

KEEPING KIDS FROM FALLING SHORT

Part I. Whole Grain Basics

The recently released Dietary Guidelines for Americans (2005) and MyPyramid recommend that Americans make half of their grain intake whole grain. Most children and adults are encouraged to eat at least three whole grain servings daily. To incorporate whole grain foods into cafeteria menus, school foodservice personnel need to know 1) what a whole grain is, 2) how to identify whole grain foods, and 3) the health benefits associated with whole grain foods.

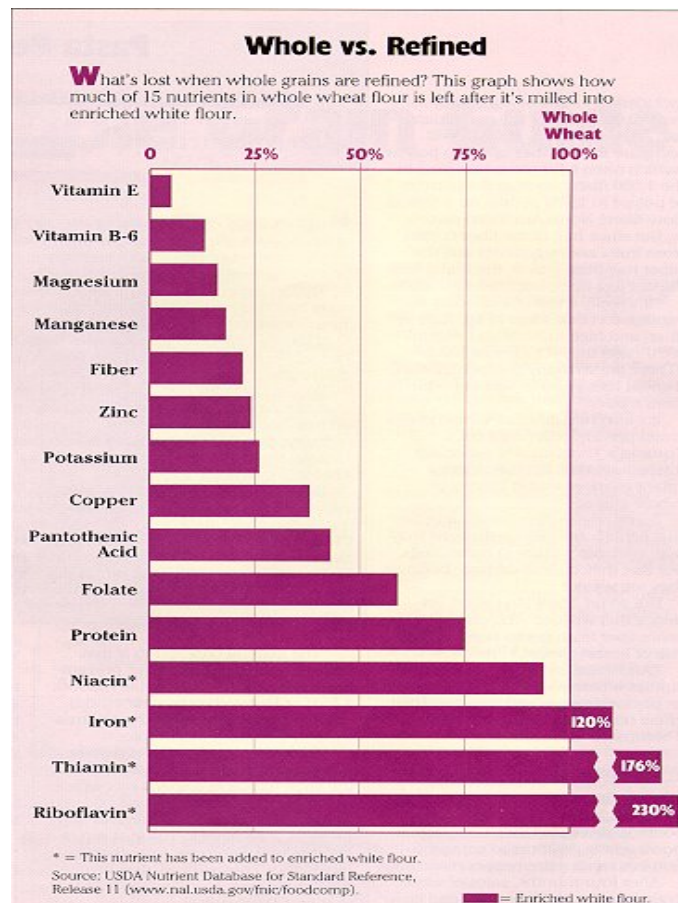
1) What is a whole grain?

Whole grain vs. refined grain

A **whole grain** is defined as containing the entire seed of the plant, including the bran (outer shell that protects the seed), the endosperm (largest part of the grain kernel containing starchy carbohydrates) and the germ (nourishment for the seed). The **bran** contains antioxidants, B vitamins, fiber and trace minerals. The **endosperm** provides energy, proteins and small amounts of B vitamins and minerals. The **germ** contains some B vitamins, vitamin E, some protein, minerals, fats and phytonutrients. After processing the whole grain, the correct proportions of each part of the seed must be present in the grain to be considered whole grain.

Refined grain products are those made with grain that has had one or more parts of the grain kernel removed during processing (e.g., all-purpose flour, white rice). Typically, refined grain includes only the endosperm.

The USDA defines a grain serving as containing **16 grams** of flour. This means 48 grams of whole grain flour must be consumed to meet the 3 daily recommended servings of whole grain foods.



Background Information

Enriched flour is refined flour with some nutrients added back. According to the FDA, a pound of enriched flour must have the following quantities of nutrients to qualify: 2.9 milligrams of thiamin, 1.8 milligrams of riboflavin, 24 milligrams of niacin, 0.7 milligrams of folic acid and 20 milligrams of iron. (Note that the first four are B vitamins.) Calcium may also be added at a minimum of 960 milligrams per pound.

Enriching is necessary because the processing used to make white refined flour removes some of the nutrients that were originally present in the whole grain. These nutrients promote good health and help to prevent some diseases. It is because of these benefits that enriched flour is so prevalent today despite there being no FDA regulations requiring its use. The word "enriched" is used instead of "fortified" to indicate the nutrients are added for the purpose of replacing those lost in the flour processing.

Different types of flour

Whole wheat flour is available in different classes based on the characteristics of the wheat (hardness of the grain, color of the kernel, and the time of planting). For purchasing, the specifications of primary importance are the color and the hardness of the grain. The color of the grain determines the color of the final product. **Red wheat** flour yields a darker product and **white wheat** flour yields a lighter product. White wheat tends to be less hardy than red wheat while it is being grown. In the U.S., red wheat is more prevalent and less expensive than white wheat.

The hardness of the grain determines its protein content. The harder the grain, the more protein it contains. While the difference in the amount of protein is nutritionally insignificant, it does make a difference in terms of baking. **Soft wheat** contains the least amount of protein and is commonly used for cakes, cookies, pastries, crackers and cereals. **Hard wheat**, which contains more protein, is commonly used for yeast breads. **Durum wheat** contains the most protein and is commonly used for pasta.

Although white wheat is common in Britain, American farmers ended up growing the red wheat brought to the Great Plains in the 1870s by Mennonite immigrants from Germany and Russia. Red wheat is the primary US wheat crop. White wheat accounts for just a fraction of the U.S. wheat crop (1-5%). About 305 million bushels of white wheat were grown in 2003, the last year for which data were available. White wheat is grown mostly in the Pacific Northwest, the Great Plains and Michigan, according to the National Agricultural Statistics Service.

The tannins and phenolic compounds in the outer bran of the red wheat, commonly used to make red whole-wheat flour, can give it a bitter taste. **Phenolic compounds, including tannins**, are essential for the growth and reproduction of plants. They are produced as a response to external stimuli such as microbial infections, ultraviolet radiation and chemical stressors. White wheat doesn't have those compounds and therefore tastes sweeter in comparison. The chemicals that give red wheat its bitter taste are actually part of the plant's protection system. The taste is a repellent for pests.

2) Ways to identify whole grain foods

Ingredient list

Look for whole grain as the first ingredient in the ingredient list to help determine whether the product is whole grain. Because ingredients are listed on packages in order by weight, it is important that the whole grain ingredient be first in the list of ingredients to ensure that the product is predominately whole grain. There may be several sources of whole grains in one food. The first ingredient will represent the primary ingredient in the product. However, if the second, third and fourth ingredients are refined grains, the product may still represent an important source of whole grain. Terms such as “whole grain,” “whole wheat” and “brown rice” indicate they contain all parts of the grain. Terms such as “unbleached flour,” “wheat flour,” “bran,” “enriched flour” and “corn meal,” indicate that parts of the grains are missing.

FDA-authorized health claim

According to the Food and Drug Administration regulations, the health claim can be listed on a product if it includes 51% or more of whole grains by weight per reference amount commonly consumed. The product must also contain all portions of the grain kernel and be low in fat, saturated fat and cholesterol. The first health claim was approved as follows:

Diets rich in whole grain foods and other plant foods, and low in total fat, saturated fat, and cholesterol may reduce the risks of heart disease and certain cancers.

A second health claim was approved in 2003 and the labeling statement was approved as follows:

Diets rich in whole grain foods and other plant foods, and low in saturated fats, and cholesterol, may reduce the risk of heart disease and certain cancers.

The second health claim recognized that saturated fat and cholesterol are related to heart disease and not necessarily total fat. Therefore, whole grain foods that are moderate in fat can carry a health claim. Not all manufacturers use the health claim. Some products may be qualified to carry the claim but do not.

Information on the package including symbols and stamps

Some food manufacturers have developed symbols to identify whole grain foods as good, excellent or excellent/100% whole grains. The Whole Grain Council provides stamps to help consumers find the amount of whole grain in products ($\geq 8-15g$) and ($\geq 16g$ and 100% whole grain). Not all whole grain products carry the stamp since manufacturers have to pay to use the Whole Grain Council stamps.

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Check the package label. You may see marketing terms that indicate a product is whole grain. Some products have banners indicating they are “made with whole grain,” others use terms like “whole grain classics” or provide the grams of whole grain in the product on the front of the package. Other terminology used on packaging may create confusion about which foods are whole grain. For example, “100% wheat” only means the product is made from wheat, but doesn’t indicate if it is whole or refined. A product labeled “multi-grain” is made of several different types of grain, but they may not be whole grain. “Stone-ground” refers to the way the grain was processed. It doesn’t indicate if the ground product was separated to remove the bran or germ or kept intact. The best way to identify a whole grain food is to look at the ingredient list and then for other helpful indicators. Do not depend on the color, texture or marketing terms.

3) Benefits from eating whole grain foods

Whole grains contain disease-fighting phytonutrients and antioxidants, B vitamins, vitamin E, magnesium, iron, zinc, copper and fiber. **Phytonutrients** are non-nutritive substances in plants that possess health-protective effects. Whole grains contain an abundance of phenolic compounds, terpenoids, pigments and other natural antioxidants that have been associated with protection from chronic diseases such as heart disease, cancer and diabetes.

Epidemiological evidence shows that at least three daily servings of whole grains can decrease the risk of heart disease by 25-36%, stroke by 36%, type 2 diabetes by 21-35%, digestive system cancers by 21-43% and hormone-related cancers by 10-40%. People who consume whole grains at higher levels are at a decreased risk of obesity and may have lower cholesterol.

Why is it important to eat grains, especially whole grains? (From MyPyramid.gov)
Eating grains, especially whole grains, provides health benefits. People who eat whole grains as part of a healthy diet have a reduced risk of some chronic diseases. Grains provide many nutrients that are vital for the health and maintenance of our bodies.

Health benefits

- Consuming foods rich in fiber, such as whole grains, as part of a healthy diet, reduces the risk of coronary heart disease.
- Consuming foods rich in fiber, such as whole grains, as part of a healthy diet, may reduce constipation.
- Eating at least 3 ounce equivalents a day of whole grains may help with weight management.
- Eating grains fortified with folate before and during pregnancy helps prevent neural tube defects during fetal development.

Nutrients

Grains are important sources of many nutrients, including dietary fiber, several B vitamins (thiamin, riboflavin, niacin and folate) and minerals (iron, magnesium and selenium).

- B vitamins (thiamin, riboflavin, niacin) play a key role in metabolism – they help the body release energy from protein, fat and carbohydrates. B vitamins are also essential for a healthy nervous system. Many refined grains are enriched with these B vitamins.
- Folate (folic acid), another B vitamin, helps the body form red blood cells. Women of childbearing age who may become pregnant and those in the first trimester of pregnancy should consume adequate folate, including folic acid from fortified foods or supplements. This reduces the risk of neural tube defects, spina bifida and anencephaly during fetal development.
- Iron is used to carry oxygen in the blood. Many teenage girls and women in their childbearing years have iron-deficiency anemia. They should eat foods high in heme iron (meats) or other iron-containing foods. Consuming foods rich in vitamin C can improve absorption of non-heme iron. Whole and enriched refined grain products are major sources of non-heme iron in American diets.
- Whole grains are sources of magnesium and selenium. Magnesium is a mineral used in building bones and releasing energy from muscles. Selenium protects cells from oxidation. It is also important for a healthy immune system.
- Dietary fiber from whole grains, as part of an overall healthy diet, helps reduce blood cholesterol levels and may lower the risk of heart disease. Fiber is important for proper bowel function. It helps reduce constipation and diverticulosis. Fiber-containing foods, such as whole grains, help provide a feeling of fullness with fewer calories. Whole grains are good sources of dietary fiber; most refined (processed) grains contain little fiber.

A note about the fiber content: Some whole grain products have a higher fiber content compared to refined grain counterparts (as indicated on the Nutrition Facts Panel), but this not a foolproof way to identify a whole grain product. The fiber content of a food depends on the type of grain used. Some grains contain less fiber than others. Fiber content can vary with as little as 3.5% in rice to over 15% in barley and bulgur. Even if both fiber and whole grains have health benefits, they are not interchangeable.

For example:

Grain (100 grams)	Fiber
Whole wheat	12.2 grams
Whole corn meal	7.3 grams
Brown rice	1.8 grams

The amount of fiber in a food made with these grains will also vary (a 30-gram serving of brown rice has 0.5 grams of fiber and a 30-gram serving of corn chips

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made with whole corn meal has 1 gram of fiber). Both are considered whole grain foods.

Heart disease

Recent review articles summarized the protective effects of whole grains on the reduction of risk of heart disease. Several large epidemiological studies showed an inverse relationship between higher levels of whole grain consumption and lower risk for heart disease. Those who usually ate whole grain foods had a 20-40% lower long-term risk of developing heart disease compared to those who rarely ate whole grain foods. The benefits were attributed to components of whole grain foods including fiber, vitamins and minerals, healthy fats and antioxidant compounds. Since high blood cholesterol is a major risk factor for heart disease, components of whole grain that can lower blood lipids can help to reduce risk for heart disease. In addition, antioxidant compounds may further reduce risk through other effects.

References

- Seal CJ. Whole grains and CVD risk. *The Proceedings of the Nutrition Society* 2006;65:24-34.
- Jacobs DR, Gallaher DD. Whole grain intake and cardiovascular disease: a review. *Current Atherosclerosis Reports* 2004;6:415-423.
- Anderson JW. Whole grains protect against atherosclerotic cardiovascular disease. *The Proceedings of the Nutrition Society* 2003;62:135-142.

Type 2 diabetes

Several recent studies have evaluated the effects of whole grains on blood glucose and insulin outcomes and showed that consumption of whole grains can decrease insulin resistance. On a longer term basis, other major epidemiological studies showed that higher intake of whole grains was related to a 21-35% decreased risk of diabetes. It has been suggested that nutrients such as magnesium, fiber, vitamin E and other compounds in whole grain foods are involved in carbohydrate metabolism and blood glucose management, thereby contributing to the lower risk of diabetes.

References

- Sayhoun NR, Jacques PF, Zhang XL, Juan W, McKeown NM. Whole-grain intake is inversely associated with the metabolic syndrome and mortality in older adults. *American Journal of Clinical Nutrition* 2006;83:124-131.
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Weight control

Several epidemiologic studies have found a protective relationship between whole grain intake and body weight, risk for overweight and weight gain; however clinical trials

Background Information

which help to determine the mechanisms whereby whole grain components affect weight management are limited.

References

- Bazzano LA, Song Y, Bubes V, Good CK, Manson JE, Liu S. Dietary intake of whole and refined grain breakfast cereals and weight gain in men. *Obesity Research* 2005;13:1952-1960.
- Koh-Banerjee P, Rimm EB. Whole grain consumption and weight gain: a review of the epidemiological evidence, potential mechanisms and opportunities for future research. *The Proceedings of the Nutrition Society* 2003;62:25-29.

Cancer

Two review articles addressed the relationship between intake of whole grain foods and incidence of gastrointestinal and hormone dependent cancers. Both articles showed a protective relationship between eating high levels of whole grain foods and decreased risk for cancer at most sites. Suggested mechanisms were related to the carbohydrates in whole grains and their fermentation, effects on bulk and transit time, as well as other components that have antioxidant effects or affect sex hormone production.

References

- La Vecchia C, Chatenoud L, Negri E, Franceschi S. Whole cereal grains, fibre and human cancer; whole grain cereals and cancer in Italy. *The Proceedings of the Nutrition Society* 2003;62:45-49.
- Jacobs DR, Marquart L, Slavin J, Kushi L. Whole-grain intake and cancer: An expanded review and meta-analysis. *Nutrition and Cancer* 1998;130:85-96.

Recommendations for whole grain intake

The recommended intake of grain and whole grain ounce equivalents is based on the age and gender of children who engage in less than 30 minutes of moderate or vigorous activity (such as playing, running, biking or participating in sports) in addition to their normal daily routine.

What kind of grains count for school lunch?

USDA established criteria for determining acceptable grains/bread and equivalent serving sizes under the food-based menu planning alternatives. The following grains and breads, whether whole or refined/enriched grains, meet these criteria:

- Biscuits, bagels, rolls, tortillas, muffins or crackers
- Cereal grains (rice, bulgur, oatmeal, corn grits, wheat or couscous)
- Ready-to-eat breakfast cereals
- Cereals or bread products used as an ingredient in another menu item (crispy rice treats, oatmeal cookies or breading on fish or poultry)
- Macaroni or noodle products
- Sweet foods (toaster pastries, coffee cake, doughnuts, sweet rolls, cookies, cakes or formulated grain-fruit products) when served as permitted
- Pie crust when served as permitted
- Non-sweet snack products (hard pretzels, hard bread sticks and chips)

Grain serving sizes

Grain	Ounce Equivalent
Bagels	1 “mini” bagel
Bread	1 slice
Crackers	5 whole wheat crackers; 2 rye crispbreads
English muffin	1/2 muffin
Muffins	1 small (2.5” diameter)
Oatmeal	1/2 cup cooked
Pancakes	1 (4.5” diameter) whole wheat or buckwheat pancake
Popcorn	3 cups (popped)
Ready-to-eat breakfast cereal	1 cup flakes or rounds; 1.25 cups puffed
Rice	1/2 cup cooked (1 ounce dry)
Pasta	1/2 cup cooked (1 ounce dry)
Tortillas	1 small (6” diameter) flour or corn tortilla

In order to consume the equivalent of 48 grams of whole grains, one can eat three servings of whole grain products containing 16 or more grams of whole grain, or six servings of partial whole grain products containing 8 grams of whole grain or some combination of these sources.

Summary

The recently released Dietary Guidelines for Americans (2005) and MyPyramid recommend that Americans make half of their grain intake whole grain. Most children and adults are encouraged to eat at least three whole grain servings daily.

Whole grains contain all three parts of the kernel: bran, endosperm and germ. Since refined grains only contain the endosperm, most are enriched with B vitamins and iron. Important health benefits are derived from consuming whole grains.

Determining the whole grain content of foods based upon the information on the labels can be challenging.