



ISSN (E): 2277-7695
 ISSN (P): 2349-8242
 NAAS Rating: 5.23
 TPI 2023; 12(3): 4875-4878
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www.thepharmajournal.com

Received: 04-12-2022

Accepted: 16-02-2023

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Black rice: A super food from north-east India

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Abstract

Zizania aquatica, sometimes known as black rice, is renowned for being very nutrient-dense. This is also been referred to as forbidden, emperor, and royal rice. Over 50% of people worldwide eat and rely on rice as a staple. This rice primarily comes from Asian nations. China (62%), Sri Lanka (8.6%), Indonesia (6.2%), and India (5.1%), which hold the fourth position, are the wealthiest nations in terms of black rice farming. It has significant amounts of tocopherols, one of the most potent antioxidants commonly known as vitamin E, and anthocyanin, a type of Antioxidant. Antioxidant-rich foods are dark purple or black. Moreover, it is rich in fiber, protein, carbs, potassium, and B vitamins.

Keywords: super food, north-east, vitamins, *Oryza sativa* L.

Introduction

Whole-grain rice (*Oryza sativa* L.) has been a widely consumed staple food in developing and developed countries (Pang *et al.*, 2018) [15]. Many different types of traditional aromatic rice landraces can be found in the northeastern states of India, including Manipur. (Roy *et al.*, 2014) [1]. *Chakhao Poireiton* variety, belonging to the species *Oryza sativa* L. *Indica.*, is the most famous one. (Moirangthem *et al.*, 2020) [2] Black rice also goes by the names emperor's rice, fortune rice, forbidden rice, purple rice, and king's rice. It was known as Kola sawl by Assamese people. There are three distinct tribes in Meghalaya, each giving it a unique name. The Garo tribe called it Mi-gisim, while the Khasi and Jaintia tribes called it Ja-iong. It can be found in the village of Keelapoongudi in Tamil Nadu and is known as kavuni rice. (Nitin & Roshni, 2020) [3].

Chakhao is a Manipuri word that translates to "delicious rice" (Chak = rice, and ahoba or hao = tasty). Farmers in the scategorizeorise distinct varieties of chakhao according to the grain's colour (Amubi= black; Angoba= white). For the people of Manipur, Chakhao rice is very special because they use it to make a variety of special dishes for celebrations and social ceremonies, including Ethe Tan (a regional puri made from black Chakhao rice flour in the Chandel district), Buhman Sang (a regional specialty made from Buhman landraces in the Churachandpur district), and Utong Chak. (Roy *et al.*, 2014) [1].

Although, Black rice (*Zizania aquatica*) is an important staple crop too. Black rice has a bran layer that is deep purple due to the presence of anthocyanins. Black rice bran contains one of the highest quantities of anthocyanins, a type of Antioxidant, in the diet. (Wahengbam *et al.*, 2015) [4].

Among all rice genotypes, black rice has the highest level of bioactive components. It has higher Total phenolic content, total flavonoid content, total anthocyanin content, fiber, and minerals than white rice. (Liu *et al.*, 2020) [16] Its iron content is rich (Ito & Lacerda, 2019) [19] enough to avoid anemia if consumed as a part of an iron-rich diet (Kumar, 2020) [2].

Nutritional composition

75% of black rice is carbohydrates, specifically starch (Ziegler *et al.*, 2017; Ito *et al.*, 2018a). It is also a rich source of a class of dietary fibers: resistant starch, cellulose, hemicellulose, and pectin (Mau *et al.*, 2017) and simple sugars (glucose, fructose, and fructose and saccharose) in its outer layers. 2–3% of the total paddy rice weight is a protein found in the gem (OECD, 2014). Black rice is a better source of plant-based protein than conventional white rice. (Kushwaha, 2016) [5] Black rice has more minerals such as iron, calcium, zinc, potassium, copper, and magnesium than refined white rice. The bran and embryo of black rice are rich in bioactive components, such as phenolic acids (mainly protocatechuic acid, 2,5-dihydroxybenzoic acid, and vanillic acid), anthocyanins (mainly cyanidin-3,5-diglucoside, cyanidin-3-O-glucoside, and petunidin-3-O-glucoside), (Ito & Lacerda, 2019) [19].

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Black rice has more nutritional attributes than white rice due to Vitamin A, E, and B Complex (Tang, Cai, & Xu, 2016) [22]. These nutrients have health-promoting human benefits (Ito & Lacerda, 2019) [19]. A few of them are discussed here:

Cardiovascular benefits

As a dietary antioxidant, they can combat reactive oxygen species and free radicals and reduce the occurrence of chronic diseases, including coronary heart disease. (Hou, 2003) [6].

In an animal study, supplementation with 20% unrefined black rice for 30 days showed decreased levels of hyperlipidemia (Salgado *et al.*, 2010) [26]. Whole grain black rice supplementation effectively decreased body weight gain; liver and EWAT weight; serum TC, TG, and non-HDL-C content; and the ratio of non-HDL-C/HDL-C. Also, it attenuated hepatic TC and TG levels and increased the fecal excretion of sterols and fat ($P < 0.05$) in mice after a 12-week treatment (Liu *et al.*, 2020) [16].

In another study, hyperlipidemic rats showed a reduction of hepatic lipogenic enzymes (Um, Ahn, Jung, & Ha, 2013). A pigment in black rice has shown reduced cholesterol in human studies (Lee, Kim, Hsieh, & Eun, 2008) [28] and antiallergic properties (Choi, Kang, Koh, Nam, & Friedman, 2007) [29]. American Health Association recognized the importance of black rice and recommended the "consumption of black rice to prevent heart disease" in its 2005 Dietary Guidelines for Americans. American Health Association and the 2005 Dietary Guidelines for Americans recommended an increase in the consumption of black rice to prevent heart disease. (USA, Rice Federation) The antioxidants anthocyanin present in black rice have also been shown to lower LDL cholesterol and inhibit its absorption, thus reducing the risk of atherosclerosis, hypertension, and heart attack (Kushwaha, 2016 [5]; Zawistowski, 2009) [31]. Consumption of high amount of dietary fiber in black rice improves glucose metabolism, which helps maintain cardiovascular health and blood pressure (Ito & Lacerda, 2019) [19].

According to one study, the black rice pigment reduces oxidative stress and inflammation, which prevents atherosclerotic plaques (Xia, 2003) [3]. Dietary supplementation with black rice extract may normalize serum lipid profiles and promote gene expression in fatty acid metabolism. (Jang, 2012) [8].

Metabolic Disorders

Previous studies on black rice mainly focused on the relationship between purified anthocyanins and metabolic syndromes (Felix *et al.*, 2017 [24], Jang *et al.*, 2012) [8]. It possesses pharmacologic abilities to decrease the risks of obesity-related metabolic syndromes (Wei *et al.*, 2016) [23].

Black rice can also be a natural antioxidant and scavenge free radicals (Finocchiaro, Ferrari, & Gianinetti, 2010) [37]. The numerous antioxidants in black rice can function individually or synergistically (Shao *et al.*, 2018) [38], meaning they can deliver more significant health benefits than each Antioxidant alone. Excessive intake of white rice has been shown to increase the risk of glucose homeostasis disorder and Type 2 diabetes (Soriquer *et al.*, 2013) [32].

While the risk of Type 2 diabetes, obesity, hypertension, hyperglycemia, and dyslipidemia can be reduced by consuming black rice (Rebello, Greenway, & Finley, 2014), black rice has shown low postprandial blood glucose response (Meng *et al.*, 2018) [33] by inhibiting the activity of intestinal

a-glucosidase and pancreatic a-amylase (Ranilla, Kwon, Apostolidis, & Shetty, 2010) [34].

Its low sugar and high fiber content maintains blood glucose levels and can be a beneficial addition to diabetics' diet (Kushwaha, 2016) [5]. Black rice is also shown to reduce weight due to its fiber-rich bran, which provides a satiating feeling and inhibits overeating (Liu *et al.*, 2020) [16].

Anti-cancer

Due to their ability to protect cells from damage from biotic and abiotic stresses, anthocyanins have long been considered potential cancer chemopreventive agents (Asem, 2015) [9]. Flavonoids and phenols are the key rice bran ingredients, particularly colored rice bran, that have been suggested to have anti-cancer properties for many different types of cancer cells. (Iriti, 2013) [10].

The lipids found in colored rice, in addition to anthocyanin, include triacylglycerol, free fatty acids, phospholipids, and other uncommon lipid-based compounds. The lipid contents of all the colorful rice types are similar (Yoshida, 2012) [11]. The cytotoxic characteristics of the cyanidin 3-glucoside and peonidin 3-glucoside present in the black rice bran extract fractions ('Cempo Ireng') result in the killing of cervical cancer cells (Pratiwi *et al.*, 2015) [12]. Black rice anthocyanin extract can be utilized to stop the development of liver cancer cells (Chen *et al.*, 2006) [13]. According to research, black rice's antioxidant qualities help decrease lung cancer cells. (Kim *et al.*, 2013) [14].

Conclusion

Black rice is one of the most potent rice; it should be introduced to our diet because of its excellent nutritional content. It is essential for promoting the advantages of good health. It is more balanced for our bodies than other foods due to its high fiber, protein, iron, vegetable fats, vitamins, and minerals content. Anthocyanin and tocopherol, two antioxidants found in black rice, are present (also known as vitamin E). People's consumption of black rice demonstrates that it can have various positive health effects and help people avoid non-communicable diseases like diabetes, atherosclerosis, obesity, and cancer.

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