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Review Article



# BLACK RICE ORYZA SATIVA L AND THEIR TRADITIONAL PRODUCTS: A REVIEW

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**Abstract:** Black rice (*Oryzae sativa L.*) is special rice cultivate with the black bran covering the endosperm. It is considered to be a super food by researchers and scientists that is because it has high fibre content, antioxidants and anthocyanins and so overall it has high nutritional value. This rice contains anti-carcinogenic properties, has ability to stop cancer, weight gain, control diabetes and also contains anti-inflammatory properties. This review gives information of The black rice from Manipur which is also called Chakhao Poireiton when made into porridge contained improved nutritional quality due to the presence of high phenolic content, anthocyanin content and antioxidant properties in the black rice. General test like fat, protein, fibre, moisture content of the Chakhao Poireiton has been done. **Keywords:** Black rice, Chakhao Poireiton, Anthocyanin, Antioxidant, Manipur

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#### INTRTODUCTION

Rice is a food staple for many households around the world. Many debates are done regarding the consumption of this little grain, but it will still be an inseparable part of various delicacies around the world. Health consciouss people are growing and so the demand of healthy alternatives of Black rice, Brown rice and Red rice has been increased. Rice grain having red brown or dark purple color in its covering layers are called pigmented rice or colored rice. Rice that are coloured has unique color and flavor and so they are used as ingredient in any dishes (Rhee et al., 2000). Black rice (Oryza sativa L.) is a special cultivar of rice and are consumed widely since ancient times in China and other Eastern Asian countries (Guo et al., 2007). Black Rice which is also known as purple rice or Asian rice or forbidden rice comes under the Oryza Sativa specie high in anthocyanin pigment, the same antioxidant pigment that gives eggplants and blackberries their deep color. It has been considered as a food that promotes health because of its abundant content of

anthocyanins, but anthocyanins are not stable and are vulnerable which gets destroyed by a number of factors such as: pH, light, oxygen, enzymes, ascorbic acid, thermal treatment, sulfur dioxide or sulfite salts, metal ions and copayments (Zhang et al., 2008). Studies showed that polyphenols such as plant anthocyanins are helpful to cardiovascular health (Stoclet et al., 2004). Rice grain having brown, red or dark purple color in its covering layers are called pigmented rice or colored rice. These pigments which are present in the aleurone layer of rice grain, have been reported as a mixture of anthocyanin compounds that belongs to the family of flavonoids (Yawadio et al., 2007). Usually Black Rice is mostly cultivated in Asian countries like China, Indonesia, Myanmar and India. And in India it is majorly grown in the eastern region. Black rice is popularly known as Chak-hao in Manipur. It is used to prepare varieties of desserts.

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#### ANTHOCYANIN

Anthocyanin are naturally occurring color substance. Anthocyanin comes under a group of plant pigments that has been widely distributed in nature (Wu & Prior, 2005). Any flowers, fruits, grains and related products derived from them has attractive colours because of the presence of anthocyanin (Bailón et al., 2003). They belong to a subgroup of water-soluble flavonoids which occurs naturally in plant kingdom. In 1835, Ludwig Marguart who is a German botanist gave the name anthocyanin that derives from the Greek words where anthos means flower, and kyanos means blue (Markakis, 1982). Colored rice having anthocyanin that is commonly found consists of acetylated procyanidins, which is reported to possess a free radical scavenging activity (Oki et al., 2002). Anthocyanins are known to be water soluble glycosides and acylglycosides of anthocyanides (Wu et al., 2004). Research shows that anthocyanin not only acts as antioxidants, but also activate detoxifying enzymes, has inflammatory effect, prevents cancer cell proliferation, induce cancer cell death, inhibits formation of new blood vessels that encourages tumour growth said by a research that was published in the Asia Pacific Journal for cancer prevention in 2014.



Figure 1. General structure of Anthocyanin

## VITAMIN E

Vitamin-E comes under fat-soluble vitamins with several forms, but alphatocopherol is the only one used by the human body. The main role of vitamin E is to act as an antioxidant, scavenging loose electrons called free radicals which damages cells (Monsen, 2000). It also helps in enhance immune function and helps to prevent clots from forming in heart arteries. Vitamin E can protect the cells from free radical damage and also it can stop the production of free radical cells completely. Deficiency of Vitamin E which is usually rare is caused due to primary problem with digesting the dietary fat rather than from a diet low in vitamin E and can cause nerve problem (Institute of Medicine, 2000).

## IRON

The mineral iron's main purpose is to carry oxygen in the hemoglobin of red blood cells all over the body by which cells produce energy. Iron also helps in removing carbon dioxide. A condition name anemia which is an iron deficiency develops when iron stored in the body becomes low and so not enough normal Red blood cells can be made to carry oxygen properly. When level of iron is low in the body, it results in fatigue, weakness and difficulty in maintaining the body temperature. It could also lead to pale skin. Iron deficiency Anemia is the most common hematologic disorder globally (Le and Auerbach, 2016). The iron that is present in the food exists as two types *i.e.*, heme and non-heme. Both the types are present in animal foods like meat, poultry, sea food and are better absorbed by the body. Non-heme iron is found in plant foods like spinach and beans, enriched grains like rice and bread and some fortified breakfast cereals.

## DIETARY FIBER

Dietary fiber is a type of carbohydrate that are not able to be digested by our bodies' enzymes. Common sources of dietary fibre are cereals, pulses, fruits, vegetables, lentils and grains. Dietary fiber consists of residues of plant cells resistant to hydrolysis (digestion) by the alimentary enzymes of man, whose components are hemicellulose, cellulose, lignin, oligosaccharides, pectin, gums and waxes (Trowell *et al.*, 1985).

## HEALTH BENEFITS OF BLACKRICE

Black rice is preferred as a healthy grain because of the health benefits it offers. Black rice does not undergo any refining or processing and so it is able to keep hold of its antioxidants, vitamins, minerals and fibers. Black rice also contains Vitamin E that helps to maintain eyes, skin, and immune health. However, over cooking the food can result in loss of essential vitamins, minerals and antioxidants. Cooking time of black rice is also important as it may reduce the natural health benefits. The flavor of black rice that is normally found is slightly bitter but also varies depending on the variety but since the bran is not removed, black rice has nutty flavor like brown rice. The antioxidants that is present in black rice is higher compared to the blueberries that contain highest amount of anthocyanin. Black rice is loaded with the goodness of fiber, protein, iron, vitamin E and antioxidants. Black rice contains vast amount of health benefits which makes it perfectly healthy option to go for. Compared to other types of rice black rice has highest amount of protein.

- Natural detoxifier: Black rice is a rich source of phytonutrients that works as a natural detoxifier and so it removes disease causing free radicals that is present in the body.
- Weight loss: Black rice consists of good fiber content. There contains approx. 6 grams of fiber in one cup of black rice which makes the body feel full even if consumed in less amount. The soluble fiber that is present in the black rice binds with the toxin and the waste from the body is pulled out which leads to weight loss.
- Antioxidants: It has been shown in a research that black rice has over 23 types of antioxidants and it has the highest antioxidant activity of all rice varieties.
- Heart health: because of the presence of antioxidants, it helps to protect against heart disease.
- Anticancer properties: Research shows that the anthocyanin that is present in the black rice maybe have strong anticancer properties.
- Eye health: Antioxidants lutein and zeaxanthin are present in the black rice, both of these antioxidants has been shown to protect retina from damaging free radicals and also anthocyanins may help in protecting eye health. Instant rice porridge has become more popular as a breakfast cereal in many Asian countries.

Rice porridge is normally eaten in Korea as it is traditionall comfort food for old people and patients because it is nutritious and good for health and also it is used for main course, diet food or appetizer. Black rice porridge will have improved nutritional quality due to phenolic content, anthocyanin content and antioxidant properties present in the Black rice. The scented rice black rice (Chakhao Poireiton) was used by the traditional medicine practitioners of Manipur. They are being sold in the local markets at premium rate. Black rice is considered as super food by many researchers and scientists as it has high nutritional value. It has high fibre, iron, antioxidants, thiamine, phosphorous, niacin and magnesium.

#### CONCLUSION

Now a day, people are finding ways to get the natural antioxidant as supplement in the diet and so consumption of pigmented rice would be the best way for the improvement of human health. The extract of the scented rice black rice (Chakhao Poireiton) could be a potential source of antioxidative phytochemicals and also as a useful ingredient for nutraceuticals or functional food products. Black rice is gaining more popularity in the recent years because of the potential sources of anthocyanins which are good for health that helps to prevent cardiovascular diseases. Therefore, addition of black rice in the diet would have a great impact on human health.

## REFERENCES

- Escribano-Bailón, M. T., Santos-Buelga, C. & Rivas-Gonzalo, J. C. (2004). Anthocyanins in cereals. *Journal of Chromatography A*, 1054(1-2):129-141.
- Guo, H., Ling, W., Wang, Q., Liu, C., Hu, Y., Xia, M., & Xia, X. (2007). Effect of anthocyanin-rich extract from black rice (Oryza sativa L. indica) on hyperlipidemia and insulin resistance in fructose-fed rats. *Plant Foods* for Human Nutrition, 62(1):1-6.
- Kushwaha, U. K. S. (2016). Black Rice: Research, history and development. Springer. pp 278
- Le, C. H. H. (2016). The prevalence of anemia and moderate-severe anemia in the US

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- Markakis, P. (1982) Coloring matter in food. *In:* Markakis, P.(Ed.), *Anthocyanins as Food colors*. New York NY: Academic Press. pp 12
- Monsen, E. R. (2000). Dietary reference intakes for the antioxidant nutrients: vitamin C, vitamin E, selenium, and carotenoids. *Journal of the Academy of Nutrition and Dietetics*, 100(6): 637.
- Oki, T., Masuda, M., Kobayashi, M., Nishiba, Y., Furuta, S., Suda, I., & Sato, T. (2002). Polymeric procyanidins as radical-scavenging components in red-hulled rice. *Journal of Agricultural and Food Chemistry*, 50(26):7524-7529.
- Song, S. J., Lee, Y. S., & Rhee, C. O. (2000). Volatile flavor components in cooked black rice. *Korean Journal of Food Science and Technology*, 32(5):1015-1021.
- Stoclet JC, Chataigneau T, Ndiaye M, Oak MH, El Bedoui J, Chataigneau M, Schini-Kerth VB. Vascular protection by dietary Polyphenols. Eur J Pharmacol. (2004); 500:299–313.
- Trowell, H., Burkitt, D., & Heaton, K. (1985). Dietary fibre, fibre-depleted foods and disease. New York NY: Academic Press. pp 98
- Wu, X., & Prior, R. L. (2005). Identification and characterization of anthocyanins by high-performance liquid chromatographyelectrospray ionization- tandem mass spectrometry in common foods in the United States: Vegetables, nuts, and grains. *Journal of agricultural and food chemistry*, 53(8):3101-3113.
- Wu, X., Gu, L., Prior, R. L., & McKay, S. (2004). Characterization of anthocyanins and proanthocyanidins in some cultivars of Ribes, Aronia, and Sambucus and their antioxidant capacity. *Journal of agricultural* and food chemistry, 52(26):7846-7856.
- Yawadio, R., Tanimori, S., & Morita, N. (2007). Identification of phenolic compounds isolated from pigmented rices and their aldose reductase inhibitory activities. *Food Chemistry*, *101*(4):1616-1625.
- Zhang, Y., Hu, X. S., Chen, F., Wu, J. H., Liao, X. J., & Wang, Z. F. (2008). Stability and colour characteristics of PEF-treated cyanidin-3-glucoside during storage. *Food chemistry*, 106(2):669-676.