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Celiac Disease: What Gluten-Free Means Today

Tricia Thompson

The only treatment for celiac disease is a gluten-free diet. This diet is free of all but very small amounts of gluten. In 2007 the Food and Drug Administration released a proposed rule for the labeling of gluten-free food. Among other criteria that must be met, food labeled gluten-free must contain less than 20 parts per million of gluten. This labeling rule is scheduled to be finalized sometime in 2012. The gluten-free diet is made up of both labeled and unlabeled gluten-free foods. If a food is not labeled gluten-free, consumers must look for the ingredients wheat, barley, rye, malt, oats, and brewer's yeast. If the food is a meat, poultry, or egg product, consumers also should look for the ingredients modified food starch, dextrin, and starch. While the gluten-free diet may be challenging at first, the learning curve is steep. It is essential that patients receive up-to-date timely and on-going counseling from a registered dietitian proficient in celiac disease and the gluten-free diet.

INTRODUCTION

Currently, the *only* treatment for celiac disease (CD) is a gluten-free diet (GFD). "Gluten" is used to describe specific amino acid sequences found in wheat, barley, and rye that must not be eaten by individuals with CD. When this protein is eaten by susceptible individuals it triggers an immune response that damages the mucosa of the small intestine.

Learning to follow a GFD can be a daunting task for many individuals with CD. It is very important that patients are referred to a dietitian very familiar with this disease as well as the GFD as soon as possible after diagnosis (*before they get misinformation on the internet*).

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"Gluten-Free" Defined

In 2007, the Food and Drug Administration (FDA) released a proposed rule for gluten-free labeling of foods (1). The rule is tentatively scheduled to be finalized in 2012 (2). In the proposed rule a food labeled GF:

- Will not contain an ingredient that is a prohibited grain. Prohibited grains include, barley; wheat (all varieties, such as durum wheat, einkorn wheat, emmer wheat, kamut, spelt wheat); rye; and triticale (a cross between wheat and rye).

- Will not contain an ingredient that is derived from a prohibited grain and that has not been processed to remove gluten. Ingredients derived from a prohibited grain that have not been processed to remove gluten and therefore can

not be included in a food labeled GF include, hydrolyzed wheat protein; wheat germ; wheat bran; barley malt extract or flavoring; malt vinegar; and flours made from prohibited grains.

- Can contain an ingredient derived from a prohibited grain that has been processed to remove gluten ONLY if the final food product contains less than 20 parts per million (ppm) of gluten. Ingredients derived from a prohibited grain that have been processed to remove gluten and can be included in a food labeled GF depending upon gluten content include, wheat starch; modified food starch from wheat; and wheat starch hydrolysates (e.g., dextrin).

- Must contain less than 20 ppm gluten. This threshold level applies to gluten that may be in a food intentionally as part of an ingredient (e.g., wheat starch) or unintentionally through cross contamination with wheat, barley, or rye (e.g., contaminated millet grain).

In addition, the FDA is proposing that single ingredient inherently GF foods, such as plain, unflavored milk can not be labeled GF unless the labeling statement makes clear that all foods of that type are GF, such as "all milk is GF" or "milk, a GF food."

"Gluten-Free Diet" Defined

The GFD as prescribed in the United States is devoid of all but tiny amounts of gluten (< 20 ppm gluten for food labeled GF). However, a GFD is not limited to foods labeled GF. This diet may be comprised of many different categories of foods (Table 1).

Label Reading for Foods NOT Labeled Gluten-Free

Because gluten is found in wheat, barley, and rye, a GFD primarily impacts food consumption from the grain food group. However, gluten derived ingredients may be found in almost any processed food. As a result, GF consumers must become proficient at reading food labels.

Ingredients to Look for on a Food Label

When a food is NOT labeled GF consumers must look for the following words in the ingredients list and, in the case of wheat, the Contains statement:

- "Wheat" Under the Food Allergen Labeling and Consumer Protection Act, if an ingredient in a packaged food product regulated by the FDA contains protein from wheat the word "wheat" must be included on the food label either in the ingredients list or Contains statement (6).

- "Barley"

- "Rye"

- "Malt" The single word "malt" in the ingredients list means "barley malt" (7).

- "Oats" Oats not labeled GF should not be eaten (4).

- "Brewer's yeast" Brewer's yeast may be made from spent brewer's yeast, which is a by-product of beer brewing (8). As a result it may be contaminated with malt and grain (9).

USDA-Regulated Foods Only

Unlike the FDA, the United States Department of Agriculture (USDA) does not have mandatory allergen labeling of food products. They do however encourage manufacturers to voluntarily list allergens on food labels (10). The USDA believes they have 80 to 90% voluntary compliance with Food Allergen Labeling and Consumer Protection Act-like allergen labeling (10). The USDA regulates meat products, poultry products, egg products, and mixed food products containing in general 3 percent raw meat or 2 percent or more cooked meat or poultry. If a food product is regulated by the USDA it will contain either the egg products shield (Figure 1) or the mark of inspection (Figure 2).

If a manufacturer of a USDA-regulated food is not voluntarily listing allergens either in the ingredients list or Contains statement, there are certain ingredients that may contain wheat protein and this might not be stated on the label. These ingredients include:

- "Modified food starch" This ingredient may be modified wheat starch.

- "Dextrin" This ingredient may be derived from wheat.

Table 1: Categories of Food Allowed on a Gluten-Free Diet

Category	Foods
Single ingredient naturally GF foods	PLAIN meat, poultry, fish, fresh eggs, plain milk, fresh and plain frozen fruits and vegetables, and plain nuts, seeds, and beans.
Single ingredient inherently GF grains	Corn, rice, amaranth, buckwheat, quinoa, millet, teff, sorghum, and wild rice. While these grains and pseudocereals are inherently GF they may be cross-contaminated with wheat, barley, or rye (3). As a result it is recommended that consumers purchase those products that are labeled GF whenever possible (4).
Oats and products made with oats	It is well established that "regular" oats are likely contaminated with gluten (5). As a result only labeled GF oats should be eaten (4).
Processed foods labeled GF	Bread, breakfast cereal, pasta, baking mixes, sweet and savory snack foods, etc. These foods have been determined to be GF by the manufacturer
Processed foods NOT labeled GF that do not include any gluten-containing ingredients	Many multi-ingredient foods may fall into this category including ice cream, yogurt, condiments, etc.
Processed foods NOT labeled GF comprised primarily of inherently GF grains	Corn tortillas, rice crackers, rice noodles, corn and rice-based cereals, etc. Because of the risk that the inherently GF grains and flours used in these products may be contaminated with gluten, it is recommended that labeled GF varieties of these foods be purchased whenever possible (4).

Figure 1: USDA Egg Products Shield

Figure 2: USDA Mark of Inspection

- "Starch" The ingredient "starch" in a USDA-regulated food may be derived from either corn or wheat (11). In FDA-regulated foods the ingredient "starch" is always derived from corn (12).

If consumers come across any of these ingredients on the label of a USDA-regulated food product and they have any questions about the source, they should contact the manufacturer. If consumers come across any of these ingredients on the label of an FDA-regulated food and the ingredients list or Contains statement does NOT include the word "wheat" then the modified food starch, dextrin, and starch do not include wheat protein.

Oats and the Gluten-Free Diet

Under the FDA's proposed definition of GF, oats are allowed to be labeled GF as long as the final food product contains less than 20 ppm gluten (1). The Academy of Nutrition and Dietetics' Celiac Disease Evidence-Based Nutrition Practice Guideline states the following about oats:

Inclusion of Gluten-Free Oats as Tolerated

The RD should advise individuals with CD who enjoy and can tolerate GF oats to gradually include them in their GF dietary pattern. Research on individuals with CD reports that, incorporating oats uncontaminated with wheat, barley, or rye at intake levels of approximately 50 g dry oats per day is generally safe, and improves compliance with the GF dietary pattern (13). Note: 50 g of dry oats is approximately equal to ½ cup dry rolled oats or ¼ cup dry steel cut oats.

Oats are documented to be contaminated with wheat, barley, or rye (Table 2) (5). As a consequence the Academy of Nutrition and Dietetics' Toolkit recommends that individuals with CD eat only those oats and oat products labeled GF (4).

A small minority of individuals with CD also appear to have an immune response to oat *avenin* (14). As a result, the Academy of Nutrition and Dietetics'

Table 2: Gluten Contamination of Commercial Oat Products in the US Not Labeled Gluten-Free

Brand (4 lot numbers tested in duplicate)	Mean Gluten Content (ppm) Lot
McCann's Steel Cut Irish Oats	< 3, 12, 23, 725
Country Choice Organic Oats	< 3, 120, 131, 210
Quaker Old Fashioned Oats	338, 364, 971, 1807

Source: Thompson T. Gluten contamination of commercial oat products in the United States. N Engl J Med. 2004;351:2021-2022.

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Toolkit recommends that patients get the okay from their dietitian or doctor before adding GF oats to their diet and to stop eating oats and contact their health care provider if they experience any gastrointestinal symptoms after adding oats to their diet (4). However, it is important that patients know that their symptoms may be related to increased fiber intake.

Wheat Starch and the Gluten-Free Diet

Under the FDA's proposed definition of GF, wheat starch is considered an ingredient that has been processed to remove gluten (1). As such, it may be included in a labeled GF food as long as the final food product contains less than 20 ppm gluten. Because wheat starch contains varying amounts of gluten depending upon processing, individuals with CD should not eat products containing wheat starch unless they are labeled GF.

Wheat starch is not generally included in foods labeled GF in the United States, but it has been used in parts of Europe for many years. The Academy of Nutrition and Dietetics' Celiac Disease Evidence Analysis Project states the following about wheat starch, "Studies have shown that both natural and wheat starch-based GF diets produce similar histological and clinical recovery in people with CD (15)." Regardless, wheat starch may be a tough sell for individuals with CD in the U.S.

Cross Contamination of Gluten-Free Grains and Flours

While it is well established that oats are frequently contaminated with wheat, barley, and rye, less is known about the cross contamination risk of other inherently GF grains, such as corn, rice, millet, sorghum, teff, wild rice, buckwheat, amaranth, and quinoa. In 2010 a pilot study was published that assessed the gluten levels of single ingredient naturally GF grains, seeds, and flours NOT labeled GF (3). Of the twenty-two products tested, seven (32%) tested above 20 ppm gluten (Table 3).

Labeled GF varieties of the flours found to be contaminated with greater than 20 ppm gluten in the above mentioned study (3) have been tested by Gluten Free Watchdog, LLC (16). The varieties of millet flour, buckwheat flour, sorghum flour, and soy flour labeled GF tested much lower for gluten than the varieties not labeled GF (Table 4).

At this time it is not known what percentage of naturally GF grains and flours NOT labeled GF are contaminated. It also is not known if there are certain grains and flours that are more or less likely to be contaminated. Much more extensive studies are needed to answer both these questions. In the meantime, because of the risk of contamination it is recommended that individuals with CD buy inherently GF grains, GF flours, and products made from GF grains and flours that are labeled GF whenever possible (4).

Nutritional Quality of the Gluten-Free Diet

Just like any other eating plan, a GFD can be healthy or unhealthy depending upon food choices. The Academy of Nutrition and Dietetics' Celiac Disease Evidence Analysis Project states the following about the nutritional adequacy of the GFD, "Adherence to the GF dietary pattern may result in a diet that is high in fat and low in

Table 3: Gluten Contamination of Grains, Seeds, and Flours NOT Labeled Gluten-Free

Product	Mean Gluten Content (ppm) of Two Extractions
Millet flour (brand 1)	305
Millet flour (brand 2)	327
Millet grain	25
Buckwheat flour	65
Sorghum flour	234
Soy flour (brand 1)	2,925
Soy flour (brand 2)	92

Source: Thompson T, Lee AR, Grace T. Gluten contamination of grains, seeds, and flours in the United States: A pilot study. J Am Diet Assoc. 2010;110:937-940.

carbohydrates and fiber, as well as low in iron, folate, niacin, vitamin B-12, calcium, phosphorus and zinc (15)."

While a growing number of manufacturers are using GF whole grains in their products, many packaged foods continue to be made with refined flours, such as white rice and milled corn and starches, such as tapioca and corn. These products offer very little dietary fiber. In addition, unlike refined wheat-based breads, pastas, and breakfast cereals which tend to be enriched or fortified with B-vitamins and iron, GF versions generally are not enriched or fortified (17). GF varieties of these foods also may be higher in fat than wheat-based varieties. Manufacturers of GF foods often add extra fat to improve texture and mouth feel of products.

The Academy of Nutrition and Dietetics' Celiac Disease Nutrition Practice Guidelines suggest that patients with CD be encouraged to choose whole or enriched GF grain products (13). If individuals with CD have nutritional inadequacies that cannot be resolved through food, a GF age and gender appropriate multivitamin and mineral supplement should be considered (13).

Individuals with CD also may gain weight following diagnosis (18). Before diagnosis individuals may experience malabsorption and require additional calories to maintain weight or at least slow the rate of weight loss. When a GFD is started the intestine is able to heal and the malabsorption resolves. The amount of calories needed to maintain weight likely decreases. If calorie intake is not decreased unwanted weight gain can result.

Steps Patients should Take to Ensure a Healthy GFD

- Eat appropriate amounts of fruits, vegetables, milk (or milk-substitutes, such as GF soy milk), legumes, nuts, seeds, fish, lean poultry, lean meat.
- Choose grain-based foods that list a whole grain, such as brown rice, whole corn, millet, sorghum, wild rice, teff, amaranth, quinoa, gf oats and buckwheat as the first ingredient. Some manufacturers of whole grain GF products include: The Quinoa Corporation, Nu-World Amaranth, Cream Hill Estates, and Namaste Foods.
- Choose refined grain-based products that are enriched or fortified with iron and B vitamins. Some manufactures of enriched or fortified GF foods include, General Mills and Enjoy Life Natural Brands.
- Look at the Nutrition Facts Panel and compare the fiber content of similar products. Choose products with the higher amount of fiber.
- Look at the Nutritional Facts Panel and compare the fat content of similar products. Choose products with lower amounts of fat, especially saturated fat. Avoid products made with trans fat.
- Eat foods that are good sources of calcium, such as low fat milk, non-fat yogurt, calcium processed tofu, and calcium fortified GF soy milk.

While the GFD may be challenging at first, the learning curve is steep. It is essential that patients receive up-to-date, timely, and on-going counseling from a registered dietitian proficient in CD and the GFD.

Table 4: Gluten Content of Flours Labeled Gluten-Free

Product	Mean Gluten Content (ppm) of Six Extractions
Millet flour	15.5
Buckwheat flour	< 5
Sorghum flour	5 extractions tested < 5; 1 extraction tested 7
Soy flour	5 extractions tested < 5; 1 extraction tested 6

Source: Gluten Free Watchdog, LLC (www.glutenfreewatchdog.org)

To locate a registered dietitian, visit www.eatright.org, and click on: "find a registered dietitian" at the top of the page. Alternatively, a state-by-state listing of dietitians specializing in CD can be found at http://www.glutenfreedietitian.com/newsletter/dietitians-specializing-in-celiac-disease/. ■

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