Chapter 10
Nutrition in Celiac Disease

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According to the Academy of Nutrition and Dietetics (formerly the American Dietetic Association) evidence analysis library, "medical nutrition therapy provided by a registered dietitian is strongly recommended for individuals with celiac disease" [1]. Therefore, consultation with a dietitian/nutritionist that has expertise in CD should be mandatory for all patients with CD at diagnosis as well as in follow-up (Table 10.1). The gluten-free diet is currently the only treatment for CD, a genetically based autoimmune disease with chronic inflammation of the small intestinal mucosa. Individuals with CD have an immunologic reaction to the proteins in wheat, rye, and barley. Patients with CD must be monitored closely by the dietitian to assess the healthfulness of the gluten-free diet as well as to discuss motivation, quality of life, symptom improvement, and barriers to compliance.

Nutrition assessment is the first step in the nutrition care process. During the assessment, pertinent data are gathered and compared to normative values. A nutrition diagnosis is determined and a nutrition care plan is developed and prescribed. The nutrition intervention should include goals that are quantifiable, achievable, time defined, and negotiated with the patient so as to improve dietary intake and reduce risk factors. The assessment continues at each patient visit. A complete nutrition assessment includes a review of dietary intake, anthropometric measures, biochemical data, medical tests, and procedures (Table 10.2). Communication with the referring physician/gastroenterologist is advisable for optimal patient care. During the assessment, the dietitian may determine that a diagnosed patient with gastrointestinal symptoms, not related to gluten intake, could be related to another food intolerance or a medical issue that the physician must investigate. Similarly, the dietitian may determine that a micronutrient deficiency or weight

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Table 10.1 When to refer patients with celiac disease to a dietitian

Initial assessment at diagnosis as well as two to three more visits within the first year of diagnosis as well as annual visits thereafter
Suspicion of gluten ingestion (positive serologies after 1 year or more of being on a gluten-free diet)
Food intolerances (lactose, fructose), food allergies
Constipation/diarrhea/reflux
Fluctuations in body mass index—weight gain or loss
Micronutrient deficiencies or toxicities
Gastroparesis
Hypercholesterolemia
Type 1 diabetes
Refractory celiac disease

Table 10.2 Nutrition assessment checklist

Obtain a complete dietary history—foods and beverages consumed at all meals and snacks, including name brands
Ensure adequate calories, protein, micronutrient intake (the typical gluten-free diet can increase the risk of calcium, iron, fiber, vitamin D, folate, niacin, zinc, vitamin B_{12} deficiencies due to lack of fortification of gluten-free packaged foods including breads, pastas)
Review intake of foods away from the home—restaurant frequency, fast food, take out, order in, cafeteria, other people's homes, social and work events
Travel—foods consumed, frequency of travel
Supplements—herbal remedies, over-the-counter diet aids
Vitamins and minerals—review name brands and check if gluten-free; compare and correct micronutrients compared to recommended intake
Prescription medications—must be gluten-free
Cross-contamination prevention measures
Review past medical history, family history, symptoms, laboratory measures; review of all tests and procedures
Anthropometrics—height, weight, BMI
Social support—family, work, peers
Quality of life—work, family, exercise, risk of depression
Activity level
Assess knowledge of gluten-free diet food labels—make sure client knows how to identify gluten in an ingredient list, understands the meaning of nutrition food claims such as no gluten, gluten-free, wheat-free, made in the same factory that processes wheat, low gluten
Readiness for change—assess patient willingness to change diet and patient's goals for learning and meeting with the dietitian
Family history—other family members with celiac disease; family members tested for celiac disease
Potential nutrition diagnoses—follows a strict gluten-free diet, ingesting gluten inadvertently in restaurants, ingesting gluten on purpose monthly, inadequate calcium/vitamin D intake, inadequate fiber intake, risk of iron deficiency, constipation due to inadequate fiber intake, excessive caloric intake resulting in weight gain, at risk of overweight

loss is not caused by inadequate intake. Dietitians can also recommend the physician to screen for CD in patients that do not have a diagnosis but exhibit symptoms or in those who have significant medical history or family history or unexplained nutrient deficiencies.

Dietary Intake Assessment

Assessment of typical dietary intake in CD must be thorough. All food and beverages consumed on weekdays and weekends should be reviewed including name brands of products and frequency of food eaten away from the home (restaurants, social events, other people's homes, travel). It is helpful for the patient to complete a food diary for the dietitian to review. Dietary restrictions such as food intolerances, food allergies, religious observances, and self-imposed restrictions are considered.

Patients should be queried about their compliance to a strict gluten-free diet and the frequency of gluten ingestion (purposely or inadvertently). It is important to assess patients' knowledge and understanding of the diet by reviewing their label reading principles, how they order foods in restaurants, and what cross-contamination procedures are utilized in shared kitchens.

Patients may have obtained information about the gluten-free diet elsewhere, and it is important to assess the source for its accuracy (internet, other nutritionists, books, peers, magazines). Medications, vitamins, and dietary supplements must be reviewed for their gluten status, their purpose, and whether they meet or exceed the Dietary Reference Intake (brands are required). It is important to assess quality of life, social history/social support, sufficiency of income, and ability to access gluten-free food. Inquiry should be made as to who prepares food at home, particularly in a shared kitchen. A review of gastrointestinal symptoms (such as type, frequency, and volume of bowel movements, abdominal pain, bloating, nausea or vomiting, delayed gastric emptying, reflux, flatulence) is required. Compliance with a strict gluten-free diet usually reduces gastrointestinal symptoms in CD [2–13] and should always be encouraged.

Anthropometric Assessment

Assess age, height, weight, body mass index, growth parameters in children, weight history, physical activity, disordered eating, and/or diets (currently or in the past).

Table 10.3 Laboratory measures recommended

Laboratory tests	Include	Frequency
Celiac disease antibodies	Anti-endomysial antibody Anti-tissue transglutaminase antibody Deamidated gliadin protein Serum IgA level	One to two times a year post diagnosis
Anemia profile	Hemoglobin Hematocrit MCV Folate Ferritin Transferrin saturation Vitamin B_{12}	One to two times a year
Vitamin profile	Vitamin B_6 Thiamin Riboflavin 25-Hydroxy vitamin D Vitamins A, E	Annually—if abnormal must be repeated 3 months after treatment
Mineral profile	Copper Zinc Magnesium Calcium	Annually
Lipid profile	LDL HDL Triglycerides Total cholesterol	Annually—more frequently if abnormal
Electrolytes	Sodium Potassium	Annually
Other	PTH Albumin ESR	Annually
Renal profile	BUN Creatinine GFR	Annually

Biochemical Data, Medical Tests, and Procedure Assessment

Review all laboratory tests. If these are not accessible, a request should be made to access such information. See Table 10.3 for a list of tests that should be accessed and/or recommended.

Medical Procedures

All medical procedures must be reviewed including endoscopy report (classification of Marsh scores, number, and location of segments biopsied), bone mineral density,

Table 10.4 Nutrition education for the gluten-free diet

Label reading 101—review the list of ingredients that must be avoided, labeling laws, surprising sources of gluten, cross-contamination procedures, nutrition claims (e.g., gluten-free, wheat-free, low gluten, made in the same facility as wheat, no gluten ingredients), sources of important nutrients such as calcium, vitamin D, iron, fiber
Provide recommendations for portions and variety of foods from all food groups
Heart-healthy recommendations to prevent high cholesterol
Recommend high fiber, as tolerated, to prevent weight gain and constipation
Review of gluten-free grains—50 % of grains consumed should be gluten-free whole grains
Discuss risk of vitamin deficiencies
Encourage healthful gluten-free food choices
Discuss risks associated with ingesting gluten
Discuss vitamin supplementation as needed
Discuss use of supplements such as probiotics, over-the-counter remedies
Discuss family testing
Discuss restaurant eating, social situations, menu planning, recipes, grocery shopping
Coordinate care with other healthcare providers
Discuss other dietary restrictions within the confines of the gluten-free diet: lactose-free diet, low-fructose diet, diabetes meal plan/carbohydrate counting, kosher diet, low-fat diet, weight-control diet
Implement weight-centered guidelines as needed

breath tests (bacterial overgrowth, fructose intolerance, lactose intolerance), gastric emptying study, surgeries, medical treatments, and colonoscopy. Review past medical history (e.g., gastrointestinal, immune, neurological, and psychological), other health conditions, autoimmune diseases, family history of CD, allergies, body-muscle stores, and fat stores. Inquire about appetite, current gastrointestinal symptoms, and symptoms prior to diagnosis of CD.

Physical

Assess appearance of hair, skin, nails, and body shape.

Nutrition Intervention and Education

The gluten-free diet is the medical and nutritional treatment for CD. A gluten-free diet is discussed in a later section of this chapter. Gluten must be removed from the diet completely and permanently. Table 10.4 includes a list of items that must be included in the nutrition education for patients with CD. It is important to answer questions the patient may have, establish a trustful rapport, and set goals with the patient that can be addressed in follow-up.

Table 10.5 Nutrition items to monitor in follow-up visits

Implementation of nutrition goals
Adherence to gluten-free living
Factors affecting quality of life
Medical status (e.g., gastrointestinal, immune, neurological, and psychological)
Social supports
Body mass index
Label reading principles
Restaurant habits and frequency
Diet history and gluten-free dietary pattern—specific focus on intake of nutrients at risk of deficiency (iron, calcium, vitamin D, B vitamins, fiber, folate, niacin, zinc), intake compared to recommendations (food pyramid), recommend not ingesting excessive sugar and fat from prepared gluten-free foods, overall caloric intake
Vitamin intake
Medications and supplements
Antibody levels, potential exposure to cross-contamination, surprising sources of gluten in foods
Answer patient questions

Follow-up

CD is a lifelong systemic disease with a burdensome treatment that requires regular follow-up visits with the expert dietitian and gastroenterologist; patients must be monitored for compliance, symptoms, well-being, and medical issues. See Table 10.5 for items that need to be monitored during follow-up visits.

If someone with CD is not treated with the gluten-free diet, there can be serious consequences. The intake of gluten may result in gastrointestinal symptoms, malabsorption and micronutrient deficiencies, villous atrophy and the development of neurological complications, fertility problems, reduced quality of life, intestinal lymphoma, and reduced bone mineral density. The dietitian must assess compliance in follow-up, particularly in patients with symptoms. If gluten exposure is determined not to be the cause of symptoms, other potential causes could be lactose, fructose, and carbohydrate intolerances, bacterial overgrowth, refractory sprue, related cancers, and other gastrointestinal diseases and conditions. These would require investigation by a gastroenterologist.

Individuals with CD have been found to show improved quality of life after compliance with a gluten-free dietary pattern for at least 1 year particularly if they had symptoms prior to diagnosis [12, 14]. However, they may not attain the same level of quality of life as the general population; this has been reported more frequently by women than men and particularly in those that continue to have gastrointestinal symptoms despite adherence to a gluten-free diet [15, 16].

The Gluten-Free Diet

Currently, the only treatment for CD is a strict, lifelong gluten-free diet. A gluten-free diet is defined as being free of all but miniscule amounts of protein from wheat, barley, rye, and crossbred varieties of these grains, such as triticale. In the USA, labeled gluten-free foods must contain less than 20 ppm of gluten from ingredients and/or cross-contact with gluten. In place of gluten-containing cereal foods (breads, pastas, breakfast cereals), foods containing corn, rice, millet teff, sorghum, wild rice, oats, amaranth, buckwheat, and quinoa are used.

Labeled Gluten-Free Foods

There are an ever-increasing number of labeled gluten-free cereal foods available in both natural foods stores and mainstream grocery stores. At the time of this writing, the Food and Drug Administration (FDA) had not yet released the final rule for labeling foods gluten-free. Under the FDA's proposed rule, a food may not be labeled gluten-free if any of the following applies [17]:

- The food contains an ingredient that is a prohibited grain. Prohibited grains include wheat, barley, rye, and triticale (a cross between wheat and rye).
- The food contains an ingredient derived from a prohibited grain that has not been processed to remove gluten. Examples of these types of ingredients include wheat flour, hydrolyzed wheat protein, wheat germ, malt, and barley malt flavoring.
- The food contains an ingredient derived from a prohibited grain that has been processed to remove gluten but use of the ingredient results in the final food product containing 20 ppm or more gluten. Examples of these types of ingredients are wheat starch and modified food starch made from wheat.
- The food contains 20 ppm or more of gluten.

The definition of gluten-free in the USA differs slightly from the codex standard for foods for special dietary use for persons intolerant to gluten [18]. Under this standard, gluten-free foods are dietary foods that fit one of the two definitions below.

- Foods that are made only from ingredients that do not contain wheat, barley, rye, oats,[1] or their crossbred varieties and with a gluten content not greater than 20 ppm.
- Foods made using one or more ingredients from wheat, barley, rye, oats, or their crossbred varieties which have been specially processed to remove gluten and with a gluten content not greater than 20 ppm.

[1] Under Codex, the use of oats uncontaminated with wheat, barley, and rye may be determined at a national level. In the United States, oats are not considered a prohibited grain and may be included in labeled gluten-free foods as long as the final food product contains less than 20 ppm of gluten and the food meets the other criteria for gluten-free labeling.

Reading Labels of Foods Not Labeled Gluten-Free

In the USA, gluten-free consumers are advised to trust the food label. If a food is labeled gluten-free, the manufacturer has determined that the product meets the criteria for labeling established by the FDA. For food not labeled gluten-free, the consumer has to read the ingredients list and contains statement for six words. If any of the following words are included on the food label, the food should be avoided:

1. "Wheat." Under the FDA's Food Allergen Labeling and Consumer Protection Act (FALCPA), if an ingredient in a packaged food product regulated by the FDA includes protein from wheat, the word "wheat" must be included on the food label either in the ingredients list or Contains statement [19]. If the word "wheat" is not included on the food label, none of the ingredients in the product contain protein from wheat.
2. "Barley."
3. "Rye."
4. "Oats." Only oats and products containing oats labeled gluten-free should be eaten by individuals with CD [20]. While oats are considered inherently gluten-free, they also are highly likely to be contaminated with wheat, barley, or rye [21, 22].
5. "Malt." The single word "malt" in an ingredients list means "barley malt" [23]. If another source of malt is used, such as corn, the ingredients list will read "corn malt."
6. "Brewer's yeast." This type of yeast may be a product of the beer brewing process (i.e., spent brewer's yeast) [24]. As a result, it may be contaminated with malt and grain.

Foods Regulated by the USDA

While the labeling of most food in the USA is under the jurisdiction of the FDA, some foods are regulated by the United States Department of Agriculture (USDA). These products are meat products, poultry products, egg products (defined as liquid, dried, and frozen whole eggs, egg yolks, and egg whites with or without added ingredients), and mixed food products containing in general more than 3 % raw meat or 2 % or more cooked meat or poultry meat [25–27]. While the FDA has mandatory allergen labeling under FALCPA, the USDA does not. Manufacturers under the jurisdiction of the USDA are encouraged to voluntarily follow FALCPA-like allergen labeling, and the USDA believes 80–90 % of product labels are in voluntary compliance [25].

There are a few additional ingredients consumers must look for in the ingredients lists of foods regulated by the USDA if the manufacturer is not voluntarily following FALCPA-like allergen labeling. These ingredients (in addition to the ingredients already listed above) should be avoided until the manufacturer is contacted and it is confirmed that the source of the ingredient is not wheat.

1. "Modified food starch." Modified food starch in a food regulated by the USDA may contain protein from wheat and "wheat" may not be included on the food label if the manufacturer is not voluntarily complying with FALCPA-like allergen labeling [28].
2. "Dextrin." Dextrin in a food regulated by the USDA may contain protein from wheat, and "wheat" may not be included on the food label if the manufacturer is not voluntarily complying with FALCPA-like allergen labeling [28].
3. "Starch." The single word "starch" in the ingredients list of a food product regulated by the USDA may mean either "corn starch" or "wheat starch" [29]. If the starch is derived from wheat and contains wheat protein, the word wheat may not be included on the food label if the manufacturer is not voluntarily complying with FALCPA-like allergen labeling [28]. Note: In foods regulated by the FDA, the single word "starch" in the ingredients list means "cornstarch."

For all of these ingredients—modified food starch, dextrin, and starch—the source is most likely cornstarch if the ingredient is manufactured in the USA. If the ingredient is manufactured outside the USA, there is a greater likelihood that the source is wheat starch.

Beverages Regulated by the TTB

The Alcohol and Tobacco Tax and Trade Bureau (TTB) recently released an interim policy on gluten content statements in the labeling and advertising of wines, distilled spirits, and malt beverages [30]. The TTB regulates almost all alcohol sold in the USA. Exceptions include beer made without malted barley and hops and wines containing less than 7 % alcohol by volume. These beverages are regulated by the FDA and must comply with FDA labeling laws.

Under the TTB's interim policy, a gluten-free claim cannot be included on product labels if the alcohol is made with any amount of wheat, barley, rye, or crossbred varieties of these grains. Manufacturers can include a gluten-free claim on product labels if the beverage is made without gluten-containing grains, but manufacturers must ensure that the raw materials, ingredients, production facilities, storage materials, and finished products are not cross-contaminated with gluten. Alcoholic beverages that may qualify for a gluten-free claim include wine, rum, and vodka distilled from potatoes.

The TTB is allowing the statement "Processed (or treated or crafted) to remove gluten" on product labels if the grains used or ingredients used in the beverage have been processed to remove all or some of the gluten, but an explanatory statement must also be included. For fermented products, the statement must read, "Product fermented from grains containing gluten and processed (or treated or crafted) to remove gluten. The gluten content of this product cannot be verified, and this product may contain gluten." For distilled products the statement must read, "This product was distilled from grains containing gluten which removed some or all of the gluten. The gluten content of this product cannot be verified, and this product may contain gluten."

Cross-Contamination with Wheat, Barley, or Rye

Naturally gluten-free grains may become contaminated with gluten-containing grain anywhere along the line from the field where they are grown (due to crop rotation with wheat, barley, or rye or one of these grains being grown in a adjacent field) to the plant where they are processed (due to shared harvesting, transporting, and/or processing equipment). A study by Thompson et al. found that of 22 samples of naturally gluten-free grains and flours sold in the USA, nine contained mean levels of gluten ranging from 8.5 to 2,925.0 ppm of gluten [31]. Seven of these samples contained mean levels of gluten at or above 20 ppm and would not be considered gluten-free under the FDA's proposed gluten-free labeling rule. To help decrease the risk of cross-contamination, the Academy of Nutrition and Dietetics Celiac Disease Toolkit recommends that individuals with CD buy naturally gluten-free grains and flours that are labeled gluten-free [32]. It is also recommended that products that are predominantly grain-based be labeled gluten-free [32]. A comparison of the gluten content of labeled versus not labeled gluten-free millet, rice, soy, and sorghum flours is provided in Table 10.6. The labeled gluten-free brands tested contained lower amounts of gluten than the brands not labeled gluten-free [31, 33].

Inadvertent gluten intake through contamination must be considered if it is believed that an individual is consuming gluten despite the appearance of a strict gluten-free diet based on symptoms and/or follow-up serological testing. A registered dietitian well versed in CD must be consulted to help determine the source of contamination. Food may be contaminated at point of purchase or become contaminated in the home. If a lot of eating is done outside the home (e.g., restaurant), then this will have to be investigated too.

Nutritional Quality of the Gluten-Free Diet

The nutritional quality of the gluten-free diet depends upon the food choices of consumers. According to the Academy of Nutrition and Dietetics Evidence Analysis Library, "adherence to the gluten-free dietary pattern may result in a diet that is high in fat and low in carbohydrates and fiber, as well as low in iron, folate, niacin, vitamin B_{12}, calcium, phosphorus and zinc" [34]. There is also evidence that gluten-free diets may contain inadequate amounts of thiamin [35]. As a result, the Academy's Evidence-Based Nutrition Practice Guideline for Celiac Disease recommends the consumption of whole and enriched gluten-free grains and products [20]. The addition of a gluten-free age and gender-specific multivitamin and mineral supplement is advised if "usual food intake shows nutritional inadequacies that cannot be alleviated through improved eating habits" [20].

There are several possible reasons for this macro- and micronutrient profile of the gluten-free diet. Individuals with CD may not consume the recommended number of servings of grain foods. A study conducted by Thompson et al. found that only 21 % of US adult female participants consumed the minimum recommended

Table 10.6 Gluten content of labeled versus not labeled gluten-free flours[a]

Flour	Mean gluten content ppm[b]
Labeled gluten-free	
Millet	15.5
Rice	<5
Sorghum	<5[c]
Soy	<5[d]
Not labeled gluten-free	
Millet	305.0
Millet	327.0
Rice	8.5
Sorghum	234.0
Soy	2,925.0
Soy	92.0

[a]Data from [31, 33]
[b]Flours not labeled gluten-free: one sample tested in duplicate (mean of two extractions); flours labeled gluten-free: three samples of same brand tested in duplicate (six extractions)
[c]Five extractions tested <5 ppm gluten; one extraction tested at 7 ppm gluten
[d]Five extractions tested <5 ppm gluten; one extraction tested at 6 ppm gluten

number of grain food servings [36]. A retrospective review of diet histories of patients with CD at a US celiac disease center conducted by Lee et al. found that 38 % of meals and snacks eaten by study participants did not contain a grain or starch component [37]. Low overall grain consumption can result in diets that are low in carbohydrates and fiber and proportionally higher in fat [38]. It also can result in diets that are low in iron, folate, niacin, and zinc [38].

Many of the grain-based foods that individuals with CD eat may be higher in fat than their gluten-containing counterparts. This is due to manufacturers adding ingredients, including fat, to mimic the mouthfeel and texture of gluten. Increased fat content of foods not generally thought to contain fat can result in diets that are inadvertently high in fat.

Individuals with CD may consume grain foods made primarily from refined gluten-free grains and starch, such as white rice, milled corn, rice starch, cornstarch, and tapioca starch. A study conducted by Thompson found that of 268 gluten-free breads, pastas, and breakfast cereals for sale in the USA and reviewed for ingredients, 73 % listed a refined grain or starch as the first ingredient [39]. Of these refined grain foods, only 16 % were enriched or fortified with B vitamins and iron. Since this study was conducted, there has been an increase in availability and use of alternative gluten-free whole grains and flours, including millet, teff, sorghum, wild rice, amaranth, buckwheat, and quinoa. Regardless, too many gluten-free cereal products are made that still list maize, starch, or white rice flour as the first ingredient. Additionally, there has not been much of an increase in the numbers of manufacturers enriching or fortifying refined gluten-free products. An overreliance on refined

grain-based foods (versus whole grains) that are not enriched or fortified can result in diets that are low in fiber, iron, folate, niacin, vitamin B_{12}, and zinc [38].

In addition, many individuals newly diagnosed with CD also are diagnosed with secondary lactose intolerance. While this type of lactose intolerance generally resolves as the small intestine heals, individuals may limit their intake of milk-based products. This may result in decreased intakes of calcium, vitamin B_{12}, and phosphorous [38].

To help ensure a healthy gluten-free diet, individuals with CD should be:

- Referred to a dietitian well versed in CD as soon as possible after diagnosis. Dietitians can be found at http://www.eatright.org and http://www.glutenfreedietitian.com/newsletter/dietitians-specializing-in-celiac-disease/.
- Encouraged to consume foods made from gluten-free whole grains (e.g., quinoa, gluten-free oats, teff), especially those products that list a whole grain as the first ingredient, and to choose whole grain products over those made with refined gluten-free grains (e.g., white rice, milled corn, tapioca starch).
- Counseled to choose enriched or fortified refined grain foods over refined grain foods that are not enriched. Consumers should be advised that they can determine whether a product is enriched or fortified by reading the ingredients list. Added vitamins and minerals will be included in the list or immediately following the list.
- Advised to use the Nutrition Facts panel to compare the fat and fiber content of gluten-free grain foods and to choose products with more fiber and less fat whenever possible.
- Encouraged to eat or drink calcium-rich foods even if they are lactose intolerant, such as calcium-fortified soy milk, calcium-fortified orange juice, and calcium-processed plain tofu, as well as foods naturally containing calcium, such as leafy greens and beans.

Weight Gain and the Gluten-Free Diet

Contrary to what is often reported in the media, a gluten-free diet is not a weight loss plan. In fact, many individuals complain of weight gain after being diagnosed with CD and starting a gluten-free diet. According to the Academy of Nutrition and Dietetics Evidence Analysis Library, “A small number of studies in adults show a trend toward weight gain after diagnosis; further research is needed in this area” [34]. One reason why individuals with CD might gain weight after diagnosis is that caloric intake requirements may decrease once the gluten-free diet is begun [36]. Prior to diagnosis, individuals may have experienced varying degrees of malabsorption. In order to maintain their weight or decrease the rate of weight loss, they may have become used to eating a certain number of calories. Once a diagnosis is made, a gluten-free diet is started, and the intestine heals. Therefore, fewer calories may be needed to maintain weight. Individuals may have to adjust their caloric intake and relearn appropriate portion control to prevent unwanted weight gain.

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