to aspirin have a cross-sensitivity to it,<sup>30</sup> as has been claimed in the past. Whenever FD&C Yellow No. 5 is added to foods, it must be listed on the product label. This allows the small portion of people who may be sensitive to FD&C Yellow No. 5 to avoid it.

### **Monosodium glutamate (MSG)**

Monosodium glutamate (MSG) has been used for many years as a flavor enhancer. It is the sodium salt of glutamic acid, an amino acid found naturally in the human body and in all protein-containing foods such as cheese, vegetables, meat, and milk. The U.S. Food and Drug Administration (FDA) believes MSG is a safe food ingredient for the general population.<sup>31</sup> MSG is not an allergen and there is conclusive scientific evidence that MSG does not cause or exacerbate asthma.<sup>32,33</sup> A small number of people may experience mild and transitory symptoms to MSG. However, these short-lived responses only occur in clinical settings upon ingestion of large doses of MSG without food, and were not reproduced in retesting. Whenever MSG is added to food, it is listed on the label as monosodium glutamate.

### **Sulfites**

Sulfiting agents are sometimes used to preserve the color of foods such as dried fruits and vegetables, and to inhibit the growth of microorganisms in fermented foods such as wine. Sulfites are safe for most people. A small segment of the population, however, has been found to develop shortness of breath or fatal shock shortly after exposure to these preservatives.<sup>34</sup> Sulfites can provoke severe asthma attacks in sulfite-sensitive asthmatics.<sup>35</sup> For that reason, in 1986 the FDA banned the use of sulfites on fresh fruits and vegetables (except potatoes) intended to be sold or served raw to consumers. Sulfites added to all packaged and processed foods must be listed on the product label.

## Food and Drug Administration (FDA) Guidelines on Food Biotechnology and Food Allergy

Food biotechnology uses what is known about plant science and genetics to improve food and how it is produced. Through recent advancements in recombinant DNA, or gene transfer, scientists are able to produce tastier, more varied and more wholesome foods. According to FDA guidelines, any company enhancing food through biotechnology must evaluate the safety of the new food, including its potential to contain allergens. If unexpected allergens are found in the food, it must be properly labeled to alert individuals who may be sensitive to the specific allergen(s).<sup>36</sup> The International Food Biotechnology Council (IFBC), in collaboration with the International Life Sciences Institute's

(ILSI) Allergy and Immunology Institute, has developed a "decision tree" assessment process to help identify allergenic proteins in foods produced through biotechnology.<sup>37</sup> This decision tree was adapted by the Food and Agriculture Organization/ World Health Organization in 2001 to address more recent research related to the evaluation of allergenicity of novel proteins introduced into foods produced from biotechnology.<sup>38</sup> This process ensures that foods posing a potential risk to allergic individuals are properly labeled and offers a tool to reduce the levels of specific allergenic proteins in the food supply.



## Glossary of Food Allergy Terms

**Allergen** - Any substance that produces an allergic reaction.

**Allergy** - Any adverse reaction to an otherwise harmless substance that involves the body's immune system; also referred to as hypersensitivity.

**Anaphylaxis** - Severe systemic reaction to an allergen.

**Basophils** - Blood cells that release histamine or other substances causing allergic symptoms.

**Board-certified Allergist** - A physician who has completed a training program in allergy and immunology.

**Eczema** - Scaly skin rash characterized by small red and white bumps that itch; also called atopic dermatitis.

**ELISA** - Acronym for enzyme-linked immunosorbent assay, a blood test sometimes used to evaluate food allergy.

**Food hypersensitivity** - Another term for food allergy.

**Food idiosyncrasy** - Non-allergic reaction to food or food component that occurs through unknown mechanisms.

**Food intolerance or sensitivity** - General term for any adverse reaction to a food or food component that does not involve the body's immune system.

**Food poisoning** - Non-allergic reaction to food caused by consuming toxins in a food, such as histamine in certain species of spoiled fish.

**Immunoglobulin E (IgE)** - Antibody in the immune system that reacts with allergens.

**Mast cells** - Tissue cells that release histamine or other substances causing allergic symptoms.

**Metabolic food reaction** - Non-allergic reaction to food resulting from the inability to properly digest certain food components.

**Oral Allergy Syndrome** - A complexity of symptoms caused by IgE-mediated reactions that occur in the oropharyngeal mucosa (mouth and throat) when it comes in contact with an allergen. Symptoms include oral itching, lip swelling, labial angioedema, glottis edema and sometimes (rarely) anaphylactic reactions.

**RAST** - Acronym for radioallergosorbent test, a blood test sometimes used to evaluate food allergy.

**Urticaria** - Raised red bumps or welts that are itchy; also called hives.

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