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Dr. Black Rice

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Black rice is well known as "Imperical rice" or "Forbidden rice" as it was reserved solely for the Chinese royalties for centuries. Thousands of years ago, Asian royal families and kings preferred to consume speciality rice which were good for health, efficient in curing diseases and are enriched with compounds *viz.*, proteins, minerals, vitamins, antioxidants, etc. along with excellent taste and aroma. Ever since, speciality rice has enjoyed high value and prestige among the rice consumers. Black rice holds a special place among speciality rice, due to its unique colour and extraordinary health benefits.

In rice, most of the nutrients like protein, micro-nutrients, fibre, fatty acids and anti-oxidant compounds get accumulated in the outer aleuronic layer and the embryo. All these nutri-compounds are scrapped away from grain, during the process of hulling and milling. Hence, milled rice diet is over-reliant on the nutrient deficient endosperm, the only part of grain remains, after dehusking and milling. However, the pigmented rice is mostly consumed as brown rice that retains the nutritionally rich aleuronic layer and the germ.

A huge variation for rice grain colour exists across the globe *viz.*, red, brown, green, yellow, purple, etc. However, the black rice offers a Pandora's Box of health beneficial compounds to its consumers. Among all other pigmented rice, black rice offers the richest source of proteins, fibre, micronutrients and anti-oxidant compounds. There are several variations of black rice reported globally. *Balatinaw* from Philippine heirloom (Santhosh 2021), *LeumPua* rice of Thailand (Kerdphol*et al.*, 2015), *Kokushimai* from Japan (Pereira *et al.*, 2013) are some of the globally known black rice. Indonesia harbours several black rice varieties from different regions including Java and other islands, but a very few among them are formally described in the literature such as *MelikJava*, *CempoIreng*, and *Toraja* (Pratiwi*et al.*, 2017; Putri*et al.*, 2022). Some well-known black rice types from India includes, *Chakhao* from Manipur, *Mamihanger* from Tripura, *Kalabati* from Odisha, *Burma black* from Telangana and *Karuppukavuni* from Tamil Nadu (Veda Krishnan *et al.*, 2020).

Black rice holds a treasure of health beneficial compounds that are effective against various chronic diseases such as heart attack, cardiovascular diseases (CVD), Alzheimer's disease, urinary tract infections, cancer, obesity, diabetes, etc. It also helps to improve our visual & neurological health. Therefore, they might be explored to provide an alternate in the treatment of heart diseases, dermatitis, allergies, and preventing constipation and anaemia. It is being traditionally served to pregnant women in Manipur to reduce complications during childbirth (Bhuvaneswari *et al.*, 2020).

Under the rapidly changing socio-economic scenario, men and women are contributing almost equally to economic sustainability and growth. Therefore, our workplaces are experiencing a pressing and competitive culture because of which our attention has completely shifted from proper health and balance diet. Moreover, it has completely changed our outlook from health to economics and so has changed our life styles. This shift in life style has invited several health disorders, now profoundly named as life style disorders. Every year nearly 40 million people succumb to the non-communicable diseases (NCDs), that accounts for 70% of the deaths occurring globally. These NCDs are results of combined effect of genetic, physiological, environmental and behavioural changes in human life. The main category of NDCs include CVD, stroke, diabetes and cancer that are highly linked with the life choices we made, i.e., life style diseases / disorders. Around 17.7 million deaths are happening every year due to CVD and strokes. Cancer kills nearly 8.8 million people while the, respiratory diseases and diabetes

cause annual mortality of 3.9 million and 1.6 million people respectively across the globe (medical-journals/lifestyle-disorders-33826.html).

The increased life stresses have caused a huge upsurge in diseases like Alzheimer's, arthritis, atherosclerosis, asthma, cirrhosis, pulmonary diseases, hypertension, mental instability, osteoporosis, PCODs, obesity, depression, various neurological and skin problems. In this dreadful scenario of increasing cases of stress instigated diseases that affect people across the globe, irrespective of age, race and class, people are looking back towards health and health benefitting compounds. Antioxidant rich compounds have been found to hold great hope in preventing and treating these stress related disorders. Moreover, the abundance of these compounds in rice, one of the most important staple cereals that feed nearly half of the global population is a real treasure and great news for the rice loving, health-conscious people. Black rice is a special category of rice that is rich in antioxidant compounds, and therefore displays great promise in healing or preventing the life style diseases. Being a staple crop, it can easily fit into our diet schedules and food habits, and can easily meet the daily intake requirement of these healing compounds. Black rice is therefore a boon to mankind in combating the up surging incidences of life style disorders, and restoring the individual and social health.

Fig 1. (a) Purple pigmented Geminating seedlings of black rice; (b) Panicle of black rice with black lemma and palea; (c) Dehulled grains with black pigmented pericarp

Under the condition of stress, human body releases reactive oxygen species (ROS). The over production of ROS result in oxidative damage to bio molecules such as lipids, proteins, DNA, etc., that eventually causes cell death. This in turn, leads to early aging tumors/ cancer, CVD, dementia, allergies, etc. Antioxidants play vital role in scavenging these ROS and reducing the oxidation of cellular molecules, thus alleviate OS (Oxygen Species) content in the body (Gilgun-Sherki *et al.,* 2001). Therefore, it is important to know about the antioxidant compounds present in black rice that make it a potential healer. These antioxidant compounds include, anthocyanin, proanthocyanin, tocopherols, tocotrienols, phenols, gamma-oryzanol and flavonoids (Aalim *et al*., 2021).

The abundance of anthocyanin pigment in black pigmented rice imparts its blackness and also provides the first line of defence against the toxic free radicals, which are precursors of cancer/tumours in the body. A review on population-based studies showed that high intake of anthocyanin rich food could lower the risk of colorectal cancer and breast cancer by decelerating the growth of cancerous cells, and restricting its ability to spread (McGrane *et al.,* 2019). An experimental study conducted by the Third Military University in China found that an anthocyanin-rich extract of black rice could successfully suppress the tumour growth and spread of breast cancer cells in mice (Hui *et al.,* 2010). Still researchers are trying to understand the role of anthocyanin in reducing the risk and spread of cancer.

High intake of anthocyanin can increase the level of HDL (High Density Lipo proteins or good cholesterol) decrease the level of LDL (Low Density Lipo-proteins/bad cholesterol). This in turn, reduces the chances of developing atherosclerosis and heart attacks. In a study involving 120 adults with high cholesterol levels found that taking 2 capsules of 80 mg anthocyanin per day for 12 weeks resulted in improvement of HDL level and reduced the LDL levels significantly (Xu*et al.,* 2021). Antioxidants play significant role in detoxification of liver by regulating the metabolism of fatty acids and decrease the level of triglycerides and cholesterol. The antimicrobial properties of black rice boost up our immunity against diseases.

Apart from anthocyanin, black rice is rich in gama-oryzanol, phenols and flavonoids. They have high anti-oxidant properties. High content of gama-oryzanol decreases the neurodegenerative diseases like hypertension. Phenols and flavonoids have antiviral, anti-inflammatory and anti-cancerous properties.

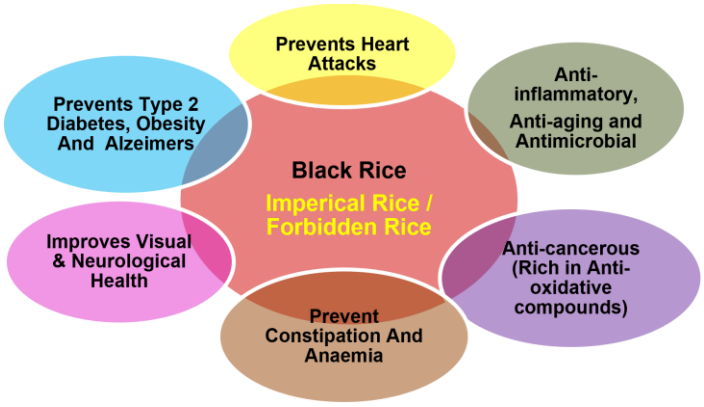

Fig. 2 Health Benefits of black Rice

Black rice is also a rich source of essential amino acids like tryptophan and lysine; vitamins such as thiamine (B_1), riboflavin (B_2), niacin (B_3), vitamin E, folic acid and minerals like iron, zinc, phosphorous, calcium, selenium and magnesium. Since black rice is rich in iron, it is involved in the generation of new RBCs that increases the haemoglobin content and prevents anaemia. According to some researchers, the high content of carotenoids like lutein and zeaxanthin in black rice provides protection to the retina of our eyes. They help in filtering out the harmful blue light and thereby, reducing the risk of cataract and diabetic retinopathy.

Suppression of dermatitis through intake of black rice has been demonstrated by researchers in one of the studies (Kim *et al.,* 2006). They compared the effect of black rice intake with the brown rice intake in two separate groups of animals. It has been observed that black rice prevents the release of the amino acid histamine, which is responsible for the allergic response. Black rice soothes skin, reduces inflammation and irritation; it is therefore recognised as a therapeutic agent. It can be very effective in preventing and curing the chronic diseases associated with inflammation.

As black rice contains twice the amount of fibre than brown rice, it eases the bowel movement and can also help to cure chronic constipation. The fibres get bind with the toxic compounds in the colon and are easily flushed out with the faeces. The high fibre content in black rice also helps to regulate the blood sugar levels by slow release of sugars due to delayed digestion process which in turn, prevents a sudden shooting up of blood glucose levels, as observed in case of white rice intake. Additionally, the low levels of sugars in black rice (less than blueberries) (Thanua *et al*., 2018) provides further advantage in maintaining the blood sugar. The low sugars and high fibre content in black rice thus helps to prevent the occurrence of type2 diabetes. Black rice also helps to slow down the fatty acid synthesis, thereby helping in weight management programmes.

Black rice contains higher levels of protein, fibre and 6 times more antioxidants than the brown rice. A 1/4 cup (45 grams) of uncooked black rice provides 160 calories, 1.5 grams of fat, 4 grams of protein, 34 grams of carbs, 1 gram of fibre and 6% Iron in Daily Value (DV) bases (McGrane *et al.,* 2019). Thus black rice is found to be very effective in promoting heart and liver health, prevention of cancer and anaemia, controlling diabetes, constipation, hyperlipidaemia, helps in weight management and can be suggested as a potential healer for next generation disorders.

Conclusions

A small portion of black rice in a meal gives fullness. Inculcating the habit of eating black rice in the normal diet can enhance the overall life span and improve the health and well-being of people. Therefore, black rice can be an excellent health supplement with white and brown rice. Moreover, intake of black rice may be improved by using the black rice flour for manufacturing different value-added products, suiting the taste of people belonging to different age groups. Due to the huge health benefits associated with black rice, it may be correctly called as Dr. Black rice.

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