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Whole Grains and the Gluten-Free Diet

Amy E. Pagano

Recent attention to whole grains has increased with the *Dietary Guidelines for Americans 2005* recommendation to eat at least three servings of whole grains daily. This new emphasis follows research linking whole grains to reduction of chronic disease risk. The American population in general is not meeting this recommendation. For a person diagnosed with celiac disease, a gluten-free diet and the elimination of one of the most common grains in the U.S. makes meeting those recommendations even more challenging. Many gluten-free whole grain options are available and several are exceptionally nutrient dense. Familiarity with these grains, however, is limited. Educating patients on gluten-free whole grains and helping them to incorporate these foods can improve the nutrient profile and add fiber to a gluten-free diet.

INTRODUCTION

Grains, the edible portions of cereal grasses in the Gramineae family, have been an indispensable source of food for millennia (Table 1). Botanically, grains are complete fruits, containing both the fruit and seed of the plant. The term whole grain is generally used to refer to a grain or grain product that contains all three of its main parts (endosperm, bran and germ), either intact, or in the same relative proportion as the original grain. The outer protective layer of the grain, known as the bran, contains fiber and a large percentage of the B vitamins. The germ is actually the embryo of the seed and contains unsaturated fat, vitamin E, some protein, minerals and B vitamins. The endosperm is designed to function as the food supply for the germ and therefore is made up mostly of carbohydrate and protein with some B vitamins. Since the bran and most of the germ are removed during the refining and milling of grains, the majority of fiber, mineral and vitamin content are lost. Other beneficial phytonutrients such as lignans, phytoestrogens and phenolic compounds are removed as well.

Historically, the invention of the roller mill allowed for more efficient separation of the germ, bran and

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endosperm and made refined grains more readily available. This refinement originally flourished because removal of the lipid portion (in the germ) prevented the oxidation of unsaturated fats and spoilage of grains when exposed to prolonged air and light. Prior to the days of refrigeration and rapid transportation, this proved beneficial. Refined grains were also seen as symbols of purity and greater wealth. These distinctions only added to the popularity of refined grains, a popularity that unfortunately still lingers today.

Data from the 1994–1996 United States Department of Agriculture (USDA) Continuing Survey of Food Intakes by Individuals showed the average intake of whole grains in children, adolescents and adults to be one serving or less per day (1,2). This falls short of the recommended minimum of three servings as put forth in the *Dietary Guidelines for Americans 2005* (3). This newest set of guidelines, published jointly by the USDA and the Department of Health and Human Services, and its accompanying MyPyramid Food Guidance System (*www.mypyramid.gov*) make use of the catch phrase make half your grains whole. This recommendation stems from an association between whole grain intake and reduced risk of chronic disease including cardiovascular disease and type 2 diabetes (4,5).

GLUTEN-FREE DIET

A strict gluten-free diet is currently the only treatment for celiac disease and requires the complete removal of all wheat, rye and barley products. This quickly eliminates one of the most common sources of both refined and whole grain products in the U.S. Gluten-free replacements for cereals and baking mixes are often made up of a combination of cornstarch, potato starch, tapioca starch and/or white rice flour. The nutrient composition of these products pale in comparison to those made from whole grains. Even refined gluten-containing products can be more nutrient dense because they are fortified with iron, thiamine, riboflavin, niacin and folate to replace the losses in the refining process. Refined gluten-free products are typically not enriched. Although the research is limited, low intakes of fiber, calcium and iron (in women) have been found in the celiac population (6,7). While these findings are not necessarily any different from deficiencies in the general population, they are nonetheless important. Especially since many gluten-free whole grains are packed with higher levels of fiber and minerals than the more familiar grains, and provide an opportunity to further enrich the diet (Table 2). One will find the information below on gluten-free grains is also applicable to the general population and need not be limited to those with celiac disease.

Table 1
Gluten-Free and Gluten-Containing Grains

Gluten-free grains	*Gluten-containing grains*
Amaranth*	Barley
Buckwheat*	Rye
Corn	Wheat
Millet	
Oats**	
Rice	
Quinoa*	
Sorghum	
Teff	
Wild Rice	

*Not a true cereal grain; **High risk of gluten contamination.

PREPARING GRAINS

Cooking whole grains involves rinsing the grain in cold water, adding it to an appropriate amount of water, bringing to a boil and simmering covered and undisturbed for a specified amount of time. See Table 3 for specifics for each grain. While simmering on low heat, grains typically do not need to be stirred. Once all the water is absorbed, remove from heat and let sit for about five minutes before serving. The amount of grain will typically double or triple in size when cooked (i.e. 1 cup of dry quinoa will produce approximately 2½–3 cups of cooked quinoa). Other liquids, such as chicken or vegetable stock, juice or milk can be used instead of water to add flavor.

Since most whole grains require a longer cooking time than refined grains, time saving methods are often necessary for busy lifestyles. Pressure cookers are pots

Table 2
Nutrient Content of Gluten-Free Whole Grains

Grain (1 cup raw)	*Fiber (g)*	*Calcium (mg)*	*Iron (mg)*	*Magnesium (mg)*	*Zinc (mg)*	*Thiamine (mg)*	*Riboflavin (mg)*	*Niacin (mg)*	*Folate (mcg)*
Amaranth	18	298	14.8	519	6.2	0.16	0.41	2.5	96
Buckwheat	17	31	3.7	393	4.1	0.17	0.72	11.9	51
Millet	17	16	6.0	228	3.4	0.84	0.58	9.4	170
Oats	16.5	54	7.4	276	6.2	1.19	0.22	1.50	87
Rice, brown	6.5	63	3.4	272	3.8	0.79	0.08	8.19	38
Quinoa	10	102	15.7	357	5.6	0.34	0.67	5.0	83
Sorghum	12	54	8.5	n/a	n/a	0.46	0.27	5.6	38
Teff*	11	331	12	342	8.8	0.70	0.20	2.7	135
Wild rice	9.9	34	3.1	283	9.5	0.18	0.42	10.8	152
Compare to Wheat:									
Wheat, durum	n/a	65	6.7	276	8.0	0.80	0.23	12.9	83

All data, unless otherwise noted, obtained from USDA National Nutrient Database for Standard Reference at http://www.nal.usda.gov/fnic/foodcomp/search/

*Data obtained from *Gluten-Free Diet: A Comprehensive Resource Guide* by Shelley Case

with lids that seal. With the steam trapped inside, pressure builds, temperatures rise and foods cook quicker. If using a pressure cooker to cook whole grains, use one-half cup less liquid than normal and shorten the cooking time by half. Batch cooking is another time saver. Doubling a recipe will create enough for leftovers for the next day's lunch or freeze and reheat later in the week. It is also useful to cook a larger amount of plain grain for use in two or more different recipes. For example, cook a double batch of millet and use half immediately to make millet "polenta" or other dinner recipes and use the rest the following morning for a breakfast cereal mixed with fruit, nuts and/or seeds and milk.

STORAGE

Storage of whole grains also warrants mention. The unsaturated fat content of whole grains is small but significant for storage purposes and thus whole grains have a shorter shelf life than refined grains. Whole grains are best kept in airtight containers and stored in a cool, dark and dry environment. Most intact grains can be stored at room temperature for up to a year if the above conditions are met. Millet and oats, however, are best used within two to three months. It is recommended that whole grain flours, unless used within one month, be kept in the refrigerator (up to six months) or the freezer (up to one year) as they are more susceptible to oxidation. It is not necessary to bring the flour to room temperature before using in a recipe; the flour can be used directly from the refrigerator or freezer.

GLUTEN-FREE GRAINS

There are a variety of gluten-free whole grains available, each with its own unique texture and flavor, including corn, millet, oats, brown rice, sorghum, teff and wild rice. All of the above grains will be highlighted below except for corn, which is already famil-

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Table 3
Cooking Gluten-Free Whole Grains

Grain (1 cup dry)	*Water (or other fluid)*	*Cooking Time*
Amaranth	2 cups	20–30 minutes
Buckwheat	2–2½ cups	15–20 minutes
Millet	2 cups (dinner grain) 3–4 cups (porridge)	20–30 minutes 30–40 minutes
Oats	2–2½ cups (rolled oats) 2½–3 cups (steel cut oats)	10–20 minutes 25–30 minutes
Rice (brown)	1½–2 cups (long grain) 2–2½ cups (short grain)	45–60 minutes 45–60 minutes
Quinoa	1¾–2 cups	15–20 minutes
Sorghum	2½–3 cups	30–45 minutes
Teff	2½– 3 cups	10–20 minutes
Wild Rice	3 cups	40–60 minutes

*Note: if using a pressure-cooker, use ½ cup less liquid and reduce cooking time by half.

iar to most Americans. In addition, several grains will be reviewed that are not technically in the grass family, but rather share comparable content and structure and are used in a similar manner. These pseudo-grains include amaranth, buckwheat and quinoa.

Amaranth

Amaranth was once the staple food of the Aztecs in South America. Due to its association with the indigenous culture, amaranth almost disappeared in the years after the Spanish conquest. Fortunately, small amounts were still grown in remote areas of the mountains. Recent interest in amaranth, due to its superior nutrient profile, has led to increased cultivation throughout the world. Though not a true cereal grain, amaranth seed is used like a grain. It has a nutty flavor and a unique texture, both gelatinous and somewhat crunchy at the same time. Due to its thickening properties, amaranth is excellent as an addition to soups and casseroles or as breakfast porridge. The flour works especially well for making gravy. The seed can also be popped like popcorn and used to make cereals or sweets. Adding amaranth flour to baked goods will boost the nutrient content as amaranth has a significantly higher content of minerals (especially calcium, iron, magnesium and zinc) and fiber than other whole grains.

Buckwheat

Although the name would imply otherwise, buckwheat is not related to wheat and is not even a true cereal grain. Also known as kasha (when toasted), buckwheat has long been popular in Eastern Europe and parts of Asia and can be enjoyed as a robust side dish or stuffing. The flour is used in Japanese cuisine to make soba noodles and in America to make pancakes (although most commercial buckwheat pancake mixes and soba noodles in the U.S. typically contain wheat also). Dry toasting a grain, prior to cooking, accentuates its flavor and aroma and this is especially true for the hearty, triangular shaped buckwheat. Buckwheat is an excellent source of fiber, riboflavin and niacin.

Millet

Millet, originally a staple in Northern China, is currently used widely in India and Africa. In North America, millet is used most often as bird seed. A highly versatile grain, millet can be cooked as a light, dry, individual grain for a pilaf (similar to rice). When cooked with a higher percentage of water, however, millet develops a creamier texture, similar to mashed potatoes and is well suited for a breakfast porridge or polenta. Millet is high in B vitamins and fiber and has a mild taste.

Oats

Oats have been fueled in controversy in the celiac community for years. Though oats were originally thought

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Table 4
Gluten-Free Whole Grain Resources

Suggested Books

The Best Gluten-Free Family Cookbook by Donna Washburn and Heather Butt, Robert Rose Inc. Canada 2005

The Gluten-Free Diet: A Comprehensive Resource Guide Expanded Edition by Shelley Case, Centax Books 2006

The Splendid Grain, by Rebecca Wood, William Morrow, NY 1997*

Web Sites

Alti Plano Gold
- www.altiplanogold.com

Arrowhead Mills
- www.arrowheadmills.com

The Birkett Mills
- www.thebirkettmills.com

Bob's Red Mill
- www.bobsredmill.com

Lundberg Family Farms
- www.lundberg.com

Northern Quinoa Corporation
- www.quinoa.com

Nu-World Foods
- www.nuworldamaranth.com

Quinoa Corporation/Ancient Harvest Quinoa
- www.quinoa.net

The Teff Company
- www.teffco.com

Whole Grains Council
- www.wholegrainscouncil.org

*Includes both gluten-free and gluten-containing recipes

to have an offending protein sequence, recent research has demonstrated safe inclusion of oats in the gluten-free diet (8). However, the risk of cross contamination by gluten from other offending grains is high and many health care practitioners continue to recommend avoidance of oats in the gluten-free diet (8). Several new companies (Cream Hill Estates, Gluten Free Oats) are working on growing and processing oats in a controlled environment and testing for gluten prior to packaging. The Food Allergen Labeling and Consumer Protection Act of 2004 mandates that the Food and Drug Administration must define the term gluten-free for food labeling purposes (9). Once a definition, based on scientific studies, is set, determining the safety of the oats will be clearer. This holds much promise for the future as oats are delicious and an excellent source of soluble fiber as well as zinc and B vitamins. Until further clarified, people with celiac disease should first consult their health care provider if considering oats as a possible addition to their gluten-free diet. For a more in-depth discussion of oats in the GF diet, see reference 10.

Quinoa

Quinoa was once the staple grain of the Incas in South America and has a history similar to amaranth due to this association. Quinoa (pronounced keen-wah) is also known for its exceptional nutritional profile. Grains are typically incomplete protein sources because of the low lysine content (an essential amino acid). Quinoa stands out because of its higher lysine content, and a protein profile similar to that of cow's milk. It is also an excellent source of iron, calcium, magnesium, B vitamins and fiber. Due to a bitter saponin coating, quinoa should be rinsed several times prior to cooking. It cooks relatively quickly, tastes great and can easily replace rice in most recipes, so quinoa is a good choice when first trying and experimenting with gluten-free whole grains.

Rice

Rice is likely the most familiar of the gluten-free grains, however most people use white rice. There are many varieties of rice available and all come in both the white (refined) and brown (whole) form. Brown rice, like most whole grains, requires a longer cooking time than its refined version. Experiment with different grain lengths (short, medium, long) and the different varieties as well. Some varieties are fragrant, like basmati and jasmine with their slightly nutty and floral

Table 5
A Sampling of Gluten-Free Whole Grain Food Products

Amaranth	
Arrowhead Mills:	Amaranth grain Amaranth flour
Bob's Red Mill:	Amaranth grain Amaranth flour
Nature's Path:	MesaSunrise cereal
Nu-World Amaranth:	Amaranth grain Amaranth flour and starch Puffed amaranth Amaranth cereal snaps Amaranth flatbreads Amaranth sideserve (various flavors) Amaranth mini-ridges Amaranth snackers
Buckwheat	
Arrowhead Mills:	Buckwheat groats Buckwheat flour Creamy buckwheat cereal Kasha Maple Buckwheat Flakes cereal
Bob's Red Mill:	Buckwheat groats Kasha Mighty Tasty Hot Cereal Creamy Buckwheat cereal
The Birkett Mills:	Pocono Cream of Buckwheat cereal Pocono Kasha Pocono Buckwheat flour Pocono Buckwheat groats
Eden:	100% buckwheat soba noodles
Millet	
Arrowhead Mills:	Millet grain Millet flour Puffed Millet cereal
Bob's Red Mill:	Millet grain Millet flour Millet grits
Rice (Brown)	
Arrowhead Mills:	Rice and Shine Hot Cereal Puffed Rice cereal Rice Flakes Sweetened Cereal
Bob's Red Mill:	Brown Rice flour Creamy Brown Rice Farina cereal
Lundberg:	Brown, Red and Black Rice (many varieties and blends) Brown Rice cakes Brown Rice chips Rice Xpress (various flavors)
Tinkyada:	Brown Rice Pasta
Quinoa	
Altiplano Gold:	Instant Hot Quinoa Cereal (various flavors)
Ancient Harvest:	Quinoa grain (Traditional, Inca Red and Wild Black) Quinoa flakes Quinoa flour Quinoa pasta
Arrowhead Mills:	Quinoa grain
Bob's Red Mill:	Quinoa grain Quinoa flour
Marys Gone Crackers:	Seed crackers (various flavors)
Norquin Brand:	Quinoa grain Quinoa flour Quinoa flakes
Sorghum	
Bob's Red Mill:	Mighty Tasty Hot Cereal
Shiloh Farms:	Sorghum grain
Teff	
Bob's Red Mill:	Teff grain Teff flour
The Teff Company:	Maskal Teff grain (ivory or brown) Maskal Teff flour
Wild Rice	
Arrowhead Mills:	Wild Rice Pancake and Waffle Mix
Lundberg:	Wild Rice grain Wild Rice cakes

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Table 6
Recipes

Amaranth Vegetable Stew
Adapted from a recipe by Karen Railey

½ cup amaranth seed
1½ cups water
1 onion, chopped
1 Tbsp. olive oil
2 cloves garlic, minced
½ lb mushrooms, sliced
1 can diced tomatoes, 15 oz
1½ tsp dried basil
1½ tsp dried oregano
10 oz baby spinach
Salt and pepper to taste

Bring amaranth and water to a boil. Reduce heat, cover and simmer for 25–30 minutes.

While amaranth is cooking, sauté onion in the olive oil. Once the onion has become translucent, add the garlic and mushrooms and sauté a few minutes more. Add tomatoes, including liquid, and basil, oregano, salt and pepper. Once the mixture is hot again, mix in the spinach and cover until the spinach is wilted.

Add amaranth to the vegetable mixture and mix well.

Peasant Kasha (Buckwheat), Potatoes, and Mushrooms
Reprinted with permission from *Feeding the Whole Family* by Cynthia Lair (Moon Smile Press, 1997) www.feedingfamily.com

2 teaspoons toasted sesame oil
1 small onion, chopped
2 cloves garlic, minced
½ teaspoon sea salt
2 cups boiling water
2 medium red potatoes or 1 large baking potato
3–4 mushrooms, sliced
1 cup kasha
Freshly ground pepper

Heat the oil in a 2-quart pot. Add onions, garlic and salt; sauté until the onion is soft. Put water on to boil. Scrub potatoes well and cut into ½-inch cubes. Add potatoes and mushrooms to onions; sauté 1–2 minutes. Add kasha to mixture and stir. Pour in boiling water. Turn heat to low. Cover pot and simmer 15 minutes. Fluff up and serve garnished with pepper.

Millet Breakfast Cereal

1 cup millet
3 cups water
Pinch of sea salt
¼ cup ground flaxseed
¼ cup walnuts, chopped
¼ cup maple syrup
1–2 cups milk or soymilk (optional)
1–2 cups seasonal fruit (optional)

Place millet in a pan and dry-toast it over medium heat, stirring frequently, for about 5 minutes.

Bring millet, water and sea salt to a boil, lower heat, cover and simmer for 30 minutes or until all water is absorbed.

Remove from heat and stir in flax, walnuts and maple syrup. For each individual serving, add milk and fruit as desired (omit milk for a thicker consistency).

Quick Lemon & Garlic Quinoa Salad
Reprinted with permission from *Feeding the Whole Family* by Cynthia Lair (Moon Smile Press, 1997) www.feedingfamily.com

1 cup dry quinoa
1¾ cup water
Pinch of sea salt
½ cup carrots, chopped
1/3 cup parsley, minced
¼ cup sunflower seeds
Dressing
2–3 cloves garlic, minced
¼ cup freshly squeezed lemon juice
2 tablespoons extra-virgin olive oil
2 tablespoons GF tamari (soy sauce)

Rinse quinoa well with warm water and drain. Place rinsed quinoa, salt, and water in a pot. Bring to a boil, reduce heat to low, cover and let simmer 15–20 minutes, until all the water is absorbed.

Prepare dressing and place in a large bowl. Add carrots, seeds, and parsley. Add cooked quinoa and toss well. Serve at room temperature or chilled.

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Table 6 (continued)

Teff Polenta
Recipe provided, with permission, from the Teff Company
www.teffco.com

2 cups water
2 tablespoons extra virgin olive oil
8 cloves garlic, thickly sliced
1 cup coarsely chopped onion
1 cup coarsely chopped green pepper
⅔ cup teff grain
½ teaspoon sea salt
2 cups coarsely chopped plum tomatoes
1 cup coarsely chopped fresh basil

Boil water in a tea kettle.

Place the oil in a 10-inch skillet and warm over medium heat. Add garlic and onions and sauté, stirring occasionally, for about 5 minutes or until fragrant. Add peppers and sauté for 2 minutes or until bright green. Add teff grain.

Turn off the heat to prevent splattering and add the boiling water and salt. Resume heat and let simmer 2 minutes. Add tomatoes and basil.

Cover and simmer for 10–15 minutes, stirring occasionally, until the water is absorbed. There may be some extra liquid from the tomatoes but as long as the teff is not crunchy, the polenta is done.

Taste and adjust the seasonings if desired. Transfer to an un-oiled 9-inch pie plate. Let it cool for at least 30 minutes. Slice and serve.

Wild Rice and Yellow Summer Squash
Reprinted with permission from *The Splendid Grain*
by Rebecca Wood (William Morrow) www.rwood.com

1 Tablespoon unsalted butter or ghee
1 teaspoon minced fresh ginger
1 teaspoon cumin seeds
1 teaspoon ground coriander
¼ teaspoon turmeric
1 clove garlic, minced
½ cup chopped shiitake mushrooms
1 small yellow summer squash, scrubbed and chopped
2 leaves kale, finely sliced
2 cups cooked wild rice
½ cup pumpkin seeds, toasted
Sea salt and freshly ground black pepper, to taste

Heat the butter in a small sauté pan. Add the ginger, cumin, coriander, and turmeric and sauté for about 3 minutes or until the spices release their aroma. Add the garlic and shiitakes and sauté until limp, about 4 minutes. Add and sauté the squash for about 3 minutes, or until it starts to soften. Add and sauté the kale for about 5 minutes, or just until cooked. Add the wild rice and pumpkin seeds and sauté until heated through. Season with salt and pepper and serve.

flavors. In others, the bran is a different color, creating red or black rice instead of brown. Try them all!

Sorghum

Sorghum, a grain used in the U.S. mostly for livestock feed and molasses production, is delicious as porridge or an addition to pilafs, casseroles and soups. Sorghum flour has a slightly sweet and nutty flavor and works particularly well in combination with bean flours (such as garbanzo or fava bean flour) in gluten-free baked goods.

Teff

Teff is a tiny seed used regularly in Africa. It is used to make a flat, spongy bread called injera, a staple in Ethiopian cuisine. Due to its small size, it is best used as a breakfast cereal or added to other grains as a side dish. Teff has a high mineral content, including calcium, iron, magnesium and zinc.

Wild Rice

Wild rice, native to North America, is not a member of the rice family. This grass, previously a staple for several Native American tribes, continues to grow wild in the Great Lakes region. Most of the wild rice available in stores today, however, is commercially grown. Wild rice is high in zinc, magnesium and folate as well as

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fiber. It is excellent as a side dish on its own or mixed with other grains to add a splash of color.

Additional gluten-free whole grain resources are listed in Table 4 and a sampling of available brands of gluten-free grains, flours and other commercial food items can be found in Table 5. Start your whole grain adventure with some of the delicious recipes in Table 6.

CONCLUSION

A gluten-free diet, the only treatment at this time for celiac disease, presents a challenge in regards to whole grain intake. With some of the most common grains restricted from the diet, a recommendation to increase whole grain intake forces one to look for different options. Fortunately the variety of nutritious gluten free whole grains is impressive in both scope and flavor. Within the challenge of the gluten-free diet, an opportunity exists to increase variety and nutrient content through the incorporation of gluten-free whole grains. Bon appetit! ■

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