

OVERVIEW OF THE SCIENCE OF WHOLE GRAINS

This report summarizes the principal scientific evidence presented
at the Whole Grains Go Mainstream Conference
in New Orleans, LA, November 14-16, 2004.

Signatories of the Scientific Overview Report and Scientific Advisors to the Whole Grains Council

Scientific Advisory Co-Chairs:

Len Marquart, PhD, Asst. Professor of Food Science & Nutrition, Univ. of Minnesota

Julie Miller Jones, PhD, Professor of Nutrition, College of St. Catherine

James W. Anderson, MD, Professor, Medicine & Clinical Nutrition, Univ. of Kentucky

K. Dun Gifford, JD, President, Oldways Preservation Trust

Gary Fulcher, PhD, Professor, Cereal Chemistry & Nutrition, Univ. of Minnesota

Victor Fulgoni III, PhD, Nutrition Impact, LLC

Judith Hallfrisch, PhD, Nutrition Consultant

David Jacobs, PhD, Professor, Chronic Disease & Epidemiology, Univ. of Minnesota

Pamela Keagy, PhD, Nutrition Consultant

Pauline Koh-Banerjee, ScD, Asst. Professor, Univ. of Tennessee Health Science Ctr.

Rui Hai Liu, PhD, Asst. Professor, Food Science & Toxicology, Cornell University

Simin Liu, MD, ScD, Harvard School of Public Health, Brigham & Women's Hospital

Lloyd Rooney, PhD, Cereal Quality Lab, Texas A&M University

Joanne Slavin, PhD, RD, Professor, Food Science & Nutrition, Univ. of Minnesota

WHOLE GRAINS: HOW MUCH, HOW OFTEN?

What is a whole grain?

The following definition was developed and ratified by the Whole Grains Council:

Whole grains or foods made from them contain all the essential parts and naturally-occurring nutrients of the entire grain seed. If the grain has been processed (e.g., cracked, crushed, rolled, extruded, lightly pearled and/or cooked), the food product should deliver approximately the same rich balance of nutrients that are found in the original grain seed.

Examples of generally accepted whole grain foods and flours are: Amaranth, Barley (lightly pearled), Brown and Colored Rice, Buckwheat, Bulgur, Corn and Whole Cornmeal, Emmer, Farro, Grano (lightly pearled wheat), Kamut, Millet, Oatmeal and Whole Oats, Popcorn, Quinoa, Sorghum, Spelt, Triticale, Whole Rye, Whole or Cracked Wheat, Wheat Berries, and Wild Rice.

Why should you eat whole grains?

- Whole grains lower the risk for diabetes, heart disease, high blood pressure and certain cancers.
- Whole grains help promote healthy bowel functions.
- Whole grains help regulate body weight; those who eat more whole grains may specifically avoid weight gain around the waist, which is a risk factor for many diseases.

How much whole grain should you eat every day?

- Studies show health benefits at about three servings per day. The new 2005 Dietary Guidelines are poised to recommend:
- Everyone age 9 and up should eat at least 3 servings of whole grains per day.
- Men aged 14-50 and active women should eat an additional serving or two of whole grains, depending on their age and activity level.

What equals three servings of whole grains?

The USDA defines a grain serving as a grain product containing 16 grams of flour. As a result, three servings would be 48 grams of whole grain ingredients.

The USDA recommends meeting the daily requirement by eating:

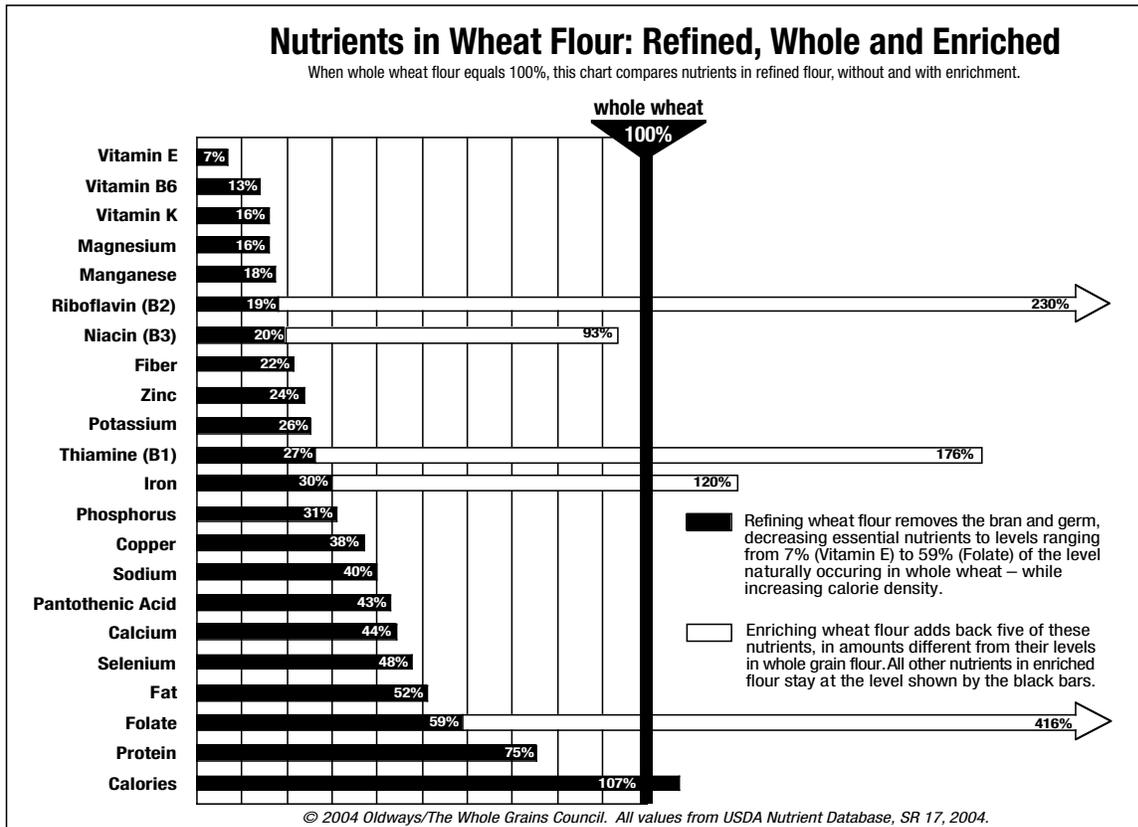
- Three ounces of breads, rolls, cereals or other grain foods made with 100% whole grains. A slice of bread or a serving of breakfast cereal usually weighs about an ounce.

If new labeling descriptive claims now under consideration by FDA are approved, consumers will be able to find their three whole grain servings by eating:

- Six foods labeled “a Good Source of Whole Grain,” since “Good Source” will mean at least 8 grams of whole grain per serving
- Three foods labeled “an Excellent Source of Whole Grain,” since “Excellent Source” will mean at least 16 grams of whole grain per serving

COMPARISON OF GRAIN NUTRIENTS

Whole grains, refined grains, and enriched grains contain different amounts of nutrients. Since wheat is the grain most commonly consumed in the U.S., this chart compares the nutrients for whole wheat flour, refined wheat flour (wheat with almost all bran and germ removed) and enriched wheat flour (refined flour with some nutrients added back in).



Many people mistakenly believe that enriching white flour brings the level of all nutrients back to that of whole grain flour. As shown here,

- most lost nutrients are not replaced,
- two (niacin and iron) are replaced in amounts similar to original. and
- three (thiamine, riboflavin and folate) are replaced at much higher levels than original.

While this example focuses on wheat, the most widely-consumed grain in the United States, other grains also lose a good part of their nutrients when refined by removal of the bran and germ.

It's also important to keep in mind that the nutrients listed above do *not* include all the different antioxidants and phytonutrients thought to contribute to the health benefits of whole grains. Many other useful nutrients – and some other, no doubt, still to be discovered – are removed when whole grains are refined.

THE 2005 DIETARY GUIDELINES

The 2005 Dietary Guidelines Advisory Committee Report

The 2005 Dietary Guidelines Advisory Committee Report recommends a substantial increase in consumption of whole grains. While the Guidelines will not be finalized until early 2005, it is expected that they will follow the Advisory Committee Report.

Overall Grain Conclusion of the Report

Part D, Section 5, Page 3

“Consuming at least 3 servings (approximately equivalent to 3 ounces¹) of whole grains per day can reduce the risk of diabetes and CHD [coronary heart disease] and help with weight maintenance. Thus, daily intake of three or more servings of whole grains per day is recommended, preferably by substituting whole grains for refined grains.”

Revised USDA Food Intake Patterns for Meeting Recommended Nutrient Intakes

Table D-13

Servings of whole grain	Females		Males	
	Total Grain	Whole Grain	Total Grain	Whole Grain
Age 9-13	5	3	6	3
Age 14-18	6	3	7	3.5
Age 19-30	6	3	8	4
Age 31-50	6	3	7	3.5
Age 51 and up	5	3	6	3

“The whole grain subgroup amounts shown in this table represent at least 3 one-ounce servings, and one-half of the total amount as whole grains for all calorie levels of 1600 and above... This is the minimum suggested amount of whole grains to consume as part of the food patterns. More whole grains up to all of the grains recommended may be selected, with offsetting decreases in the amounts of other (enriched) grains.”

Definitions:

“Whole Grains. All whole grain products and whole grains used as ingredients: for example, whole wheat and rye breads, whole grain cereals and crackers, oatmeal, brown rice.”

“Other Grains. All refined grain products and refined grains used as ingredients: for example, white breads, enriched grain cereals and crackers, enriched pasta, white rice.”

Notes:

(1) *Scientists generally have recommended at least 3 servings of 16 grams of whole grain daily. The Advisory Report recommends at least 3 servings of one ounce (28.35 grams) each. These are roughly equivalent because scientists are measuring only the whole grain ingredients in a product, while the Report is measuring total product weight. A one-ounce slice of whole-wheat bread, for instance, contains about 16.8 grams of whole wheat. The rest of the weight consists of moisture, oil, and other ingredients.*

MAJOR HEALTH BENEFITS OF WHOLE GRAINS

Hundreds of studies around the world, using different grains in different cultures, provide solid backing for the many health benefits of whole grains. These benefits can be attributed not just to fiber but also to the many phytonutrients in whole grains. Studies indicate that:

1. **Whole grains lower the risk of Type 2 Diabetes;** they are now recommended by the American Diabetes Association for diabetes prevention.

Dr. Nicola McKeown and fellow researchers at Tufts University found that people who eat three or more servings of whole grains a day, especially from high-fiber cereals, are less likely to develop insulin resistance and metabolic syndrome, common precursors of both Type 2 diabetes and cardiovascular disease.

Diabetes Care, February 2004; vol 27: 538-546

2. **Whole grains lower the risk of cardiovascular disease.** Among other mechanisms, whole grains help blood vessels resist the impact of high-fat meals.

Researchers led by Dr. Mark Pereira collected data on 91,058 men and 245,186 women who participated in 10 studies in the US and Europe. After 6-10 years of follow-up, the research showed that, for each 10 grams of fiber consumed per day, there was a 14% reduction in heart disease risk and a 25% reduction in risk of dying from heart disease. In short, the cereal fiber in whole grains appears to make heart disease much less likely—and less serious if it does occur.

Archives of Internal Medicine, February 2004; vol 164: 370-37

3. **Whole grain consumption improves blood pressure control** and reduces the need for antihypertensive medications.

University of Minnesota researchers working with Dr. Joel Pins found that almost three-quarters of patients with high blood pressure were able to reduce or even eliminate their anti-hypertensive medications, when they ate a whole-grain oat-based breakfast cereal regularly.

Journal of Family Practice, April 2002; vol 51(4): 353-9

4. **Whole grains lower the risk of some cancers,** including colon, stomach and pancreatic cancer. The reduction of insulin levels may in part explain this, since higher insulin levels in the blood are associated with a higher risk of some cancers.

At the Univ. of Utah, a team led by Dr. Martha Slattery found that high intakes of vegetables, fruits and whole grains reduced the risk of rectal cancer by 28%, 27% and 31% respectively. A high-fiber diet (more than 34 grams of fiber per day) reduced rectal cancer by an impressive 66%, in this study of over 2000 people.

American Journal of Clinical Nutrition, February 2004; vol 79: 2/274-281

5. **Whole grains help regulate body weight.** Repeated studies have shown that people who eat more whole grains tend to gain less weight and have a healthier waist-to-hip ratio. This may be because whole grains require chewing and are digested slowly, both of which contribute to feelings of fullness and delay the return of hunger pangs.

As part of the Nurses' Study, Dr. Simin Liu and fellow researchers at the Harvard School of Public Health followed over 74,000 women from 1984-1996, and concluded that women who consumed more whole grains consistently weighed less than women who consumed less whole grains.

American Journal of Clinical Nutrition, November 2003; vol 78: 5/920-927

In the companion study among male health professionals, Dr. Pauline Koh-Banerjee and colleagues at the Harvard School of Public Health followed over 27,000 men for eight years, and reported that increasing consumption of whole grains significantly protected against weight gain. For every 40 gram increase in whole grains consumed per day (ie approximate amount found in 1 1/2 cups of brown rice), long-term weight gain was reduced by 1.1 kg.

American Journal of Clinical, Nutrition November 2004; vol 80; 5/1237-1245

6. **Whole grains help promote regular healthy bowel functions** by bulking up feces and speeding transit time. This may also contribute to the reduction in cancer risk, as constipation allows cancer-promoting toxins more time to interact with the lining of the intestines.

Dr. Judith Marlett, at the University of Wisconsin, studied the effects of increasing amounts of dietary fiber in the diet and found that whole grains and other high-fiber foods improve bowel function. Her team concluded that regular consumption of both whole grains and legumes is necessary to get enough dietary fiber.

American Journal of Clinical Nutrition, Sept. 1988; vol 68(3); 615-22

7. Several studies suggest that **whole grains reduce the overall risk of death** from all causes.

In another Harvard School of Public Health study, Dr. Simin Liu, Dr. Walter Willett and others found that total mortality and deaths from cardiovascular disease were reduced in men eating as little as one serving per day of whole grains, regardless of the men's age, weight, or history of smoking – and regardless of multi-vitamin use.

American Journal of Clinical Nutrition, March 2003; vol 77(3): 594-9