

Brown Rice Versus White Rice: A Nutritional and Health Perspective

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ABSTRACT

Rice (*Oryza sativa* L.) is a staple cereal for a large proportion of the global population. The nutritional implications of consuming whole-grain versus milled rice are of considerable public health interest. Retention of the bran and germ in brown rice results in higher concentrations of dietary fibre, minerals and B-complex vitamins, whereas milled white rice, particularly when enriched, is more digestible and may supply greater amounts of folate and iron. This article compares the two forms in terms of processing, nutrient composition, glycemic response, association with type 2 diabetes, and potential risks such as arsenic accumulation. Overall, brown rice is nutritionally superior for most individuals, although white rice may be preferable under specific physiological and clinical conditions.

INTRODUCTION:

Rice is a versatile cereal grain consumed worldwide and a staple in much of Asia. Although it occurs in a wide range of colours, shapes and sizes, white and brown rice are the most commonly consumed forms. In India, cereals remain the dominant dietary component, contributing

approximately two-thirds of total carbohydrate intake.

Traditionally, cereals were processed by labour-intensive hand-pounding, which retained a considerable proportion of the outer grain layers. Contemporary Asian diets, however, have undergone a rapid nutrition

transition characterised by increased consumption of refined carbohydrates, unhealthy fats and animal-source foods, a pattern associated with a higher risk of obesity and type 2 diabetes (Jayawardena *et al.*, 2017). Polished white rice is also deficient in several bioactive phytochemicals, including polyphenols, oryzanol, phytosterols, tocotrienols, tocopherols and carotenoids, which have been linked to protection against cardiovascular disease and cancer (Liu *et al.*, 2023). The choice between whole-grain and milled rice therefore has implications beyond sensory preference. This article reviews the differences between the two forms and the circumstances under which each may be appropriate.

Processing and structural differences

Brown rice is a whole grain in which only the inedible hull is removed, so that the bran, endosperm and germ are retained. White rice is produced by further milling and polishing, which removes the bran and germ and leaves predominantly starchy endosperm (Juliano, 1993). The nutritional consequences of this process are substantial. Milling and polishing strip away the bran and germ layers, which hold most of the grain's B vitamins, minerals, dietary fibre and lipids, so polished rice is markedly poorer in these nutrients than brown rice (Akhter *et al.*, 2023). From a culinary standpoint, white rice cooks faster, whereas brown rice is chewier and has a characteristic nutty flavour.

Nutrient composition

Owing to retention of the bran and germ, brown rice is more nutrient-dense than white rice. As shown in Table 1, one cup of cooked brown rice provides roughly five times more dietary fibre and considerably higher proportions of the daily values of magnesium, phosphorus and manganese. Enriched white rice, in contrast, supplies higher amounts of

folate and iron owing to fortification (Khalua *et al.*, 2019). Both forms are naturally gluten-free, and the lower fibre content of white rice contributes to its greater digestibility (Klein, 2024).

Table 1. Nutrient content of 1 cup of cooked long-grain white and brown rice

Nutrient (1 cup cooked, long-grain)	White rice (enriched)	Brown rice
Energy (kcal)	205	248
Protein (g)	4.25	5.53
Fat (g)	0.44	1.96
Carbohydrate (g)	44.51	51.67
Fibre (g)	0.6	3.2
Magnesium (% daily value)	5	20
Phosphorus (% daily value)	7	21
Manganese (% daily value)	37	98
Folate (% daily value)	38	5
Iron (% daily value)	11	6

Energy value

Brown rice is not a low-energy alternative. One cup of cooked long-grain brown rice yields approximately 248 kcal, compared with about 205 kcal for enriched long-grain white rice, reflecting its higher protein, lipid and carbohydrate content. These values vary with cultivar and grain length. The advantage of brown rice therefore lies in its nutrient and fibre density rather than reduced energy content.

Glycemic response and diabetes risk

The glycemic index (GI) classifies carbohydrate foods according to their capacity to raise postprandial blood glucose and is particularly relevant for individuals with diabetes. Brown rice generally exhibits a

modestly lower GI than white rice; however, the ranges overlap considerably, and cultivar, grain length, amylose content and cooking method significantly influence the value (Foster-Powell *et al.*, 2002). Epidemiological evidence is more consistent. In a large prospective analysis, higher white rice intake was associated with an increased risk of type 2 diabetes, whereas higher brown rice intake was associated with a reduced risk (Sun *et al.*, 2010). A subsequent meta-analysis confirmed the positive association between white rice consumption and diabetes risk, particularly in Asian populations (Hu *et al.*, 2012). Nevertheless, in a 16-week intervention trial, substitution of white rice with brown rice did not substantially alter most metabolic risk factors (Zhang *et al.*, 2011), indicating that portion size and overall dietary pattern remain important determinants.

Dietary and physiological considerations

High-fibre diets. Brown rice is the better choice when a higher fibre intake is the goal, since dietary fibre is associated with lower serum cholesterol, improved bowel function and better weight control (Anderson *et al.*, 2009). Because a sudden rise in fibre can cause gas, bloating and constipation, intake should be raised gradually and accompanied by enough fluid (Dahl & Stewart, 2015).

Low-fibre diets. White rice, being low in fibre, may be more suitable when temporary fibre restriction is clinically indicated, for example after gastrointestinal surgery, during flares of inflammatory bowel disease, or in the presence of bowel strictures (Vanhauwaert *et al.*, 2015). Restriction is not routinely recommended for diverticular disease, where fibre is more likely to be beneficial (Tarleton & DiBaise, 2011), and any restriction should be short term and guided by a clinician or dietitian.

Folate requirements. Adequate folate intake reduces the risk of neural tube defects and is especially important for women who are pregnant, planning pregnancy or breast-feeding. Because enriched white rice supplies substantially more folate than brown rice (Table 1), it may be the more appropriate choice in this group, although supplementation with 400-800 mcg of folic acid per day is additionally recommended for women who may become pregnant (US Preventive Services Task Force, 2017).

Resistant starch. Cooling cooked rice increases its resistant starch content through starch retrogradation, and the increase persists after reheating (Sonia *et al.*, 2015). Resistant starch is not digested in the small intestine and behaves like dietary fibre, which may benefit gut health (Birt *et al.*, 2013). Although both types of rice form resistant starch on cooling, brown rice contains more total fibre (Akhter *et al.*, 2023).

Potential limitations of brown rice

Rice accumulates inorganic arsenic from soil and irrigation water, and the metalloid is concentrated in the bran layers; consequently, brown rice may contain higher inorganic arsenic levels than polished rice (Meharg *et al.*, 2008; EFSA, 2009). Thorough rinsing, cooking in excess water and dietary diversification, including millets, may reduce exposure. In addition, phytic acid in the bran can inhibit mineral bioavailability, an effect that may be mitigated by soaking or germination. The lipid-rich bran is also prone to oxidative rancidity, which shortens shelf life and necessitates cool, dry storage.

CONCLUSION

Brown rice is nutritionally richer than white rice, providing higher levels of fibre, minerals and B vitamins, and higher intake is associated with a lower risk of type 2 diabetes. White rice, particularly when enriched, remains

appropriate for low-fibre dietary regimens, gastrointestinal flare-ups and situations requiring higher folate intake. Concerns regarding arsenic, phytate and storage stability should be addressed through proper preparation and dietary diversity. Individuals with diabetes should seek individualised advice from a registered dietitian.

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