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Black Rice - An Extensive Review

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Abstract

Black rice consumption gains its popularity in the modern world because of its various health benefits. It is a type of the rice species, Oryza sativa L. Its colour is black due to the presence of anthocyanin, an antioxidant in the pericarp (Outer Part) of the kernel. This rice is also known as forbidden rice or Emperor's rice, because in China, it was only consumed by the royals and believed that consumption of black rice would increase the life span of the king. It was not allowed or forbidden for use of the ordinary people. It is rich in nutrients and antioxidants. It reduces the incidence of diabetes, heart attack, allergy, inflammation, obesity, cancer, improves digestive system, and have antioxidant activity. Since black rice has various health benefits, it is also called the Super Food of modern world.

Keywords: Black rice, Anthocyanin, Antioxidant, Emperor's rice, Allergy, Inflammation, Super food.

Introduction

Rice is the most important cereal crop in the developing world. It is consumed as a staple food by over one-half of the world's population. Approximately 95% of rice is cultivated in Asia. Mostly white rice is consumed around the world, but there are many special cultivars of rice that contain colour pigments, such as black rice, red rice and brown rice. Their names were given according to their kernel colours (black, red and purple) which are formed by deposits of anthocyanins in different layers of the pericarp, seed coat and aleurone. Ujjawal Kumar Singh Kushwaha writes that "Black rice is also known as purple rice, forbidden rice, heaven rice, imperial rice, king's rice and prized rice. Many people assume this rice as a panacea of many diseases because of its high nutritive value and curative effect." (Kushwaha 2) This rice includes several varieties with a long history of cultivation in Southeast Asian countries such as China, India and Thailand. Coloured rices are reported as potent sources of antioxidants

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and considered as functional foods. Of these, red rice gained popularity in Japan as a functional food because of its high polyphenols and anthocyanin content. Kushwaha also defines the very nature of black rice: "Black rice is a type of the rice species Oryza sativa L. which is glutinous in nature, rich in high level of nutrients and mainly cultivated in Asia. (Kushwaha 1)

Before the health beneficial effects of pigmented rice emerged, scientists saw an upcoming demand of black rice as an organic food colouring agent which has been at least partly possible due to the increased production of black rice. Black rice is more nutritious than common rice. It contains higher content of protein, vitamins and minerals compared to other rice varieties; although, nutrient content varies with cultivar and production location. "Mineral contents in rice were highly influenced not only by difference among cultivar, but also difference in cultivating area." (Suzuki 424) Anthocyanin pigments have been reported to be highly effective in reducing cholesterol levels in the human body. "Anthocyanins play an important role in neuroprotection by reducing oxidative stress, pre-serving cognitive performance as well as limiting or reversing the deleterious effects of brain ageing." (Kangwan 315)

Colour of Black Rice

Anthocyanin is responsible for the dark purple colour of black rice which is higher by weight than that of other coloured grains. In the words of Ujjawal Kumar Singh Kushwaha: "Anthocyanins are a group of reddish purple water soluble flavonoids located on pericarp, seed coat and aleurone layer. Black glutinous rice has been also shown to accumulate compounds such as anthocyanins." (Kushwaha 4)





According to Widiastuti Setyaningsih, et al., "The phenolic compounds, mainly anthocyanin, are mostly associated with the pericarp in the grain, the milling process to produce polished grain reduces the level of these compounds in the grain." (Setyaningsih 28)

Types and Varieties

(i) Black Japonica Rice is a combination of black short-grain rice and mahogany medium-grain rice grown together in the same field. It has an earthy flavour with a mild, sweet spiciness.

(ii) Black Glutinous Rice, also known as black sticky rice, is short-grain rice with a sweet flavour and sticky texture. The grains are unevenly coloured and are often used to make sweet dishes in Asia.

(iii) Thai Black Jasmine Rice is medium-grain rice from Thailand that combines Chinese black rice with jasmine rice. It has a subtle floral aroma when cooked.

(iv) Italian black rice is long-grain rice that combines Chinese black rice with Italian rice. It has a rich, buttery flavour.

Healthy Ingredient Contribution

Antioxidants: Black rice is high in substances that have antioxidant properties. Antioxidants protect against free radicals that cause ageing, cancer and disease. They help support memory function and coordination.

Anthocyanins: The outer bran layer of black rice is full of anthocyanins, a plant compound that gives black rice its dark complexion. Anthocyanins help improve memory, enhance vision and act as an anti-inflammatory.

Protein: One serving of black rice offers 10 percent of the daily recommended value of protein, an important macronutrient needed to build and repair tissues and muscles. It plays a role in the production and action of enzymes, involved in most body functions.

Fiber: Black rice provides 8 percent of the daily recommended value of fibre. Soluble fibres help control weight by making the stomach feel full. Insoluble fibres add bulk to the diet and help prevent constipation.

Iron: One serving of black rice offers 4 percent of the daily recommended value of iron, which is an essential mineral that helps keep blood strong and healthy. Blood carries oxygen from the lungs to the rest of the body, and without enough oxygen, the body becomes fatigued, resulting in decreased brain function and a weaker immune system.

Nutritive Value of Black Rice

Black rice contains many vitamins and minerals, including iron, vitamin A and vitamin B, fibre, protein, essential amino acids, etc. Black rice is high in nutritional value. It contains 18 amino acids, iron, copper, carotene, zinc, and several important vitamins. Thus black rice is a universal remedy to many diseases. Minerals such as calcium (Ca) and iron (Fe) are high in black rice (21.38 mg/100g) sodium (Na), is low in all samples except for the black rice (10.19 mg/100g). Magnesium and potassium content is high in it (Potassium 186.54 mg/100g and Magnesium 107.21 mg/100g). "Among all the rice varieties investigated, the total saturated fatty acid and unsaturated fatty acid content was highest in black rice (5.89%)." (Thomas 1148) Oleic and linoleic acid was present in all the rice samples with the highest being in black rice. The Soluble Dietary Fibre (SDF) (%) in black rice is 8.17±0.07 and Insoluble Dietary Fibre (IDF) (%) is 14.49±0.07. "According to previous studies, antioxi-dant activity

and phenolic content of black rice is greater than that of white rice." (Saenkod 300) There exists no other rice with a higher nutritional spectrum near black rice. This rice is free of gluten, free of cholesterol, low in sugar, salt and fat. Black rice is a whole grain, super nutritious type of rice that is high in fibre, anthocyanin, antioxidants, vitamins B and E, iron, thiamine, magnesium, niacin and phosphorous. "A huge number of scientific studies show that black rice powder is one of nature's most well balanced super food and its abilities are truly remarkable." (Kushwaha 2)

Health Benefits

(i) **Antidiabetic Effect:** Black rice bran contains bioactive compounds; previous studies revealed that the ethanol extract of black rice bran (EEBRB) can decrease glucose levels in diabetic rats. "Antidiabetic mechanism of EEBRB is associated with increased insulin levels because of regeneration of pancreatic beta cells in diabetic rats." (Wahyuni 106)

(ii) **Antioxidant Effect:** Among different compounds of black rice, anthocyanin is the one which scavenges harmful molecules and helps to protect arteries and prevent the DNA damage. Anthocyanins are the flavonoid pigments of black rice. It acts as a source of antioxidants and has the ability to inhibit the formation or to reduce the concentrations of reactive cell damaging free radicals. Adyati Putriekasari Handayani, Roselina Karim and Kharidah Muhammad, in their paper, observe that "it can be seen that the cooking water of pigmented rice, which is in the form of an aqueous extract, has the potential to be the base for an antioxidant drink" (Handayani, et al. 1). Black rice extract has the ability to scavenge superoxide anions more effectively than hydroxyl radicals. Apart from anthocyanins, black rice is rich in tocopherols, another powerful antioxidant which is better known as vitamin E. Recent research has shown that antioxidants may work synergistically, meaning that foods containing two or more types of antioxidant may deliver greater health benefits than the sum of each antioxidant alone.

(iii) **Anti-inflammatory Effect:** Studies revealed that feeding of mice with a standard diet with added 10% black rice bran significantly reduced DNFB (2,4-dinitrofluorobenzene) -induced allergic contact dermatitis on the skin of the mice but a non-pigmented brown rice bran extract did not prevent the TPA (2-O-tetradecanolylphorbol-13-acetate) -induced edema and failed to prevent the production of pro-inflammatory biomarkers (mediators). It indicates that black rice bran is a potent anti-inflammatory and anti-allergic agent which can be used for treatment and prevention of chronic inflammation.

(iv) **Weight Reduction:** Regular consumption of black rice helps in weight reduction. Black rice is rich in fibre which gives a feeling of fullness when consumed but low in calories. It also helps in bowel movement, therefore, acting as a detoxifying agent.

Research has shown that black rice extract (BRE) reduces adipogenesis. In cells stimulated with BREs, the rate of fatty acid synthesis was significantly decreased, while there was no effect on the rate of fatty acid oxidation, resulting in reduced intracellular lipid accumulation.

(v) **Prevention of Cardio Vascular Diseases:** American Health Association, the American Cancer Society and the 2005 Dietary Guidelines for Americans recommended an increase in the consumption of black rice to prevent heart disease. "Black rice contains many vitamins and minerals, including iron, vitamin A and vitamin B, which are beneficial for overall health and the prevention of heart disease." (qtd. Kushwaha 11) Black rice may have antiatherogenic activity and may improve certain metabolic pathways associated with diets high in fructose. In this context Qin stated that "Anthocyanin supplementation in humans improves LDL- and HDL-cholesterol concentrations and enhances cellular cholesterol efflux to serum. These benefits may be due to the inhibition of CETP." (Qin, et al 485)

(vi) **Effect:** Very high anthocyanin content in Sticky black rice helps to prevent harmful effects of free radicals, inhibit inflammation throughout the body and acts as anticancer agent.

(vii) **Prevention of Anaemia:** Black rice has higher iron content and is excellent for those who are on a vegetarian diet. Iron is essential for healthy red blood cell production, for energy expenditure, and even for digestion. Iron prevents anaemia.

(viii) **Useful in Gluten Allergy:** Black rice is naturally free of gluten. Consuming it might help remove digestive problems (such as bloating, constipation, diarrhoea, nutrient deficiencies, as well as an increased risk for developing leaky gut syndrome) related to consuming gluten for most people who are suffering from celiac disease.

Selecting and Storing

(i) Packet of rice should be free of moisture and should have expiry date on the packet as the rice bran contains oils that can go rancid.

(ii) Fresh black rice will have a nutty aroma. When rice has a bitter aroma, it should be discarded.

(iii) Uncooked black rice can be stored in an airtight container in a dry, dark, cool place for 3-6 months. Shelf life can be extended by 6-12 months in the refrigerator and 12-18 months in the freezer.

(iv) Cooked rice should be covered tightly and can be stored in the refrigerator for no more than three days. It can be frozen for up to three months.

Culinary Uses

"Black rice is typically sold as unmilled rice, means the fibre rich black husks of the rice are not removed. This rice is commonly used as a condiment, dressing, or as a decoration for different types of desserts in many countries around the world. The unusual colour makes it very popular for desserts and the high nutritional value is an added benefit." (Kushwaha 3) The unusual colour makes it very popular for desserts and the high nutritional value is an added advantage. This rice is often served with fresh fruit such as mangoes and lychees. Conventionally this rice has been used in China and Taiwan as dessert rice, but it can be used in almost any sweet or spicy dish where plain rice is used. Its pitch is black when raw, but it actually turns a beautiful, shiny indigo when cooked. Noodles also have been produced from black rice. Black rice is usually consumed mixed with white rice in Korea. The grain has a similar amount of fibre to brown rice and like brown rice; it has a mild and nutty taste. Wine is also prepared from black rice by yeast fermentation. Teramoto found that "The amount of total phenolic compounds of black rice wine made from the uncooked black rice grains was higher than that of the beverage made from cooked black rice grains." (Teramoto, et al 10706)

Conclusion

Black rice has been used in Asia from ancient times and in China it was used as medicine. Now-a-days, it is considered as "Super Food" because of its various health benefits. It is extremely rich source of nutrients but low in sugar compared to other antioxidant rich foods. Its use is increasing day by day. Unhealthy eating habits and an over dependence on heavily processed foods and refined grains increases the risk of chronic diseases such as heart disease, cancer and diabetes, as well as the shocking increase in obesity rates are all indicators of this harmful trend. Studies showed that a diet rich in whole grains, fruits, vegetables and high quality proteins is an important factor in maintaining overall good health. Consumption of black rice lowers the risk of various degenerative diseases, diabetes, cancer, heart disease, Alzheimer's disease, etc. It is also delicious, affordable, easy to prepare and has good smell and taste. Therefore awareness should be created among people about this nutritious super food so that people can learn about its health benefits and enjoy a healthy and long life.

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