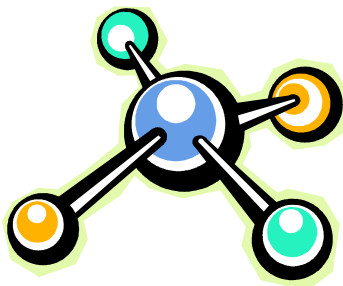


The Biochemical Study of Celiac Disease



Tabitha Julien
Columbia-Presbyterian Hospital
Dr. Sanil Manavalan
Harlem Childrens Society
Dr. Sat Battacharya

Tabitha Julien

Columbia University

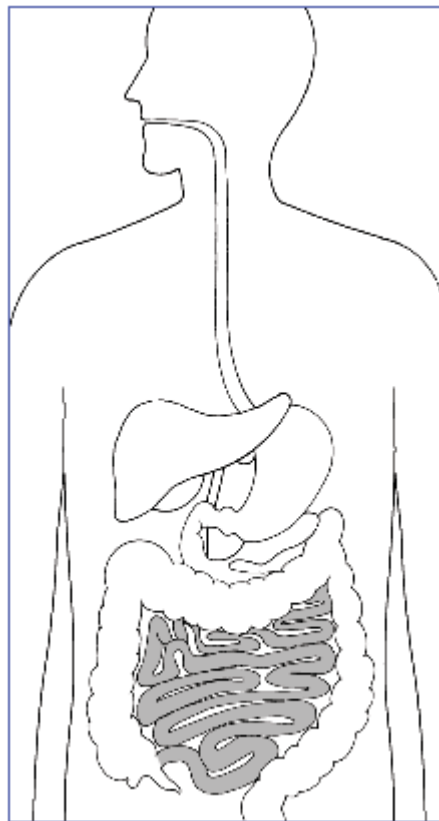
Dr. Manavalan

Freeport High School

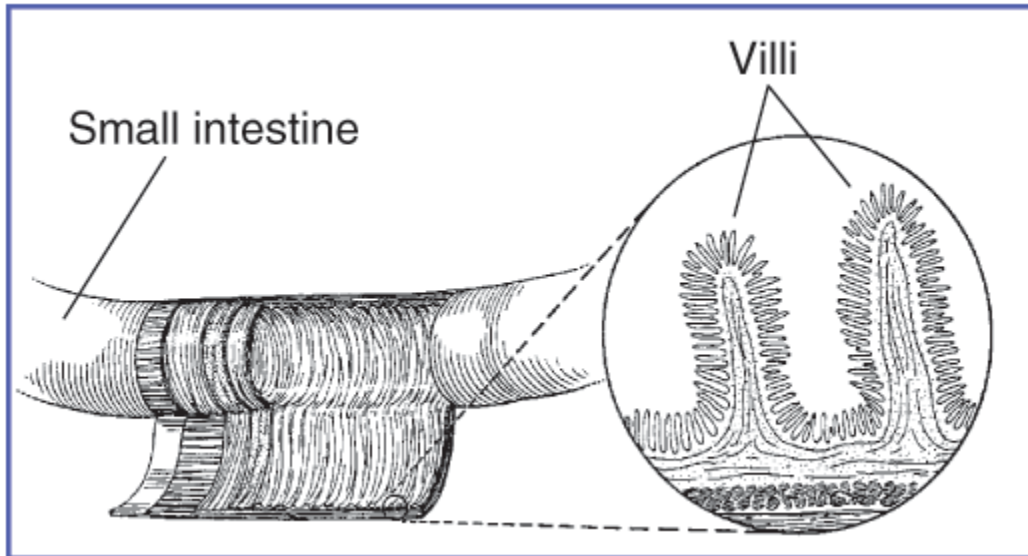
Celiac Disease

What is celiac disease?

Celiac disease is a digestive disease that damages the small intestine and interferes with absorption of nutrients from food. People who have celiac disease cannot tolerate a protein called gluten, found in wheat, rye, and barley. Gluten is found mainly in foods, but is also found in products we use every day and even some medicines.



Intestine



Villi on the lining of the small intestine help absorb nutrients.

When people with celiac disease eat foods or use products containing gluten, their immune system responds by damaging the small intestine. The tiny, fingerlike protrusions lining the small intestine are damaged or destroyed. Called villi, they normally allow nutrients from food to be absorbed into the bloodstream. Without healthy villi, a person becomes malnourished, regardless of the quantity of food eaten.

Because the body's own immune system causes the damage, celiac disease is considered an autoimmune disorder. However, it is also classified as a disease of malabsorption because nutrients are not absorbed. Celiac disease is also known as celiac sprue, nontropical sprue, and gluten-sensitive enteropathy.

Celiac disease is a genetic disease, meaning it runs in families. Sometimes the disease is triggered-or becomes active for the first time-after surgery, pregnancy, childbirth, viral infection, or severe emotional stress.

What are the symptoms of celiac disease?

Celiac disease affects people differently. Symptoms may occur in the digestive system, or in other parts of the body. For example, one person might have diarrhea and abdominal pain, while another person may be irritable or depressed. In fact, irritability is one of the most common symptoms in children.

Symptoms of celiac disease may include one or more of the following:

- gas
- recurring abdominal bloating and pain
- chronic diarrhea

- pale, foul-smelling, or fatty stool
- weight loss / weight gain
- fatigue
- unexplained anemia (a low count of red blood cells causing fatigue)
- bone or joint pain
- osteoporosis, osteopenia
- behavioral changes
- tingling numbness in the legs (from nerve damage)
- muscle cramps
- seizures
- missed menstrual periods (often because of excessive weight loss)
- infertility, recurrent miscarriage
- delayed growth
- failure to thrive in infants
- pale sores inside the mouth, called aphthous ulcers
- tooth discoloration or loss of enamel
- itchy skin rash called dermatitis herpetiformis

A person with celiac disease may have no symptoms. People without symptoms are still at risk for the complications of celiac disease, including malnutrition. The longer a person goes undiagnosed and untreated, the greater the chance of developing malnutrition and other complications. Anemia, delayed growth, and weight loss are signs of malnutrition: The body is just not getting enough nutrients. Malnutrition is a serious problem for children because they need adequate nutrition to develop properly.

Why are celiac symptoms so varied?

Researchers are studying the reasons celiac disease affects people differently. Some people develop symptoms as children, others as adults. Some people with celiac disease may not have symptoms or may be unaware of symptoms. The undamaged part of their small intestine may not be able to absorb enough nutrients to prevent symptoms.

The length of time a person is breastfed, the age a person started eating gluten-containing foods, and the amount of gluten containing foods one eats are three factors thought to play a role in when and how celiac appears. Some studies have shown, for example, that the longer a person was breastfed, the later the symptoms of celiac disease appear and the more uncommon the symptoms.

How is celiac disease diagnosed?

Recognizing celiac disease can be difficult because some of its symptoms are similar to those of other diseases. In fact, sometimes celiac disease is confused with irritable bowel syndrome, iron-deficiency anemia caused by menstrual blood loss, Crohn's disease, diverticulitis, intestinal infections, and chronic fatigue

syndrome. As a result, celiac disease is commonly under diagnosed or misdiagnosed.

Recently, researchers discovered that people with celiac disease have higher than normal levels of certain autoantibodies in their blood. Antibodies are protective proteins produced by the immune system in response to substances that the body perceives to be threatening. Autoantibodies are proteins that react against the body's own molecules or tissues. To diagnose celiac disease, physicians will usually test blood to measure levels of Immunoglobulin A (IgA) anti-tissue transglutaminase (tTGA) or IgA anti-endomysium antibodies (AEA).

Before being tested, one should continue to eat a regular diet that includes foods with gluten, such as breads and pastas. If a person stops eating foods with gluten before being tested, the results may be negative for celiac disease even if celiac disease is actually present.

If the tests and symptoms suggest celiac disease, the doctor will perform a small bowel biopsy. During the biopsy, the doctor removes a tiny piece of tissue from the small intestine to check for damage to the villi. To obtain the tissue sample, the doctor eases a long, thin tube called an endoscope through the mouth and stomach into the small intestine. Using instruments passed through the endoscope, the doctor then takes the sample.

Screening

Screening for celiac disease involves testing for the presence of antibodies in the blood in people without symptoms. Americans are not routinely screened for celiac disease. Testing for celiac-related antibodies in children less than 5 years old may not be reliable. However, since celiac disease is hereditary, family members, particularly first-degree relatives-meaning parents, siblings, or children of people who have been diagnosed-may wish to be tested for the disease. About 5 to 15 percent of an affected person's first-degree relatives will also have the disease. About 3 to 8 percent of people with type 1 diabetes will have biopsy-confirmed celiac disease and 5 to 10 percent of people with Down syndrome will be diagnosed with celiac disease.

The Web contains information about celiac disease, some of which is not accurate. The best people for advice about diagnosing and treating celiac disease are one's doctor and dietitian.

What is the treatment?

The only treatment for celiac disease is to follow a gluten-free diet. When a person is first diagnosed with celiac disease, the doctor usually will ask the person to work with a dietitian on a gluten-free diet plan. A dietitian is a health care professional who specializes in food and nutrition. Someone with celiac

disease can learn from a dietitian how to read ingredient lists and identify foods that contain gluten in order to make informed decisions at the grocery store and when eating out.

For most people, following this diet will stop symptoms, heal existing intestinal damage, and prevent further damage. Improvements begin within days of starting the diet. The small intestine is usually completely healed in 3 to 6 months in children and younger adults and within 2 years for older adults. Completely healed means a person now has villi that can absorb nutrients from food into the bloodstream.

In order to stay well, people with celiac disease must avoid gluten for the rest of their lives. Eating any gluten, no matter how small an amount, can damage the small intestine. The damage will occur in anyone with the disease, including people without noticeable symptoms. Depending on a person's age at diagnosis, some problems will not improve, such as delayed growth and tooth discoloration.

Some people with celiac disease show no improvement on the gluten-free diet. The condition is called unresponsive celiac disease. The most common reason for poor response is that small amounts of gluten are still present in the diet. Advice from a dietitian who is skilled in educating patients about the gluten-free diet is essential to achieve best results.

Rarely, the intestinal injury will continue despite a strictly gluten-free diet. People in this situation have severely damaged intestines that cannot heal. Because their intestines are not absorbing enough nutrients, they may need to directly receive nutrients into their bloodstream through a vein (intravenously). People with this condition may need to be evaluated for complications of the disease. Researchers are now evaluating drug treatments for unresponsive celiac disease.

The Gluten-Free Diet

A gluten-free diet means not eating foods that contain wheat (including spelt, triticale, and kamut), rye, and barley. The foods and products made from these grains are also disallowed. In other words, a person with celiac disease should not eat most grain, pasta, cereal, and many processed foods. Despite these restrictions, people with celiac disease can eat a well balanced diet with a variety of foods, including gluten-free bread and pasta. For example, people with celiac disease can use potato, rice, soy, amaranth, quinoa, buckwheat, or bean flour instead of wheat flour. They can buy gluten-free bread, pasta, and other products from stores that carry organic foods, or order products from special food companies. Gluten-free products are increasingly available from regular stores.

Checking labels for "gluten free" is important since many corn and rice products are produced in factories that also manufacture wheat products. Hidden sources

of gluten include additives such as modified food starch, preservatives, and stabilizers. Wheat and wheat products are often used as thickeners, stabilizers, and texture enhancers in foods.

"Plain" meat, fish, rice, fruits, and vegetables do not contain gluten, so people with celiac disease can eat as much of these foods as they like. Recommending that people with celiac disease avoid oats is controversial because some people have been able to eat oats without having symptoms. Scientists are currently studying whether people with celiac disease can tolerate oats. Until the studies are complete, people with celiac disease should follow their physician's or dietitian's advice about eating oats. Examples of foods that are safe to eat and those that are not are provided in the table on pages 4-5.

The gluten-free diet is complicated. It requires a completely new approach to eating that affects a person's entire life. Newly diagnosed people and their families may find support groups to be particularly helpful as they learn to adjust to a new way of life. People with celiac disease have to be extremely careful about what they buy for lunch at school or work, what they purchase at the grocery store, what they eat at restaurants or parties, or what they grab for a snack. Eating out can be a challenge. If a person with celiac disease is in doubt about a menu item, asking the waiter or chef about ingredients is a good idea.

Gluten is also used in some medications. One should check with the pharmacist to learn whether medications used contain gluten. Reading all labels is important since gluten is also sometimes used as an additive in surprising products. If the ingredients are not listed on the product label, the manufacturer of the product should provide the list upon request. With practice, screening for gluten becomes second nature.

The Gluten-Free Diet: Some Examples

Following are examples of foods that are allowed and those that should be avoided when eating a gluten-free diet. This list is not complete, so people with celiac disease should discuss gluten-free food choices with a dietitian or physician who specializes in celiac disease. People with celiac disease should always read food ingredient lists carefully to make sure that the food does not contain gluten.

Food Categories	Foods Recommended	Foods To Omit	Tips
Breads, cereals, rice, and pasta: 6 to 8 servings each day			
Serving size = 1 slice bread, 1 cup ready-to-	• Bread made from corn, rice, soy, arrowroot corn, or	• Breads or baked products containing wheat,	• Use corn, rice, soy, arrowroot, tapioca, quinoa,

eat cereal, ½ cup cooked cereal, rice, or pasta; ½ bun, bagel, or English muffin, 1 or 2 crackers or pretzels	potato starch; pea, potato, or whole-bean flour; or tapioca, sago, rice bran, cornmeal, buckwheat, millet, flax, teff, sorghum, amaranth, quinoa <ul style="list-style-type: none"> • Hot cereals made from soy, hominy, hominy grits, brown rice, white rice, buckwheat groats, millet, cornmeal, quinoa flakes • Puffed corn, rice, or millet, other rice and corn made with allowed ingredients • Rice, rice noodles, pastas made from allowed ingredients • Some rice crackers and cakes, popped corn cakes made from allowed ingredients 	rye, triticale, barley, oats, wheat germ, bran; graham, gluten, or durum flour; wheat starch, oat bran, bulgur, farina, wheat-based semolina, spelt, kamut <ul style="list-style-type: none"> • Cereals made from wheat, rye, triticale, barley, and oats; or made with malt extract, malt flavorings added • Pastas made from ingredients above • Most crackers 	amaranth, buckwheat, and potato flours or a mixture of them instead of wheat flours in recipes. <ul style="list-style-type: none"> • Experiment with gluten-free products. • Look for gluten-free products at the supermarket, health food store, or directly from the manufacturer.
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Food Categories	Foods Recommended	Foods To Omit	Tips
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Vegetables: 6 to 8 servings each day (includes starchy vegetables)

Serving size = 1 cup raw leafy, ½ cup cooked or chopped, ¾ cup juice	<ul style="list-style-type: none"> • All plain, fresh, frozen, or canned vegetables made with allowed ingredients 	<ul style="list-style-type: none"> • Any creamed or breaded vegetables (unless allowed ingredients are used), and canned baked beans • Some french fries 	<ul style="list-style-type: none"> • Buy plain, frozen, or canned vegetables seasoned with herbs, spices, or sauces made with allowed ingredients.
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Food Categories	Foods Recommended	Foods To Omit	Tips
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Fruits: 1 ½ to 2 cups each day			
Serving size = 1 medium size, ½ cup canned, ¾ cup juice, ¼ cup dried	<ul style="list-style-type: none"> • All fruits and fruit juices 	<ul style="list-style-type: none"> • Some commercial fruit pie fillings, dried fruit 	
Food Categories	Foods Recommended	Foods To Omit	Tips
Milk, yogurt, and cheese: 2 to 3 servings each day			
Serving size = 1 cup milk or yogurt, 1 ½ oz natural cheese, 2 oz processed cheese	<ul style="list-style-type: none"> • All milk and milk products except those made with gluten additives • Aged cheese 	<ul style="list-style-type: none"> • Malted milk • Some milk drinks, flavored or frozen yogurt 	<ul style="list-style-type: none"> • Contact the food manufacturer for product information if the ingredients are not listed on the label.
Food Categories	Foods Recommended	Foods To Omit	Tips
Meats, poultry, fish, dry beans and peas, eggs, and nuts: 2 to 3 servings or total of 6 oz daily			
Serving size = 2 to 3 oz cooked; count 1 egg, ½ cup cooked beans, 2 Tbsp peanut butter, or ¼ cup nuts as 1 oz of meat	<ul style="list-style-type: none"> • All meat, poultry, fish, and shellfish; eggs • Dry peas and beans, nuts, peanut butter, soybeans • Cold cuts, frankfurters, or sausage without fillers 	<ul style="list-style-type: none"> • Any prepared with wheat, rye, oats, barley, gluten stabilizers, or fillers including some frankfurters, cold cuts, sandwich spreads, sausages, and canned meats • Self-basting turkey • Some egg substitutes 	When dining out, select meat, poultry, or fish made without breading, gravies, or sauces.
Food Categories	Foods Recommended	Foods To Omit	Tips
Fats, snacks, sweets, condiments, and beverages			
	<ul style="list-style-type: none"> • Butter, margarine, 	<ul style="list-style-type: none"> • Commercial 	<ul style="list-style-type: none"> • Store all gluten-

	salad dressings, sauces, soups, desserts made with allowed ingredients <ul style="list-style-type: none"> • Sugar, honey, jelly, jam, hard candy, plain chocolate, coconut, molasses, marshmallows, meringues • Pure instant or ground coffee, tea, carbonated drinks, wine (made in United States), rum, alcohol distilled from cereals such as gin, vodka, whiskey • Most seasonings and flavorings, including soy sauce 	salad dressings, prepared soups, condiments, sauces, seasonings prepared with ingredients listed above <ul style="list-style-type: none"> • Hot cocoa mixes, nondairy cream substitutes, flavored instant coffee, herbal tea • Beer, ale, malted beverages • Licorice • Cereal 	free products in your refrigerator or freezer because they do not contain preservatives. <ul style="list-style-type: none"> • Avoid sauces, gravies, canned fish, products with hydrolyzed vegetable protein or hydrolyzed plant protein (HVP/HPP) made from wheat protein, and anything with questionable ingredients.
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2001, the American Dietetic Association. "Patient Education Materials: Supplement to the Manual of Clinical .

What are the complications of celiac disease?

Damage to the small intestine and the resulting nutrient absorption problems put a person with celiac disease at risk for malnutrition and anemia as well as several diseases and health problems.

- **Lymphoma and adenocarcinoma** are cancers that can develop in the intestine.
- **Osteoporosis** is a condition in which the bones become weak, brittle, and prone to breaking. Poor calcium absorption contributes to osteoporosis.
- **Miscarriage and congenital malformation** of the baby, such as neural tube defects, are risks for pregnant women with untreated celiac disease because of nutrient absorption problems.
- **Short stature** refers to being significantly under-the-average height. Short stature results when childhood celiac disease prevents nutrient absorption during the years when nutrition is critical to a child's normal growth and development. Children who are diagnosed and treated before their growth stops may have a catch-up period.
- **Seizures**, or convulsions, are uncontrollable contractions of the muscles that can result if the body cannot absorb enough folic acid from foods

eaten. A lack of folic acid causes calcium deposits, called calcifications, to form in the brain, which in turn cause seizures.

How common is celiac disease?

Data on the prevalence of celiac disease is spotty. In Italy, about 1 in 250 people and in Ireland about 1 in 300 people have celiac disease. Recent studies have shown that it may be more common in Africa, South America, and Asia than previously believed.

Until recently, celiac disease was thought to be uncommon in the United States. However, studies have shown that celiac disease is very common. Recent findings estimate about 2 million people in the United States have celiac disease, or about 1 in 133 people. Among people who have a first-degree relative diagnosed with celiac disease, as many as 1 in 22 people may have the disease.

Celiac disease could be under diagnosed in the United States for a number of reasons including:

- Celiac symptoms can be attributed to other problems.
- Many doctors are not knowledgeable about the disease.
- Only a small number of U.S. laboratories are experienced and skilled in testing for celiac disease.

More research is needed to learn the true prevalence of celiac disease among Americans.

Points to Remember

- People with celiac disease cannot tolerate gluten, a protein in wheat, rye, barley, and possibly oats.
- Celiac disease damages the small intestine and interferes with nutrient absorption.
- Without treatment, people with celiac disease can develop complications like cancer, osteoporosis, anemia, and seizures.
- A person with celiac disease may or may not have symptoms.
- Diagnosis involves blood tests and a biopsy of the small intestine.
- Since celiac disease is hereditary, family members of a person with celiac disease may wish to be tested.
- Celiac disease is treated by eliminating all gluten from the diet. The gluten-free diet is a lifetime requirement.
- A dietitian can teach a person with celiac disease food selection, label reading, and other strategies to help manage the disease.

Diseases Linked to Celiac Disease

People with celiac disease tend to have other autoimmune diseases. The connection between celiac disease and these diseases may be genetic. These diseases include:

- dermatitis herpetiformis
- thyroid disease
- systemic lupus erythematosus
- type 1 diabetes
- liver disease
- collagen vascular disease
- rheumatoid arthritis
- Sjogren's syndrome

Dermatitis Herpetiformis

Dermatitis herpetiformis (DH) is a severe itchy, blistering skin condition found in people with celiac disease. The rash usually occurs on the elbows, knees, and buttocks. Unlike other forms of celiac disease, the range of intestinal abnormalities in DH is highly variable, from minimal to severe. Only about 20 percent of people with DH have intestinal symptoms of celiac disease.

To diagnose DH, the doctor will test the person's blood for auto antibodies related to celiac disease and will biopsy the person's skin. If the antibody tests are positive and the skin biopsy has the typical findings of DH, patients do not need to have an intestinal biopsy. Both the skin disease and the intestinal disease respond to gluten-free diet and recur if gluten is added back into diet. In addition, the rash symptoms can be controlled with medications such as dapsone (4',4'diamino-diphenylsufone). However, dapsone does not treat the intestinal condition and people with DH should also maintain a gluten-free diet.

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ELISA

This is a method that we used in the lab for one of the experiments that we did.

Definition

A rapid test where an antibody or antigen is linked to an enzyme as a means of detecting a match between the antibody and antigen.

This versatile test is widely used in the medical laboratory. It allows your health care provider to:

- test your blood with an antigen (e.g., virus or bacteria) to see if your immune system recognizes it as something it has seen before, or
- test your blood with an antibody to see if a particular substance like a hormone (an antigen) is present in your system.

How the test is performed?

Blood is drawn from a vein, usually from the inside of the elbow or the back of the hand. The puncture site is cleaned with antiseptic, and an elastic band is placed around the upper arm to cause the vein to swell with blood.

A needle is inserted into the vein, and the blood is collected in air-tight vials or a syringe. During the procedure, the band is removed to restore circulation. Once the blood has been collected, the needle is removed, and the puncture site is covered to stop any bleeding.

The sample is then taken to the laboratory where it is tested for the target antibody or antigen. If the target substance is present in the sample, the test solution has an intense color reaction generated by the attached enzyme indicating a positive test result.

How to prepare for the test?

If your child is to have this test performed, it may be helpful to explain how the test will feel, and even practice or demonstrate on a doll. The more familiar your child is with what will happen, and why, the less anxiety he or she will feel.

How the test will feel?

When the needle is inserted to draw blood, some people feel moderate pain, while others feel only a prick or stinging sensation. Afterward, there may be some throbbing.

This is a preliminary screening tool used to detect either the presence of antigen or antibody in your blood. It is frequently used to screen for present or past infections.

Normal Values

Normal values depend on the type of substance your health care provider is screening for. In some people, a positive result may be normal.

What abnormal results mean

Abnormal values depend on the type of substance your health care provider is screening for. In some people, a positive result may be normal.

Risks associated with venipuncture are slight:

- excessive bleeding
- fainting or feeling light-headed
- hematoma (blood accumulating under the skin)
- infection (a slight risk any time the skin is broken)
- multiple punctures to
- locate veins

Special considerations

Veins and arteries vary in size from one patient to another and from one side of the body to the other. Obtaining a blood sample from some people may be more difficult than from others.

Tourniquet is applied
and area is disinfected



Needle is introduced
into vein, blood is drawn
into vial and analyzed



ADAM.

