

Brown Rice-Beyond the Color Reviving a Lost Health Food - A Review

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Abstract: Rice is a staple food for over half of the world's population. Today people are going for whole food, to the days our forefather had been eating. You hardly heard of cancer, heart attack and diabetics and so on. All these degenerative diseases in our present society are caused by the pollutants from within and without. White food, better known as refined carbohydrates was once a delicacy affordable only to the financially wealthy. However, financial wealth does not equate to a wealth of health. A primary reason for the development of refining wheat for white flour products is to establish a longer shelf life. Whole wheat flour left in sacks for long periods of time cause bugs to appear within it. In their natural form, whole grains contain natural nutrients vital to our health.

Key words: Brown rice • Germinated Brown rice • Health benefits

INTRODUCTION

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.

Reviving a Lost Health Food - Brown Rice: Brown rice is unpolished whole grain rice that is produced by removing only the hull or husk using a mortar and pestle or rubber rolls. It may be distinctly brown, reddish or purplish. The embryo may or may not be left intact depending on the hulling process. It becomes milled or white rice when the bran layer is stripped of in the milling or 'whitening' process. Thus, the distinguishing factor should be its unpolished feature and not the color. It has a mild nutty flavour, is chewier than white rice and becomes rancid more quickly, but is far more nutritious. Any rice, including sticky rice, long-grain rice, or short-grain rice,

may be eaten as brown rice. In much of Asia, brown rice is associated with poverty and wartime shortages and in the past was rarely eaten except by the sick, the elderly and as a cure for constipation. This traditionally denigrated kind of rice is now more expensive than common white rice, partly due to its relatively low supply and difficulty of storage and transport [1].

Nutritional Implications of Rice Milling: In rice milling, the bran layers and germ removed during polishing are high in fiber, vitamins and minerals as well as protein. Their removal results in loss of nutrients, especially in substantial losses of B vitamins. Polishing rice reduces the thiamin content of rice by over 80%. Parboiling results in gelatinization of the starch and disintegration of the protein in the endosperm resulting in inward shift of water-soluble vitamins to the endosperm. Parboiled rice is therefore higher in B vitamins than raw milled rice [2].

Nutrient content of Rice [2]

mg/100g	Brown rice	Polished rice
Thiamine	0.34	0.07
Riboflavin	0.05	0.03
Niacin	4.7	1.6
Iron	1.9	0.5
Magnesium	187.0	13.0

Brown Rice Is Superior to Polished Rice: Brown rice has high dietary fiber (a gentle laxative, prevents gastro-intestinal diseases and good for diabetes

sufferers); rich in B vitamins and minerals (prevents beriberi); and high in fat (energy source). Also it has been reported that brown rice contains high phytic acid (antioxidant, anti-cancer); it decreases serum cholesterol (prevents cardio-vascular diseases); and it is considered a low glycemic index food (low starch, high complex carbohydrates which decreases risk to type 2 diabetes). The enhancement of rice supply is another advantage of brown rice relative to polished or white rice. Post harvest researchers say that the milling recovery in brown rice is 10% higher than polished rice [3].

There is the other benefit of brown rice – economics. The fuel savings in milling is 50-60% because the polishing and whitening steps are eliminated. It follows that the milling time is also shortened; labor is less; and the cost of equipment (if the mill is dedicated to brown rice) is much lower because the miller doesn't have to install polishers and whiteners. The enhancement in output volume and the economy in milling constitute the business opportunity in brown rice. [4].

Brown Rice versus White Rice:



Brown Rice

White rice

Milling is the primary difference between brown and white rice. The varieties may be identical, but it is in the milling process where brown rice becomes white rice. Milling, often called "whitening", removes the outer bran layer of the rice grain. Milling affects the nutritional quality of the rice. Milling strips off the bran layer, leaving a core comprised of mostly carbohydrates. In this bran layer resides nutrients of vital importance in the diet, making white rice a poor competitor in the nutrition game. The following chart shows the nutritional differences between brown and white rices. Fiber is dramatically lower in white rice, as are the oils, most of the B vitamins and important minerals. Unknown to many, the bran layer contains very important nutrient such as thiamine, an important component in mother's milk [5].

Comparison of Nutrient Contents of Brown Rice and White Rice [6]: Bran contains several things of major importance - two major ones are fiber and essential oils. Fiber is not only filling, but is implicated in prevention of major diseases in this country such as certain gastrointestinal diseases and heart disease. The National Cancer Institute recommends 25 grams of fiber a day, a cup of brown rice adds nearly 3.5 g, while an equal amount of white rice not even 1 g. Also, components of the oils present in rice bran have been shown in numerous studies to decrease serum cholesterol, a major risk factor in heart disease [7, 8].

Parameters	Brown Rice	White Rice
Calories	232	232
Protein	4.88 g	4.10 g
Carbohydrate	49.7 g	49.6 g
Fat	1.17 g	0.205 g
Dietary Fiber	3.32 g	0.74 g
Thiamin (B1)	0.223 mg	0.176 mg
Riboflavin (B2)	0.039 mg	0.021 mg
Niacin (B3)	2.730 mg	2.050 mg
Vitamin B6	0.294 mg	0.103 mg
Folacin	10 mcg	4.1 mcg
Vitamin E	1.4 mg	0.462 mg
Magnesium	72.2 mg	22.6 mg
Phosphorus	142 mg	57.4 mg
Potassium	137 mg	57.4 mg
Selenium	26 mg	19 mg
Zinc	1.05 mg	0.841 mg

Germinated Brown Rice: Germinated Brown Rice is considered as innovative rice by preserving all the nutrients in the rice grain for consumption in order to create the highest value from rice. It containing all of the vitamins, minerals and other nutrients needed to help fight disease, aging and to help promote health. All nutrients your body needs are stabilized in grain by Orization process prior to cracking to brown rice. Low Glycemic Index of Germinated Brown Rice can help to balance blood sugar, promote weight loss and energize the body. GABA - Gamma Amino Butyric Acid in Germinated associated with mental status of calm and serenity and also promotes muscle relaxation. Powerful antioxidants like Orizanol and Proanthocynin in Pre-Germinated and Germinated Brown Rice can neutralize the damage of oxidation [9].

Germinated brown rice contains a lot of natural tranquilizer, GABA (gamma-amino butyric acid) an amino acid produced in the brain. It acts as a neurotransmitter - a chemical that fosters communication between nerve cells - and helps to keep stress-related nerve impulses at bay. It appears to promote relaxation and sleep. They may also have a role to play in preventing seizures and allaying chronic pain

Normally, the brain pumps out all the GABA we need. Unfortunately, due to a poor diet, exposure to environmental toxins, or other factors, levels of GABA may become depleted. Too little of this important compound may result in anxiety, irritability and insomnia. A deficiency of GABA has also been linked to depression [2].

Germinated Brown Rice is considered whole food because only the outermost layer is removed, 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 vitamins 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 [10].

Germinated brown rice contains all the nutrients with high fiber and therefore low glycemic index which means that carbohydrates can break down slowly, releasing low blood glucose level into the blood stream. Having Germinated brown rice regularly can help control blood sugar level. It is an answer for diabetic patients and people who wish to control their weight. Pigment in Germinated brown rice is natural source for Proanthocyanin which can help prevent high blood pressure, diabetes and also reduce the risk of cardiovascular disease and cancer. Germinated brown rice is also a good source of magnesium; it has been shown in studies to be helpful in reducing the severity of asthma, lowering high blood pressure, reducing the frequency of migraine headaches and reducing the risk of heart attack and stroke [11].

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 innervated) 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 [12].

Health Benefits of Brown Rice: The health benefits of brown rice are immeasurable. Brown rice is a whole grain meaning it contains a large amount of fiber. This is

due to the fact that the whole grain contains all three components: bran, germ and endosperm. Conversely, when grain is processed, all that is left is the endosperm.

When the endosperm is left intact, it generates all of the proteins; the bran contains approximately 80% of the minerals; and the germ contains vitamin E, minerals, unsaturated fats, antioxidants and phytochemicals which are chemicals found in fruits, vegetables, beans and other types of plant food. In addition, it has been ascertained that the antioxidant levels in whole grains are higher than in white rice. The health benefits of brown rice are not only significant, but have proven to be effective in warding off disease and other conditions which can become chronic and, in some cases, life threatening. Now doctors are encouraging patients to consume more whole grain foods than ever before [13].

Why Brown-But Not White-Rice Is One of the World's Healthiest Foods: Our food ranking system qualified brown rice as an excellent source of manganese and a good source of the minerals selenium and magnesium. 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. 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." [14].

Brown Rice is Rich in Fiber and Selenium: 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 very good source of selenium, a trace mineral that has been shown to substantially reduce the risk of colon cancer.

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. 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 [15].

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 [16].

Brown Rice Substantially Lower Type 2 Diabetes Risk: Brown rice, 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 postprandial blood glucose response of ten healthy and nine diabetes type 2 volunteers to brown rice was compared to milled rice from the same batch and variety. The total sugar released in vitro was 23.7% lower in brown rice than in milled rice. In healthy volunteers, the glycemic area and glycemic index were, respectively, 19.8% and 12.1% lower ($p < 0.05$) in brown rice than milled rice and while in diabetes type 2 volunteers, the respective values were 35.2% and 35.6% lower. The effect was partly due to the higher amounts of phytic acid, polyphenols, dietary fiber and oil in brown compared to milled rice and the difference in some physicochemical properties of the rice samples such as minimum cooking time and degree of gelatinization. The study concluded that brown rice is more beneficial for diabetes type 2 and hyperglycemic individuals than milled rice [17].

Pre-germinated brown rice is made by soaking brown rice kernels in water to germinate. Blood concentrations of fasting blood glucose, fructosamine, serum total cholesterol and triacylglycerol levels have been shown to favorably improve on a pre-germinated brown rice diet, suggesting that diets including pre-germinated brown rice may be useful to control blood glucose levels in diabetes type 2 [18].

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. 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.

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. A cup of brown rice will give you 21.0% of the daily value for magnesium [12].

Fiber from Whole Grains Protective against 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. [11] (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). 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) [19].

Inositol hexaphosphate, a naturally occurring molecule found in high-fiber foods such as brown rice, is a compound that has been shown to demonstrate cancer prevention properties. Inositol hexaphosphate holds great promise in strategies for the prevention and treatment of cancer [20, 21].

Pancreatic cancer is an extremely virulent form of cancer with few effective treatments. An in vitro study has suggested that Inositol hexaphosphate may be a therapy for treatment of pancreatic cancer [22].

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*. 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% [23].

Shelf Life of Brown Rice: The essential oil in the germ of the rice is very susceptible to oxidation and soon goes rancid. As a result, brown rice has a shelf life of only about six months from the date of purchase unless given special packaging or storage processing. Freezing or refrigeration will greatly extend its storage life. It's also possible to purchase brown rice from long term food suppliers specially packaged in air tight containers with an inert nitrogen atmosphere. In this kind of packaging, (if properly done), the storage life of brown rice can be extended for years. Currently, in some places, brown rice is parboiled to increase its shelf life. In some other cases refrigeration is preferred. Parboiling reduces the quality of brown rice and the refrigeration is almost expensive. In both cases the shelf life extension are sufficient for transportation to long distance or overseas markets. A suitable cost effective technology need to be identified for easy marketing of brown rice in local markets and for overseas markets [24].

CONCLUSION

Whole foods contain thousands of phytonutrients that have health-promoting properties, as well as vitamins, minerals and macronutrients like fiber and beneficial fats. During processing, many of these compounds are removed. In particular, the essential omega-3 fatty acids, along with other unsaturated fats, are the first to be removed, in part, because they are often located in highest amounts in the outer surfaces of whole foods and in part, because they are less shelf-stable in a processed food. They maintain their stability much better in the whole food where they are in their natural place. Whole foods are easily assimilated and absorbed readily by the body. Whole foods are nutrient rich and are thought to promote health because they are a natural source of vitamins and minerals.

White rice connotes a 'classy' lifestyle because of its distinct white polished grains. Brown rice, on the other hand, became associated with that harvested from a poorly managed paddy because of its 'dirty' look or off-color. It was regarded as suited only for animal feed. Beyond the 'dirty' look, however, Brown rice is a wealth of nutrients that are contained in the bran layer. This lost health food is now being revived and taken back into the regular diet of consumers, but this time without reintroducing the back breaking hand pounding and stone grinding method.

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