



## Learning Outcomes

*After studying this In Depth, you should be able to:*

- 3.1 Identify the most common physiologic problem underlying food intolerances, including lactose intolerance.
- 3.2 Describe how an immune hypersensitivity to food proteins can produce the symptoms characteristic of an allergic reaction.
- 3.3 Compare and contrast the risk factors and health problems associated with celiac disease and nonceliac gluten sensitivity.

**You're at a snack bar on campus, trying to decide between two brands of energy bars.** You compare their lists of ingredients. One of the bars, although it contains no nuts, says, "Produced in a facility that processes peanuts." The other warns, "Contains wheat, milk, and soy." Why all the warnings? The reason is that, for some people, consuming these normally healthful food ingredients can provoke gastrointestinal distress, itching, nasal congestion, or other uncomfortable symptoms. For others, these ingredients can impair body functions and tissues so dramatically that consuming them—even in minute amounts—can be life-threatening.

Disorders related to specific foods can be clustered into three main groupings: food intolerances, food allergies, and two disorders specifically related to consumption of a protein called gluten. Many people confuse these disorders, and even physicians sometimes misdiagnose them. In this **In Depth** essay, we'll identify their significant differences and the potential impact of those differences on your health.

# What are food intolerances?

**LO 1** Identify the most common physiologic problem underlying food intolerances, including lactose intolerance.

A **food intolerance** <sup>Ⓟ</sup> is a cluster of GI symptoms (often gas, pain, and diarrhea) that occur following the consumption of a particular food. Commonly, intolerance results when the body does not produce enough of the enzymes it needs to break down certain food components before they reach the colon. A common example is **lactose intolerance** <sup>Ⓟ</sup>, in which the small intestine does not produce sufficient amounts of the enzyme lactase to digest the milk sugar *lactose*, which is present in milk and many other dairy products. Lactose intolerance should not be confused with a milk allergy. People who are allergic to milk experience an immune reaction to the proteins found in cow's milk, whereas the immune system plays no role in food intolerances. Symptoms of lactose intolerance include intestinal gas, bloating, cramping, nausea, diarrhea, and discomfort. These symptoms resolve spontaneously within a few hours—typically once the offending food has been eliminated from the GI tract.



For those who are lactose intolerant, milk products, such as ice cream, are difficult to digest.

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Many people who are lactose intolerant are able to tolerate multiple small servings of dairy products without symptoms.<sup>1</sup> They may also be able to digest aged cheese and yogurt with live and active cultures, because the molds or bacteria used in these products break down the lactose



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< Many people who are lactose intolerant are able to tolerate multiple small servings of dairy products without symptoms.<sup>1</sup> They may also be able to digest aged cheese and yogurt with live and active cultures, because the molds or bacteria used in these products break down the lactose during processing. Other people will experience symptoms after consuming even minute amounts of lactose. These individuals should avoid not only all dairy products but also hidden sources of lactose in processed foods. If any of the following ingredients appears on a food label, the product contains lactose: milk, lactose, whey, curds, milk by-products, dry milk solids, nonfat dry milk powder. >

People with lactose intolerance need to find foods that can supply enough calcium for normal growth, development, and maintenance of bones. Many can tolerate specially formulated milk products that are low in lactose, whereas others take pills or use drops that contain the lactase enzyme when they eat dairy products. Calcium-fortified soy milk is an excellent substitute for cow's milk.

How can you tell if you are lactose intolerant? Many people discover that they have problems digesting dairy products by trial and error. But because intestinal gas, bloating, and diarrhea may indicate other health problems, you should consult a physician to determine the cause. If you're diagnosed with lactose intolerance, a consultation with a registered dietitian may help in designing a diet that provides adequate nutrients.

# What are food allergies?

**LO 2** Describe how an immune hypersensitivity to food proteins can produce the symptoms characteristic of an allergic reaction.

A **food allergy** is a hypersensitivity reaction of the immune system to a particular component (usually a protein) in a food. This reaction causes the immune cells to release chemicals that cause inflammation. Wheat, soy, egg, and other proteins are technically referred to as *allergens* because they are capable of prompting an allergic reaction in susceptible people. What are the eight most common food allergens, and how can you recognize them? Check out the **Nutrition Label Activity** to learn more.

## Nutrition Label Activity

### Recognizing Common Allergens in Foods

Beginning on January 1, 2006, the U.S. Food and Drug Administration (FDA) required food labels to clearly identify any ingredients containing protein derived from the eight major allergenic foods.<sup>2</sup> Manufacturers were required to identify “in plain English” the presence of ingredients that contain protein derived from milk, eggs, fish, crustacean shellfish (crab, lobster, shrimp, and so on), tree nuts (almonds, pecans, walnuts, and so on), peanuts, wheat, or soybeans.

Although more than 160 foods have been identified as causing food allergies in sensitive individuals, the FDA requires labeling for only these eight foods because together they account for over 90% of all documented food allergies in the United States and represent the foods most likely to result in severe or life-threatening reactions.<sup>2</sup>

These eight allergenic foods must be indicated in the list of ingredients; alternatively, adjacent to the ingredients list, the label must say “Contains” followed by the name of the food. For example, the label of a product containing the milk-derived protein casein must use the term *milk* in addition to the term *casein*, so that those who have milk allergies can clearly understand the presence of an allergen they need to avoid.<sup>2</sup> Any food product found to contain an undeclared allergen is subject to recall by the FDA.

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Look at the ingredients list from an energy bar, listed below. How many of the FDA’s eight allergenic foods does this bar contain? If you were allergic to peanuts, would you eat this bar? Would you eat it if you were lactose intolerant? Explain your answers.

**Ingredients:** Soy protein isolate, rice flour, oats, milled flaxseed, brown rice syrup, evaporated cane juice, sunflower oil, soy lecithin, cocoa, nonfat milk solids, salt.

**Contains soy and dairy. May contain traces of peanuts and other nuts.**

Although food allergies are less common than food intolerances, they can be far more serious. Approximately 30,000 consumers require emergency department treatment and 150 Americans die each year because of allergic reactions to foods.<sup>2</sup> How can peanuts, milk, or other foods that most people consume regularly cause another person’s immune system to react so violently? In food allergies, even a trace amount of the offending protein can stimulate immune cells to release their inflammatory chemicals. In some people, the inflammation is localized, so the damage is limited. For instance, some people’s mouths and throats itch when they eat cantaloupe, whereas others develop a rash whenever they eat eggs. But in some people, the inflammation is widespread, affecting essentially all body systems. This response, called *anaphylaxis*, can cause a sudden drop in blood pressure, difficulty breathing, and even loss of consciousness. Anaphylaxis is life-threatening, so many people with known food allergies carry with them a kit (called an EpiPen®) containing an injection of a powerful stimulant called epinephrine. This drug can reduce symptoms long enough for the victim to get to emergency medical care.





For some people, eating a meal of grilled shrimp with peanut sauce would cause a severe allergic reaction.

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Physicians use a variety of tests to diagnose food allergies. Usually, the physician orders a skin test, commonly known as a “scratch test,” in which a small amount of fluid containing the suspected allergen is swabbed onto the patient’s skin, which is then lightly scratched. Redness and/or swelling indicates that the patient is allergic to the substance. Some physicians perform a blood test, in which a sample of the patient’s blood is tested for the presence of unique proteins, called *antibodies*, that the immune system produces in a person with an allergy.

< The simplest way to avoid an allergic reaction to a food component is to avoid consuming foods that contain it. This may sound easier than it is in practice, as allergenic proteins can be listed on food labels by several different names. This is why FDA labeling is so important. Dozens of foods are recalled annually not because they contain bacteria or other harmful microbes, but because they contain allergens such as milk or wheat proteins that have not been identified on the label. >

If mild signs and symptoms of a food allergy do occur, taking an over-the-counter antihistamine may help. For severe reactions, an injection of epinephrine and emergency treatment are essential. Researchers are studying the potential benefits and risks of introducing infants and children to minute amounts of allergenic foods (such as peanut butter) to prevent them from developing food allergies. However, this research is experimental at this time.

Beware of e-mail spam, Internet websites, and ads in popular magazines attempting to link a vast assortment of health problems to food allergies. Typically, these ads offer allergy-testing services for exorbitant fees, then make even more money by selling “nutritional counseling” and sometimes supplements and other products they say will help you cope with your allergies. If you suspect you might have a food allergy, consult an MD.

# Is celiac disease the same as gluten sensitivity?

LO 3 Compare and contrast the risk factors and health problems associated with celiac disease and nonceliac gluten sensitivity.

*Gluten* is a protein found in wheat, rye, and barley. Until recently, it was challenging for consumers to locate breads, breakfast cereals, pasta, and other grain foods that didn't contain gluten. But in the last decade, "gluten-free" has become a craze. Why?

## Celiac Disease Is an Inherited Immune Disease

Celiac disease<sup>①</sup>, also known as *celiac sprue*, is a disease that severely damages the lining of the small intestine and interferes with the absorption of nutrients.<sup>3</sup> As in food allergy, the body's immune system causes the disorder. There is a strong genetic predisposition to celiac disease, with the risk now linked to specific gene markers. Approximately 1 in every 141 Americans is thought to have celiac disease, but among those with a close family member with the disease, the rate is much higher.<sup>3</sup>

Nutri-case

LIZ



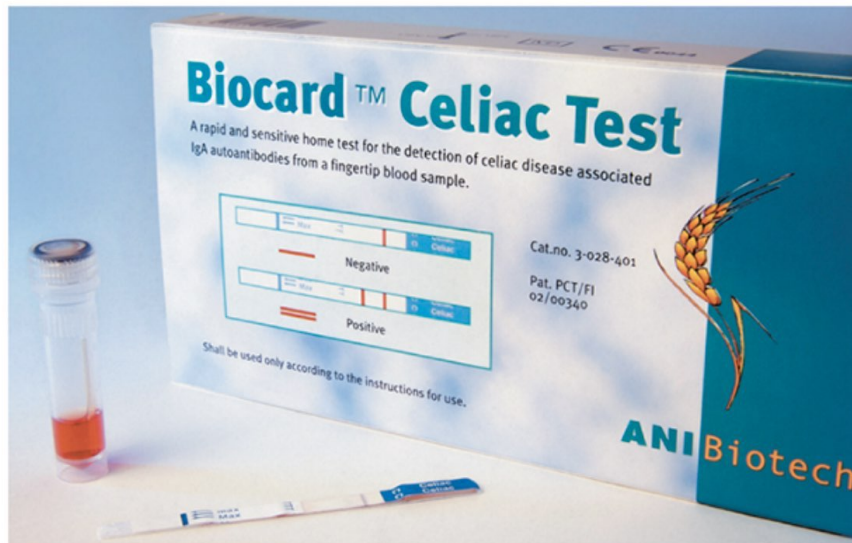


"I'm allergic to peanuts. I used to think of my allergy as no big deal, but about a year ago, I was having lunch in a restaurant when I started to itch and wheeze. I didn't realize that the dressing on the salad I was eating was made with peanut oil. Fortunately, I had my EpiPen® with me and was able to get to my doctor before things got out of control. For a long time after that, I didn't eat anything I hadn't prepared myself. I eat out again now, but always insist on talking with the chef first. Food shopping is hard, too, because I have to check every label. The worst, though, is eating at my friends' houses. I have to ask them if they have peanuts or peanut butter or oil in their house. Some of them are sympathetic, but others look at me like I'm a hypochondriac! I wish I could think of something to say to make them understand this isn't something I have any control over!"

What could Liz say in response to friends who don't understand the cause and seriousness of her food allergy? Do you think it would help Liz to share her fears with her doctor and to discuss possible strategies? If so, why? In addition to shopping, dining out, and eating at friends' houses, what other situations might require Liz to be cautious about her food choices, and sources?

Whereas many foods prompt food allergies, in celiac disease the offending food component is always *gliadin*, a fraction of the protein gluten. When people with celiac disease eat a food containing gluten, their immune system triggers an inflammatory response that erodes the villi of the small intestine. If the person is unaware of the disorder and continues to eat gluten, repeated immune reactions cause the villi to become greatly decreased, so that there is less absorptive surface area. In addition, the enzymes secreted at the brush border of the small intestine become reduced. As a result, the person becomes unable to absorb certain nutrients properly—a condition known as *malabsorption*. Over time, malabsorption can lead to malnutrition (poor nutrient status). Deficiencies of fat-soluble vitamins A, D, E, and K, as well as iron, folic acid, and calcium, are common in those suffering from celiac disease, as are inadequate intakes of protein and total energy.<sup>3</sup>

Symptoms of celiac disease often mimic those of other intestinal disturbances, such as irritable bowel syndrome, so the condition is often misdiagnosed. Some of the symptoms of celiac disease include fatty stools (due to poor fat absorption) with an odd odor; abdominal bloating and cramping; diarrhea, constipation, or vomiting; and weight loss. However, other puzzling symptoms do not appear to involve the GI tract. These include an intensely itchy rash called *dermatitis herpetiformis*, unexplained anemia, fatigue, osteoporosis (poor bone density), arthritis, infertility, seizures, anxiety, irritability, and depression, among others.<sup>3</sup>



A simple blood test can identify celiac disease.

Diagnostic tests for celiac disease include a variety of blood tests that screen for the presence of antigliadin antibodies or for the genetic markers of the disease. Definitive diagnosis requires a biopsy of the small intestine showing atrophy of the villi. Because long-term complications of undiagnosed celiac disease include an increased risk for intestinal cancer, early diagnosis can be life-saving.

Currently, there is no cure for celiac disease. Treatment is with a special diet that excludes all forms of wheat, rye, and barley. Oats are allowed, as long as they are not contaminated with wheat flour from processing, as even a microscopic amount of wheat can cause an immune response. Although many gluten-free foods are now available, and the FDA now regulates the labeling of such foods, a gluten-free diet is challenging and nutritional counseling is essential.

Someday, gluten-free foods may be unnecessary. Earlier, we discussed the beneficial functions of certain types of bacteria in the GI tract. Now, researchers have discovered that beneficial mouth

Someday, gluten-free foods may be unnecessary. Earlier, we discussed the beneficial functions of certain types of bacteria in the GI tract. Now, researchers have discovered that beneficial mouth bacteria are able to degrade gluten.<sup>3,4</sup> Thus, researchers are looking into the potential of developing probiotic breads and other gluten-containing foods that would be safe for people with celiac disease to consume.

## Nonceliac Gluten Sensitivity Is the Subject of Research

Recent surveys suggest that as many as 100 million Americans consume at least some foods specifically formulated to be gluten-free.<sup>5</sup> Many of these Americans consume gluten-free products believing that they're more healthful, or will help them lose weight. These claims are largely unfounded. However, there is "undisputable and increasing evidence" for a disorder that is related to gluten consumption but is not celiac disease.<sup>5</sup> This is called *nonceliac gluten sensitivity* (NCGS). Signs and symptoms of the disorder can vary greatly, from abdominal bloating and diarrhea to bone and joint pain to depression and confusion; however, the common factor is that patients improve on a gluten-free diet.<sup>6,7</sup> Research into the factors contributing to NCGS is ongoing. In the meantime, if you believe that you might be "gluten sensitive," don't stop eating gluten-containing foods without consulting your doctor to determine whether or not you have celiac disease. That's because antibody tests for celiac disease are not sensitive in people who aren't currently consuming gluten.

# Web Links

[www.medlineplus.gov](http://www.medlineplus.gov)

MEDLINE Plus Health Information

*Search for “food allergies” to obtain additional resources as well as the latest news about food allergies.*

[www.foodallergy.org](http://www.foodallergy.org)

The Food Allergy and Anaphylaxis Network

*Visit this site to learn more about common food allergens.*

[www.csaceliacs.org](http://www.csaceliacs.org)

Celiac Sprue Association—National Celiac Disease Support Group

*Get information on the Celiac Sprue Association, a national educational organization that provides information and referral services for persons with celiac disease.*