

BROWN RICE NATURAL PHYTONUTRIENTS ARE SUPERIOR TO WHITE RICE IN HOLISTIC HEALTHCARE

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ABSTRACT

Brown rice is whole grain rice, with the inedible outer hull removed; white rice is the same grain with the hull, bran layer and cereal germ removed. Red rice, gold rice, and black rice (sometimes known as purple rice) are all whole rices, but with a differently-pigmented outer layer. Any type of rice may be eaten whole. Whole rice has a mild, nutty flavor, and is chewier and more nutritious than white rice. A thiamine-deficient diet including only white rice can cause beriberi; the disease can be prevented, and treated, by eating whole rice instead. Rice plants accumulate arsenic, and there have been concerns over excessive arsenic levels in rice. There is more arsenic in the bran, so brown rice contains more arsenic. The European Union has introduced regulations on arsenic in rice, but the United States has not.

Brown rice and white rice have similar amounts of calories and carbohydrates. White rice, unlike brown rice, has the bran and germ removed; and has different nutritional content. Brown rice is a whole grain and a good source of magnesium, phosphorus, selenium, thiamine, niacin, vitamin B₆, and manganese, and is high in fiber. When only the outermost layer of a grain of rice (the husk) is removed, brown rice is produced. To produce white rice, the next layers underneath the husk (the bran layer and the germ) are removed, leaving mostly the starchy endosperm. Several vitamins and dietary minerals are lost in this removal and the subsequent polishing process. A part of these missing nutrients, such as vitamins B₁ and B₃, and iron are sometimes added back into the white rice. In the US the result is called "enriched rice", and must comply with Food and Drug Administration (FDA) regulations for this name to be used. One mineral not added back into white rice is magnesium; one cup (195 g) of cooked long grain brown rice contains 84 mg of magnesium, while one cup of white rice contains 19 mg.

When the bran layer is removed to make white rice, the oil in the bran is also removed. Among other nutrients lost are dietary fiber and small amounts of fatty acids. It has been found that germinated grains in general have nutritional advantages. Germinated brown rice (GBR), developed during the International Year of Rice, is brown rice that has been soaked for 4–20 hours in warm 40°C (104°F) water before cooking. This stimulates germination, which activates various enzymes in the rice, giving rise to a more complete amino acid profile, including GABA. Cooked brown rice tends to be chewy; cooked GBR is softer, and preferred particularly by children. Brown rice generally needs longer cooking times than white rice, unless it is broken or flourblasted (which perforates the bran without removing it). Parboiled rice is a modified process that forces into the kernel some of the vitamins found in the hull before the hull is removed. The process provides more nutrition than white rice while shortening the time necessary for final meal preparation. Some white rices are also fortified. Brown rice has a shelf life of approximately 6 months, but hermetic storage, refrigeration or freezing can significantly extend its lifetime. Freezing, even periodically, can also help control infestations of Indian meal moths.

KEYWORDS: Hull, Aleurone, DRI, DV, SOD, Bran, Brown Rice, White Rice, Nutrients, Macronutrients, Micronutrients, Lignans, Enterolactone, Enterodiol.

INTRODUCTION

Rice is one of the most important foods in the world, supplying as much as half of the daily calories for half of the world's population. No wonder that in Asian countries, such as Thailand, rice is so highly valued that the translation of the word "to eat" literally means "to eat rice."^[1]

Asked to name the types of rice they are familiar with, people may be able to recall one or two. Yet, in actuality there is an abundance of different types of rice—over 8,000 varieties. Oftentimes, rice is categorized by its size as being either short grain, medium grain or long grain. Short grain, which has the highest starch content, makes the stickiest rice, while long grain is lighter and tends to remain separate when cooked. The qualities of medium

grain fall between the other two types. The scientific name for rice is *Oryza sativa*. Another way that rice is classified is according to the degree of milling that it undergoes. This is what makes a brown rice different than white rice. Brown rice, often referred to as whole rice or cargo rice, is the whole grain with only its inedible outer hull removed. Brown rice still retains its nutrient-rich bran and germ. White rice, on the other hand, is both milled and polished, which removes the bran and germ along with all the nutrients that reside within these important layers.^[2]

Some of the most popular varieties of rice in this country include

- Arborio: A round grain, starchy white rice, traditionally used to make the Italian dish *risotto*.
- Basmati: An aromatic rice that has a nutlike fragrance, delicate flavor and light texture.
- Sweet rice: Almost translucent when it is cooked, this very sticky rice is traditionally used to make sushi and mochi.
- Jasmine: A soft-textured long grain aromatic rice that is available in both brown and white varieties.

- Bhutanese red rice: Grown in the Himalayas, this red colored rice has a nutty, earthy taste.
- Forbidden rice: A black colored rice that turns purple upon cooking and has a sweet taste and sticky texture.

In some parts of the world, the word "to eat" literally means "to eat rice." All varieties of rice are available throughout the year, supplying as much as half of the daily calories for half of the world's population.

The process that produces brown rice removes only the outermost layer, the hull, of the rice kernel and is the least damaging to its nutritional value. The complete milling and polishing that converts brown rice into white rice destroys 67% of the vitamin B₃, 80% of the vitamin B₁, 90% of the vitamin B₆, half of the manganese, half of the phosphorus, 60% of the iron, and all of the dietary fiber and essential fatty acids. Fully milled and polished white rice is required to be "enriched" with vitamins B₁, B₃ and iron.^[3]

Brown Rice, long grain, cooked (1.00 cup=195.00 g), GI=Low			
BASIC MACRONUTRIENTS AND CALORIES			
Nutrient	Amount	DRI/DV (%)	
Protein	5.03 g	10	
Carbohydrates	44.77 g	20	
Fat – total	1.75 g	--	
Dietary Fiber	3.51 g	14	
Calories	216.45	12	
Brown Rice, long grain, cooked 1.00 cup (195.00 grams) Calories: 216; GI=Low			
BASIC MICRONUTRIENTS			
Nutrient	DRI/DV	Nutrient Density	World's Healthiest Foods Rating
Manganese	88%	7.3	Excellent
Selenium	35%	2.9	Good
Phosphorus	23%	1.9	Good
Magnesium	21%	1.8	Good
Copper	21%	1.7	Good
Vitamin B ₃	19%	1.5	Good

World's Healthiest Foods Rating: DRI=Dietary Reference Intakes, DV= Daily Value (DV)

Excellent	DRI/DV>=75% OR Density>=7.6 and DRI/DV>=10%
Very good	DRI/DV>=50% OR Density>=3.4 and DRI/DV>=5%
Good	DRI/DV>=25% OR Density>=1.5 and DRI/DV>=2.5%

Table-1: DRI & DV of Brown Rice

This chart graphically details the %DV that a serving of Brown rice provides for each of the nutrients of which it is a good, very good, or excellent source according to Food Rating System.^[4]



Figure-1: Cooked Brown Rice & White Rice

Health Benefits

Why Brown--But Not White--Rice is One of the World's Healthiest Foods

The difference between brown rice and white rice is not just color! A whole grain of rice has several layers. Only the outermost layer, the *hull*, is removed to produce what we call brown rice. This process is the least damaging to the nutritional value of the rice and avoids the unnecessary loss of nutrients that occurs with further processing. If brown rice is further milled to remove the bran and most of the germ layer, the result is a whiter rice, but also a rice that has lost many more nutrients. At this point, however, the rice is still unpolished, and it takes polishing to produce the white rice we are used to seeing. Polishing removes the *aleurone layer* of the grain--a layer filled with health-supportive, essential fats. Because these fats, once exposed to air by the refining process, are highly susceptible to oxidation, this layer is removed to extend the shelf life of the product. The resulting white rice is simply a refined starch that is largely bereft of its original nutrients.^[5]

Our food ranking system qualified brown rice as an excellent source of manganese, and a good source of selenium, phosphorus, copper, magnesium, and niacin (vitamin B₃). By law in the United States, fully milled and polished white rice must be "enriched" with vitamins B₁, B₃, and iron. But the form of these nutrients when added back into the processed rice is not the same as in the original unprocessed version, and at least 11 lost nutrients are not replaced in any form even with rice "enrichment."

Here are some of the ways in which the nutrients supplied by brown rice can make an important difference in your health:

Manganese—Energy Production Plus Antioxidant Protection

Manganese helps produce energy from protein and carbohydrates and is involved in the synthesis of fatty acids, which are important for a healthy nervous system, and in the production of cholesterol, which is used by the body to produce sex hormones. Manganese is also a critical component of a very important antioxidant enzyme called *superoxide dismutase*. *Superoxide dismutase* (SOD) is found inside the body's *mitochondria* (the oxygen-based energy factories inside most of our cells) where it provides protection against damage from the free radicals produced during energy production.

Women Who Eat Whole Grains Weigh Less

A study published in the *American Journal of Clinical Nutrition* underscores the importance of choosing whole grains such as brown rice rather than refined grain, i.e., white rice, to maintain a healthy body weight. In this Harvard Medical School/Brigham and Women's Hospital study, which collected data on over 74,000 female nurses aged 38-63 years over a 12 year period, weight gain was inversely associated with the intake of high-fiber, whole-grain foods but positively related to the intake of refined-grain foods. Not only did women who consumed more whole grains consistently weigh less than those who ate less of these fiber-rich foods, but those consuming the most dietary fiber from whole grains were 49% less likely to gain weight compared to those eating foods made from refined grains.^[6]



Figure-2: Uncooked Brown Rice & White Rice

Brown Rice is Rich in Fiber and Selenium

For people worried about colon cancer risk, brown rice packs a double punch by being a concentrated source of the fiber needed to minimize the amount of time cancer-causing substances spend in contact with colon cells, and being a good source of selenium, a trace mineral that has been shown to substantially reduce the risk of colon cancer.^[7]

Selenium is an essential component of several major metabolic pathways, including thyroid hormone metabolism, antioxidant defense systems, and immune function. Accumulated evidence from prospective studies, intervention trials and studies on animal models of cancer has suggested a strong inverse correlation between selenium intake and cancer incidence. Several mechanisms have been suggested to explain the cancer-preventive activities of selenium. Selenium has been shown to induce DNA repair and synthesis in damaged cells, to inhibit the proliferation of cancer cells and to induce their *apoptosis*, the self-destruct sequence the body uses to eliminate worn out or abnormal cells.

In addition, selenium is incorporated at the active site of many proteins, including *glutathione peroxidase*, which is particularly important for cancer protection. One of the body's most powerful antioxidant enzymes, *glutathione peroxidase* is used in the liver to detoxify a wide range of potentially harmful molecules. When levels of *glutathione peroxidase* are too low, these toxic molecules are not disarmed and wreak havoc on any cells with which they come in contact, damaging their cellular DNA and promoting the development of cancer cells.

Not only does selenium play a critical role in cancer prevention as a cofactor of *glutathione peroxidase*, selenium also works with vitamin E in numerous other vital antioxidant systems throughout the body. These powerful antioxidant actions make selenium helpful in the prevention not only of cancer, but also of heart disease, and for decreasing the symptoms of asthma and the pain and inflammation of rheumatoid arthritis.

Lower Cholesterol with Whole Brown Rice

Here's yet another reason to rely on whole foods, such as brown rice, for your healthy way of eating. The oil in whole brown rice lowers cholesterol. When Marlene Most and colleagues from Louisiana State University evaluated the effects of rice bran and rice bran oil on cholesterol levels in volunteers with moderately elevated cholesterol levels, they found that rice bran oil lowered their LDL (bad) cholesterol.

The study, published in the *American Journal of Clinical Nutrition*, was divided into two parts. First, 26 subjects ate a diet including 13-22g of dietary fiber each day for three weeks, after which 13 switched to a diet that added defatted rice bran to double their fiber intake for five weeks. In the second part of the study, a randomized crossover trial, 14 subjects ate a diet with rice bran oil for 10 weeks. While the diet including only defatted rice

bran did not lower cholesterol, the one containing rice bran oil lowered LDL cholesterol by 7%. Since all the diets contained similar fatty acids, the researchers concluded that the reduction in cholesterol seen in that receiving rice bran oil must have been due to other constituents such as the unsaponifiable compounds found in rice bran oil. The scientists suggest that the unsaponifiables present in rice bran oil could become important functional foods for cardiovascular health. But why extract just *one* beneficial compound from brown rice when you can reap *all* the cardioprotective benefits supplied by the matrix of nutrients naturally present in this delicious whole food? In addition to unsaponifiables, this whole grain also supplies hefty doses of heart-healthy fiber, magnesium, and B vitamins.^[8]

Significant Cardiovascular Benefits for Postmenopausal Women

Eating a serving of whole grains, such as brown rice, at least 6 times each week is an especially good idea for postmenopausal women with high cholesterol, high blood pressure or other signs of cardiovascular disease (CVD).

A 3-year prospective study of over 200 postmenopausal women with CVD, published in the *American Heart Journal*, shows that those eating at least 6 servings of whole grains each week experienced both:

- Slowed progression of atherosclerosis, the build-up of plaque that narrows the vessels through which blood flows, and
- Less progression in stenosis, the narrowing of the diameter of arterial passageways.

The women's intake of fiber from fruits, vegetables and refined grains was *not* associated with a lessening in CVD progression.

Phytonutrients with Health-Promoting Activity Equal to or Even Higher than that of Vegetables and Fruits

Research reported at the American Institute for Cancer Research (AICR) International Conference on Food, Nutrition and Cancer, by Rui Hai Liu, M.D., Ph.D., and his colleagues at Cornell University shows that whole grains, such as rice, contain many powerful phytonutrients whose activity has gone unrecognized because research methods have overlooked them.^[9]

Despite the fact that for years researchers have been measuring the antioxidant power of a wide array of phytonutrients, they have typically measured only the "free" forms of these substances, which dissolve quickly and are immediately absorbed into the bloodstream. They have not looked at the "bound" forms, which are attached to the walls of plant cells and must be released by intestinal bacteria during digestion before they can be absorbed.

Phenolics, powerful antioxidants that work in multiple ways to prevent disease, are one major class of

phytonutrients that have been widely studied. Included in this broad category are such compounds as quercetin, curcumin, ellagic acid, catechins, and many others that appear frequently in the health news.

When Dr. Liu and his colleagues measured the relative amounts of phenolics and whether they were present in bound or free form, in common fruits and vegetables like apples, red grapes, broccoli and spinach, they found that phenolics in the "free" form averaged 76% of the total number of phenolics in these foods. In whole grains, however, "free" phenolics accounted for less than 1% of the total, while the remaining 99% were in "bound" form.

In his presentation, Dr. Liu explained that because researchers have examined whole grains with the same process used to measure antioxidants in vegetables and fruits—looking for their content of "free" phenolics"—the amount and activity of antioxidants in whole grains has been vastly underestimated.

Despite the differences in fruits', vegetables' and whole grains' content of "free" and "bound" phenolics, the total antioxidant activity in all three types of whole foods is similar, according to Dr. Liu's research. His team measured the antioxidant activity of various foods, assigning each a rating based on a formula (micromoles of vitamin C equivalent per gram). Broccoli and spinach measured 80 and 81, respectively; apple and banana measured 98 and 65; and of the whole grains tested, corn measured 181, whole wheat 77, oats 75, and brown rice 56.

Dr. Liu's findings may help explain why studies have shown that populations eating diets high in fiber-rich whole grains consistently have lower risk for colon cancer, yet short-term clinical trials that have focused on fiber alone in lowering colon cancer risk, often to the point of giving subjects isolated fiber supplements, yield inconsistent results. The explanation is most likely that these studies have not taken into account the interactive effects of all the nutrients in whole grains—not just their fiber, but also their many phytonutrients. As far as whole grains are concerned, Dr. Liu believes that the key to their powerful cancer-fighting potential is precisely their wholeness. A grain of whole wheat consists of three parts—its endosperm (starch), bran and germ. When

wheat—or any whole grain—is refined, its bran and germ are removed. Although these two parts make up only 15-17% of the grain's weight, they contain 83% of its phenolics. Dr. Liu says his recent findings on the antioxidant content of whole grains reinforce the message that a variety of foods should be eaten good health. "Different plant foods have different phytochemicals," he said. "These substances go to different organs, tissues and cells, where they perform different functions. What your body needs to ward off disease is this synergistic effect—this teamwork—that is produced by eating a wide variety of plant foods, including whole grains."^[10]

Lignans Protect against Heart Disease

One type of phytonutrient especially abundant in whole grains including brown rice are plant lignans, which are converted by friendly flora in our intestines into mammalian lignans, including one called enterolactone that is thought to protect against breast and other hormone-dependent cancers as well as heart disease. In addition to whole grains, nuts, seeds and berries are rich sources of plant lignans, and vegetables, fruits, and beverages such as coffee, tea and wine also contain some. When blood levels of enterolactone were measured in over 850 postmenopausal women in a Danish study published in the *Journal of Nutrition*, women eating the most whole grains were found to have significantly higher blood levels of this protective lignan. Women who ate more cabbage and leafy vegetables also had higher enterolactone levels.

Reduce Your Risk of Metabolic Syndrome

First we were told, "Don't eat fat, and you'll stay trim." After following this advice only to see obesity expand to never before seen proportions, we're told by the food gurus, "Eating fat is fine. Shun carbohydrates to stay slim."

In our opinion, neither piece of dietary advice is complete, accurate or likely to help us stay slim or healthy. Just as different kinds of fats have different effects in our bodies (e.g., saturated and trans fats are linked to increased risk for cardiovascular disease while ω -3 fats decrease cardiovascular disease risk), some carbohydrates, such as whole grains, are healthful while others, such as refined grains and the foods made from them, are not.^[11]

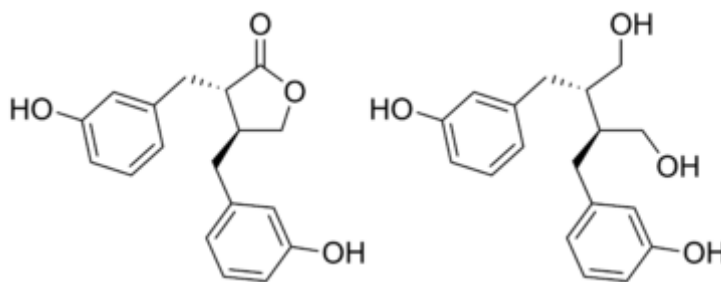


Figure-3: Enterolactone & Enterodiol

The latest research is clearly supporting this vital distinction. Refined grains and the foods made from them (e.g., white breads, cookies, pastries, pasta and rice) are now being linked not only to weight gain but to increased risk of insulin resistance (the precursor of type 2 diabetes) and the metabolic syndrome (a strong predictor of both type 2 diabetes and cardiovascular disease), while eating more wholegrain foods is being shown to protect against all these ills. Common features of the metabolic syndrome include visceral obesity (the "apple shaped" body), low levels of protective HDL cholesterol, high triglycerides, and high blood pressure.

In one of the most recent studies, which appeared in *Diabetes Care*, researchers who analyzed data on over 2,800 participants in the Framingham Offspring Study, found that the prevalence of both insulin resistance and the metabolic syndrome was significantly lower among those eating the most cereal fiber from whole grains compared to those eating the least. Prevalence of the metabolic syndrome was 38% lower among those with the highest intake of fiber from whole grains. Conversely, study subjects whose diets had the highest glycemic index and glycemic load, both of which are typically low in whole foods and high in processed refined foods, were 141% more likely to have the metabolic syndrome compared to those whose diets had the lowest glycemic index and glycemic load. In other words, compared to those whose diets were primarily composed of whole high fiber foods: whole grains, legumes, vegetables and fruits.

The researchers concluded, "Given that both a high cereal fiber content and lower glycemic index are attributes of wholegrain foods, recommendation to increase wholegrain intake may reduce the risk of developing the metabolic syndrome." Our perspective at the World's Healthiest Foods is that a way of eating that relies on the healthiest foods from all the food groups—the whole foods that contain the healthiest fats, carbohydrates and proteins—is the most effective, intelligent, and most enjoyable way to not only lower your risk of developing the metabolic syndrome, but to stay slim, vital and attractive throughout a long and healthy life.^[12]

Brown Rice and Other Whole Grains Substantially Lower Type 2 Diabetes Risk

Brown rice and other whole grains are a rich source of magnesium, a mineral that acts as a co-factor for more than 300 enzymes, including enzymes involved in the body's use of glucose and insulin secretion.

The FDA permits foods that contain at least 51% whole grains by weight (and are also low in fat, saturated fat, and cholesterol) to display a health claim stating consumption is linked to lower risk of heart disease and certain cancers. Now, research suggests regular consumption of whole grains also reduces risk of type 2 diabetes. (van Dam RM, Hu FB, *Diabetes Care*). In this

8-year trial, involving 41,186 participants of the Black Women's Health Study, research data confirmed inverse associations between magnesium, calcium and major food sources in relation to type 2 diabetes that had already been reported in predominantly white populations.

Risk of type 2 diabetes was 31% lower in black women who frequently ate whole grains compared to those eating the least of these magnesium-rich foods. When the women's dietary intake of magnesium intake was considered by itself, a beneficial, but lesser—19%—reduction in risk of type 2 diabetes was found, indicating that whole grains offer special benefits in promoting healthy blood sugar control. Daily consumption of low-fat dairy foods was also helpful, lowering risk of type 2 diabetes by 13%. Rice pudding—quickly made by simply adding low-fat milk, cinnamon, raisins, a little honey and 1/4 teaspoon of finely grated orange peel to a cup of cooked rice, then cooking over medium heat for 5 minutes—is a delicious way to enjoy both rice and dairy.^[13]

Tune Down and Bone Up on Brown Rice

Magnesium, another nutrient for which brown rice is a good source, has been shown in studies to be helpful for reducing the severity of asthma, lowering high blood pressure, reducing the frequency of migraine headaches, and reducing the risk of heart attack and stroke. How does magnesium accomplish all this? Magnesium helps regulate nerve and muscle tone by balancing the action of calcium. In many nerve cells, magnesium serves as Nature's own calcium channel blocker, preventing calcium from rushing into the nerve cell and activating the nerve. By blocking calcium's entry, magnesium keeps our nerves (and the blood vessels and muscles they innervate) relaxed. If our diet provides us with too little magnesium, however, calcium can gain free entry, and nerve cells can become over activated, sending too many messages and causing excessive contraction. Insufficient magnesium can thus contribute to high blood pressure, muscle spasms (including spasms of the heart muscle or the spasms of the airways symptomatic of asthma), and migraine headaches, as well as muscle cramps, tension, soreness and fatigue. But that's far from all magnesium does for you. Magnesium, as well as calcium, is necessary for healthy bones. About two-thirds of the magnesium in the human body is found in our bones. Some helps give bones their physical structure, while the rest is found on the surface of the bone where it is stored for the body to draw upon as needed. Brown rice can help you keep those storage sites replenished and ready to meet your body's needs.

In addition to the niacin it supplies, brown rice may also help raise blood levels of nitric oxide, a small molecule known to improve blood vessel dilation and to inhibit oxidative (free radical) damage of cholesterol and the adhesion of white cells to the vascular wall (two important steps in the development of atherosclerotic

plaques). A study published in the *British Journal of Nutrition* suggests that diets high in rice protein can help protect against atherosclerosis by increasing blood levels of nitric oxide.

In this study, when researchers gave mice bred to be apolipoprotein-E deficient a purified diet containing either casein, the principal protein in dairy products, rice protein or soy protein, the mice given casein developed the largest atherosclerotic lesions. (In humans as well as animals, apolipoprotein E plays an important role in cholesterol transport, so a deficiency of this protein increases risk for the development of atherosclerosis.) Mice given rice or soy protein fared much better. In trying to understand why, the researchers evaluated blood levels of nitric oxide. Mice fed either rice or soy protein diets were found to have increased blood levels of L-arginine (the amino acid that the body uses to produce nitric oxide) and nitric oxide metabolites when compared to those given casein-based feed. However, the L-arginine content of the rice and soy diets was not high enough to explain the amount of protective benefit they conferred, so the researchers concluded that these foods must also contain other cardioprotective compounds.^[14]

A Good Source of Fiber

The health benefits of brown rice continue with its fiber, which has been shown to reduce high cholesterol levels, one more way brown rice helps prevent atherosclerosis. Fiber also helps out by keeping blood sugar levels under control, so brown rice is an excellent grain choice for people with diabetes. As we mentioned above, the fiber in brown rice can also help to protect you against colon cancer since fiber binds to cancer-causing chemicals, keeping them away from the cells lining the colon, plus it

can help normalize bowel function, reducing constipation.

Fiber from Whole Grains and Fruit Protective against Breast Cancer

When researchers looked at how much fiber 35,972 participants in the UK Women's Cohort Study ate, they found a diet rich in fiber from whole grains, such as brown rice, and fruit offered significant protection against breast cancer for pre-menopausal women. (Cade JE, Burley VJ, et al., *International Journal of Epidemiology*).

Pre-menopausal women eating the most fiber (>30 grams daily) more than halved their risk of developing breast cancer, enjoying a 52% lower risk of breast cancer compared to women whose diets supplied the least fiber (<20 grams/day).

Fiber supplied by whole grains offered the most protection. Pre-menopausal women eating the most whole grain fiber (at least 13 g/day) had a 41% reduced risk of breast cancer, compared to those with the lowest whole grain fiber intake (4 g or less per day).^[15]

Fiber from fruit was also protective. Pre-menopausal women whose diets supplied the most fiber from fruit (at least 6 g/day) had a 29% reduced risk of breast cancer, compared to those with the lowest fruit fiber intake (2 g or less per day).

Practical Tip: As the following table shows, it's surprisingly easy to enjoy a healthy way of eating that delivers at least 13 grams of whole grain fiber and 6 grams of fiber from fruit each day.

Food	Fiber Content (Grams)	Food	Fiber Content (Grams)
Oatmeal, 1 cup	3.98	Whole wheat bread, 1 slice	2
Whole wheat spaghetti, 1 cup	6.3	Brown rice, 1 cup	3.5
Barley, 1 cup	13.6	Buckwheat, 1 cup	4.54
Rye, 1/3 cup	8.22	Corn, 1 cup	4.6
Apple, 1 medium with skin	5.0	Banana, 1 medium	4.0
Blueberries, 1 cup	3.92	Orange, 1 large	4.42
Pear, 1 large	5.02	Prunes, 1/4 cup	3.02
Strawberries, 1 cup	3.82	Raspberries, 1 cup	8.36

Table-2: Fiber Contents

Help Prevent Gallstones

Eating foods high in insoluble fiber, such as brown rice, can help women avoid gallstones, shows a study published in the *American Journal of Gastroenterology*.

Studying the overall fiber intake and types of fiber consumed over a 16 year period by over 69,000 women in the Nurses Health Study, researchers found that those consuming the most fiber overall (both soluble and insoluble) had a 13% lower risk of developing gallstones compared to women consuming the fewest fiber-rich foods.

Those eating the most foods rich in insoluble fiber gained even more protection against gallstones: a 17% lower risk compared to women eating the least. And the protection was dose-related; a 5-gram increase in insoluble fiber intake dropped risk dropped 10%.

How do foods rich in insoluble fiber help prevent gallstones? Researchers think insoluble fiber not only speeds intestinal transit time (how quickly food moves through the intestines), but reduces the secretion of bile acids (excessive amounts contribute to gallstone formation), increases insulin sensitivity and lowers triglycerides (blood fats). Abundant not just in brown

rice but all whole grains, insoluble fiber is also found in nuts and the edible skin of fruits and vegetables including tomatoes, cucumbers, many squash, apples, berries, and pears. In addition, beans provide insoluble as well as soluble fiber.^[16]

Whole Grains and Fish Highly Protective against Childhood Asthma

According to the American Lung Association, almost 20 million Americans suffer from asthma, which is reported to be responsible for over 14 million lost school days in children and an annual economic cost of more than \$16.1 billion.

Increasing consumption of whole grains and fish could reduce the risk of childhood asthma by about 50%, suggests the International Study on Allergy and Asthma in Childhood (Tabak C, Wijga AH, *Thorax*).

The researchers, from the Dutch National Institute of Public Health and the Environment, Utrecht University, University Medical Center Groningen, used food frequency questionnaires completed by the parents of 598 Dutch children aged 8-13 years. They assessed the children's consumption of a range of foods including fish, fruits, vegetables, dairy and whole grain products. Data on asthma and wheezing were also assessed using medical tests as well as questionnaires.

While no association between asthma and intake of fruits, vegetables, and dairy products was found (a result at odds with other studies that have supported a link between antioxidant intake, particularly vitamins C and E, and asthma), the children's intake of both whole grains and fish was significantly linked to incidence of wheezing and current asthma.

In children with a low intake of fish and whole grains, the prevalence of wheezing was almost 20%, but was only 4.2% in children with a high intake of both foods. Low intake of fish and whole grains also correlated with a much higher incidence of current asthma (16.7%) compared to only a 2.8% incidence of current asthma among children with a high intake of both foods.

After adjusting results for possible confounding factors, such as the educational level of the mother, and total energy intake, high intakes of whole grains and fish were found to be associated with a 54 and 66% reduction in the probability of being asthmatic, respectively. The probability of having asthma with bronchial hyperresponsiveness (BHR), defined as having an increased sensitivity to factors that cause narrowing of the airways, was reduced by 72 and 88% when children had a high-intake of whole grains and fish, respectively. Lead researcher, Cora Tabak commented, "The rise in the prevalence of asthma in western societies may be related to changed dietary habits." We agree. The Standard American Diet is sorely deficient in the numerous anti-inflammatory compounds found in fish

and whole grains, notably, the ω -3 fats supplied by cold water fish and the magnesium and vitamin E provided by whole grains. One caution: wheat may need to be avoided as it is a common food allergen associated with asthma.^[17]

Meta-analysis Explains Whole Grains' Health Benefits

In many studies, eating whole grains, such as brown rice, has been linked to protection against atherosclerosis, ischemic stroke, diabetes, insulin resistance, obesity, and premature death. A new study and accompanying editorial, published in the American Journal of Clinical Nutrition explains the likely reasons behind these findings and recommends at least 3 servings of whole grains should be eaten daily.

Whole grains are concentrated sources of fiber. In this meta-analysis of 7 studies including more than 150,000 persons, those whose diets provided the highest dietary fiber intake had a 29% lower risk of cardiovascular disease compared to those with the lowest fiber intake. But it's not just fiber's ability to serve as a bulking agent that is responsible for its beneficial effects as a component of whole grains. Wheat bran, for example, which constitutes 15% of most whole-grain wheat kernels but is virtually non-existent in refined wheat flour, is rich in minerals, antioxidants, lignans, and other phytonutrients—as well as in fiber. In addition to the matrix of nutrients in their dietary fibers, the whole-grain arsenal includes a wide variety of additional nutrients and phytochemicals that reduce the risk of cardiovascular disease. Compounds in whole grains that have cholesterol-lowering effects include polyunsaturated fatty acids, oligosaccharides, plant sterols and stanols, and saponins.

Whole grains are also important dietary sources of water-soluble, fat-soluble, and insoluble antioxidants. The long list of cereal antioxidants includes vitamin E, tocotrienols, selenium, phenolic acids, and phytic acid. These multifunctional antioxidants come in immediate-release to slow-release forms and thus are available throughout the gastrointestinal tract over a long period after being consumed. The high antioxidant capacity of wheat bran, for example, is 20-fold that of refined wheat flour (endosperm). Although the role of antioxidant supplements in protecting against cardiovascular disease has been questioned, prospective population studies consistently suggest that when consumed in whole foods, antioxidants are associated with significant protection against cardiovascular disease. Because free radical damage to cholesterol appears to contribute significantly to the development of atherosclerosis, the broad range of antioxidant activities from the phytonutrients abundant in whole grains is thought to play a strong role in their cardio-protective effects.^[18]

Like soybeans, whole grains are good sources of phytoestrogens, plant compounds that may affect blood

cholesterol levels, blood vessel elasticity, bone metabolism, and many other cellular metabolic processes. Whole grains are rich sources of lignans that are converted by the human gut to enterolactone and enterodiol. In studies of Finnish men, blood levels of enterolactone have been found to have an inverse relation not just to cardiovascular-related death, but to all causes of death, which suggests that the plant lignans in whole grains may play an important role in their protective effects. Lower insulin levels may also contribute to the protective effects of whole grains. In many persons, the risks of atherosclerotic cardiovascular disease, diabetes, and obesity are linked to insulin resistance. Higher intakes of whole grains are associated with increased sensitivity to insulin in population studies and clinical trials. Why? Because whole grains improve insulin sensitivity by lowering the glycemic index of the diet while increasing its content of fiber, magnesium, and vitamin E.

The whole kernel of truth: as part of your healthy way of eating, whole grains can significantly lower your risk of cardiovascular disease, obesity and type 2 diabetes. Enjoy at least 3 servings a day. No idea how to cook whole grains? For all the health benefits brown rice can provide, don't forget to make this delicious, nutty-flavored grain a frequent addition to your meals.

History

Everyone knows that rice is an ancient food, but only recently have we discovered just how ancient it is. Rice was believed to have been first cultivated in China around 6,000 years ago, but recent archaeological discoveries have found primitive rice seeds and ancient farm tools dating back about 9,000 years.

For the majority of its long history, rice was a staple only in Asia. Not until Arab travelers introduced rice into ancient Greece, and Alexander the Great brought it to India, did rice find its way to other corners of the world. Subsequently, the Moors brought rice to Spain in the 8th century during their conquests, while the Crusaders were responsible for bringing rice to France. Rice was introduced into South America in the 17th century by the Spanish during their colonization of this continent. The majority of the world's rice is grown in Asia, where it plays an incredibly important role in their food culture. Thailand, Vietnam and China are the three largest exporters of rice.

How to Select and Store

Rice is available prepackaged as well as in bulk containers. If purchasing brown rice in a packaged container, check to see if there is a "use-by" date on the package since brown rice, owing to its natural oils, has the potential to become rancid if kept too long. Research recently published suggests that some *non-organic* U.S. long grain rice may have 1.4 to 5 times more arsenic than rice from Europe, India or Bangladesh. For this reason, select organically grown rice whenever possible. Just as

with any other food that you may purchase in the bulk section, make sure that the bins containing the rice are covered and that the store has a good product turnover so as to ensure its maximal freshness. Whether purchasing rice in bulk or in a packaged container, make sure that there is no evidence of moisture.^[19]

Since brown rice still features an oil-rich germ, it is more susceptible to becoming rancid than white rice and therefore should be stored in the refrigerator. Stored in an airtight container, brown rice will keep fresh for about six months.

While white rice varieties should also be stored in an airtight container, they can be kept in a cool, dry place rather than the refrigerator. Stored properly, they will keep fresh for about one year. The storage of cooked rice is controversial. Most organizations recommend 4-7 days of storage in the refrigerator at most. From all of the available evidence, however, and to err on the safe side, we believe it's best to cook only the amount of rice you can consume during the day it is cooked, or at most, the following day. Several potential toxins can be produced in rice under certain conditions involving time, temperature, presence of moisture, bacterial spores, or fungi. It appears that some fungi can turn one of the amino acids (tryptophan) in rice into α -picolinic acid, and that this substance, when excessive, can cause hypersensitivity reactions to rice in some persons. Another mycotoxin (fungus-triggered toxin) called T-2 can also be produced in rice by the fungus *Fusarium*. About 300 mycotoxins are commonly found in many grains, not only rice, when these grains are allowed to become moldy. All of the research on these potential toxins involves cultivation and harvesting of rice at the agricultural level rather than cooking and storage of rice at home. However, it is suggested erring on the safe side here. Be sure to keep your cooked rice in a tightly sealed container when stored in your refrigerator.

Tips for Preparing and Cooking Rice (Brown and White)

Like all grains, before cooking rice, especially that which is sold in bulk, rinse it thoroughly under running water and then remove any dirt or debris that you may find. After rinsing brown rice, add one part rice to two parts boiling water or broth. After the liquid has returned to a boil, turn down the heat, cover and simmer for about 45 minutes. To prevent them from sticking, wash medium grain and round rice (like Arborio) under cool running water before cooking.

To cook basmati rice, which has a lighter, fluffier texture, soak it in a bowl of cool water before cooking, stirring frequently and replacing the water four or five times until the water no longer has a milky appearance.^[20]

How to Enjoy

A Few Quick Serving Ideas

- Heat up cooked rice with milk or soymilk. Add in cinnamon, nutmeg, raisins and honey for a delicious rice pudding.
- Make homemade vegetable sushi rolls by wrapping brown rice and your favorite vegetables in sheets of well-moistened nori.
- Use rice leftovers for cold rice salads that are great for on-the-go lunches. Be creative and add either chicken or tofu plus your favorite vegetables, nuts, herbs and spices.
- For a simple yet delicious lunch or dinner entrée, serve beans and rice accompanied by the vegetables of your choice.
- Rice as a side dish need not be served plain - spruce it up with the toppings of your choice. Some of our favorites include nuts, sesame seeds, healthy sautéed mushrooms, and scallions.
- Place rice and chopped vegetables in a pita bread, top with your favorite dressing, and enjoy a quick and easy lunch meal.

CONCLUSION

Brown rice is an excellent source of the trace mineral manganese and a good source of selenium, phosphorus, copper, magnesium and niacin.

Introduction to Food Rating System Chart

In order to better help you identify foods that feature a high concentration of nutrients for the calories they contain, we created a Food Rating System. This system

allows us to highlight the foods that are especially rich in particular nutrients. The following chart shows the nutrients for which this food is either an excellent, very good, or good source (below the chart you will find a table that explains these qualifications). If a nutrient is not listed in the chart, it does not necessarily mean that the food doesn't contain it. It simply means that the nutrient is not provided in a sufficient amount or concentration to meet our rating criteria. (To view this food's in-depth nutritional profile that includes values for dozens of nutrients - not just the ones rated as excellent, very good, or good - please use the link below the chart.) To read this chart accurately, you'll need to glance up in the top left corner where you will find the name of the food and the serving size we used to calculate the food's nutrient composition. This serving size will tell you how much of the food you need to eat to obtain the amount of nutrients found in the chart. Now, returning to the chart itself, you can look next to the nutrient name in order to find the nutrient amount it offers, the percent Daily Value (DV%) that this amount represents, the nutrient density that we calculated for this food and nutrient, and the rating we established in our rating system.

In-Depth Nutritional Profile

In addition to the nutrients highlighted in our ratings chart, here is an in-depth nutritional profile for Brown rice. This profile includes information on a full array of nutrients, including carbohydrates, sugar, soluble and insoluble fiber, sodium, vitamins, minerals, fatty acids, amino acids and more.

Nutrient values	Brown Rice	White Rice
Energy	170 calories	160 calories
Protein	4 g	3 g
Total lipid (fat)	1.5 g	0 g
Carbohydrates	35 g	36 g
Total Dietary Fiber	4 g	1 g
Total Sugars	0 g	0 g
Calcium	0 mg	0 mg
Iron	0.36 mg	0.36 mg
Sodium	20 mg	0 mg
Total Saturated Fatty Acids	0 g	0 g
Total Trans Fatty Acids	0 g	0 g
Cholesterol	0 mg	0 mg

Table-3: Comparison of nutrients of Brown Rice and White Rice

Macronutrients and Calorie details

Carbohydrate

Total Sugars=0.68g [Monosaccharides (Glucose/Fructose/Galactose=0.00g), Disaccharides (Lactose/Maltose=0.00 and Sucrose=0.68g), Soluble Fiber=0.39g, Insoluble Fiber=3.12g, Other carbohydrates=40.45g.

Fat

Monounsaturated Fat=0.64g, Polyunsaturated Fat=0.63g, Saturated Fat=0.35g, Trans Fat=0.00g, Calories from

Fat=15.79g, Calories from Saturated Fat=3.16g, Calories from Trans Fat=0.00g, Cholesterol=0.00mg
Water=142.53g.

Micronutrients and Calorie details

Vitamins

Water-Soluble Vitamins

Vitamin B₁=0.19mg (DV=16%), Vitamin B₂=0.05mg (DV=4%), Vitamin B₃=2.98mg (DV=19%), Niacin=4.05mg, Vitamin B₆=0.28mg (DV=16%), Vitamin B₁₂=0.00mcg (DV=5%), Biotin=1.54mcg

(DV=5%), Choline=17.94mg, (DV=4%), Folate=7.80mcg, (DV=2%), Pantothenic Acid=0.56mg, (DV=11%), Vitamin C=0.00mg, (DV=0%).

Fat-Soluble Vitamins

Vitamin A International Units, Retinol-Carotenoids (IU)/A-Carotene/B-Carotene/Cryptoxanthin/Lycopene/Lutein/Zeaxanthin=0.00mcg, (DA=0%), Vitamin D=0.00mcg, (DA=0%), Vitamin E (A-Tocopherol)=0.06mg, (DA=0%), Vitamin K=1.17mcg, (DA=1%).

Minerals

Calcium=19.50mg, (DA=2%), Chloride=448.50mg, Chromium=0.78mcg, (DA=2%), Copper=0.19mg, (DA=21%), Iron=0.82mg, (DA=5%), Magnesium=83.85mg, (DA=21%), Manganese=1.76mg, (DA=88%), Phosphorus=161.85mg, (DA=23%), Potassium=83.85mg, (DA=2%), Selenium=19.11mcg, (DA=35%), Sodium=9.75mg, (DA=1%), Zinc=1.23mg, (DA=11%).

Individual Fatty Acids

ω -3 Fatty Acids=0.03g, (DA=1%), ω -6 Fatty Acids=0.60g.

Monounsaturated Fats

14:1 Myristoleic acid, 15:1 Pentadecenoic acid, 16:1 Palmitol=0.01g, 17:1 Heptadecenoic acid, 18:1 Oleic acid=0.63g, 20:1 Eicosenoic acid, 22:1 Erucic acid, 24:1 Nervonic acid.

Polyunsaturated Fatty Acids

18:2 Linoleic acid=0.60g, 18:2 Conjugated Linoleic Acid, 18:3 Linolenic acid=0.03g, 18:4 Stearidonic acid=0.00g, 20:3 Eicosatrienoic acid=0.00g, 20:4 Arachidonic acid=0.00g, 20:5 Eicosapentaenoic acid (EPA)=0.00g, 2:5 Docosapentaenoic acid (DPA)=0.00g, 22:6 Docosaheptaenoic acid (DHA)=0.00g.

Saturated Fatty Acids

4:0 Butyric acid, 6:0 Caproic acid, 8:0 Caprylic acid, 10:0 Capric acid, 12:0 Lauric acid=0.00g, 14:0 Myristic acid=0.01g, 15:0 Pentadecanoic acid, 16:0 Palmitic acid=0.30g, 17:0 Margaric acid, 18:0 Stearic acid=0.03g, 0:0 Arachidic acid, 22:0 Behenate, 24:0 Lignoceric acid.

Individual Amino Acids

Alanine =0.29g, Arginine=0.38g, Aspartic Acid=0.47g, Cysteine=0.06g, Glutamic Acid=1.02g, Glycine=0.25g, Histidine=0.13g, Isoleucine=0.21g, Leucine=0.42g, Lysine=0.19g, Methionine=0.11g, Phenylalanine=0.26g, Proline=0.24g, Serine=0.26g, Threonine=0.19g, Tryptophan=0.06g, Tyrosine=0.19g, Valine=0.29g.

Other Components

Ash=0.90g, Organic Acids: Acetic Acid, Citric Acid, Lactic Acid, Malic Acid, Taurine.

Sugar Alcohols: Glycerol, Inositol, Mannitol, Sorbitol, Xylitol.

Artificial Sweeteners

Aspartame, Saccharin, Alcohol=0.00g, Caffeine=0.00mg.

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