

A REVIEW ON *ORYZA SATIVA* L. (BLACK RICE) BIOACTIVE COMPOUNDS ENDORSE THE IMMUNE RESPONSE IN HUMAN.

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ABSTRACT

Black Rice is a type of *Oryza sativa* L. species. Black rice is an excellent source for vegetarians. It helps in many purposes in human health to cure the diabetic level, for heart patients. It is also used in development of brain activity such as Alzheimer's disease due to the high level of protein, Iron, vitamin B, E source content. The present study gives the description about to increase the immune response in humans with the help of various bioactive compounds. It also helps in cure of colon rectal cancer. It also a good source of antioxidant in human body. That's why it is called "Super food". Black rice helps in treatment of pyrexia, dysentery problems, urinary problems as well as used in improvement of vision, It helps in blood circulation and removal of kidney stones.

Keywords: *Oryza sativa* L., Anticancer, Alzheimer's disease, Antioxidant

1. INTRODUCTION

Black rice is also called Forbidden Rice or called Emperor's rice due to has superior nutritional value and its high antioxidant activity (Yang DS, Lee KS et al., 2003). It is a medium grain, nonglutinous heirloom rice with deep purple hue and nutty slightly sweet flavor because it is rich in anthocyanin level. It contains total 160 calories that is distributed as 1.5 grams of fat content, 4 grams of protein content, 34 grams of carbs. 1 gram of fiber content and 6 % of iron content. It also contains several form of flavonoids and carotenoids (Kang MY, Kim JH, Rico CW et al., 2011). It is presently consumed as functional food that is useful for human health (Ryu SN, Park SZ et al., 1998).

Black rice has maximum content of phenolic compounds (Stinzing FC et al., 2002). Black rice has maximum content of anthocyanin level (Thompson LU., 1994). It plays important role to prevent chronic and degenerative diseases such as anticancerous, antiinflammatory, antioxidant

and hypoglycemic activities (Hamid AA et al., 2010). There are four varieties of black rice are: First one is Black Japonica Rice is a short grain and mahogany medium grain rice which has an earthy flavor with mild, spicy and sweet in flavour. Second is Black Glutinous Rice that variety of rice is sticky in nature, it is short grain and sticky in nature. Third variety of black rice is Italian black rice this type of variety is long grain in size, it is rich and buttery in flavor. Last variety of black rice is Thai black jasmine Rice is medium grain rice. This type of rice is a combination of Thailand and Chinese black rice. It has floral aroma (Black rice: Ingredient., 2016). So, there are various components play important role in maintenance of health and control of diseases (Harbone JB et al., 2000).

2. PHYTOCHEMICAL PROPERTIES

Black rice is powerful sources of phytochemicals. There are number of flavonoids glycosides. These flavonoids glycosides are myricetin-7-O-Glucoside, isorhamnetin-3-O-glucosides, Quercetin-3-O-glucoside and γ -oryzanols are present. These flavonoids glycosides is benefitted for human health (Irakli, MN et al., 2012; Sriseadka T. et al., 2012). There are ten aromatic compounds that has six alcohol, ten aldehydes, three ketones, two aldehydes and four nitrogen compounds are present (Dong Sik et al., 2012).

3. BENEFITS OF BLACK RICE

Black rice has many important nutrients. It contains many vitamins, minerals, proteins, fibres and various aminoacids. It is free from gluten, cholesterol and fats. It increase the longevity and protects heart diseases and detoxify the body fluids and improves lipid profile (Das KR et al., 2014).

a) Black Rice act as Antiinflammatory agent:-

Black rice helps to increase the inflammation responses of the immune system against the infection because it helps to increase the various chemical factors such as serotonin, bradykinin, histamine. These types of chemicals are used to prevent chronic diseases with their chronic inflammation related to cytokines. These cytokines are IL-6, 1, 8, 11, TNF- α , IFN-gamma (Dwijayanti, Widodo et al., 2016; Liang, Zhou and Shen, 2004).

b) Black rice act as Antioxidant agent:-

Anthocyanins of black rice acts as antioxidant agents because they help to prevent the occurrence of tumour and reduce the genome of normal cells by oxidative stress (Shih et al., 2007; Yi et al., 2010). Black rice has high antioxidant activity due to its functional groups

such as sugars. so the anthocyanin content is higher, that's why antioxidant activity level is higher (Zhang Shao et al., 2015).

c) Black rice act as Anticancerous agent

Black rice has anthocyanin help in breast cancer cells to inhibit the issues of fatty liver (Chang H et al., 2010). It also help in reduce the risk of hyperlipidemia and hyperglycemia activities. Anthocyanins help in prevention of carcinogenesis to inhibit the the cancer progress and metastasis through cell signal transduction in breast cancer, colon cancer, prostate cancer as well as lung cancer, esophageal cancer (Muserref et al., 2014; Chang et al 2010; Faria et al., 2010; Adams et al., 2011; HO et al., 2010; Ratasarl et al., 2014; Bilal et al., 2008; Hafeez et al., 2008; Stoner et al., 2010). Anthocyanin helps to inhibit the growth of breast cancer by apoptosis and scavenging reactive oxygen species (Xu et al., 2010)

d) Black rice protects Heart Health

Black rice decrease the atherosclerotic plaque to keep the arteries clear and prevent the heart attacks and strokes and to maintain the cholesterol level and low the level of triglycerides and control the hyperlipidemia (Ling, Wen Hua et al., 2002).

e) Black rice improves Digestive and Metabolic Health

Black rice helps to prevent the constipation. The fibre of black rice binds to waste and toxins in digestive tract and pull them out and helps to prevent the diarrhea (Molla, AM et al., 1982; Nalin D.R. et al., 1971).

f) Black rice help in brain function

Black rice helps to improve the memory impairment and prevent and reduce the risks of Alzheimer's disease, dementia, depression and helps to boost the memory and prevent the premature cognitive aging (Jang, Hwan-Hee et al., 2012).

4. CONCLUSION

This review appraise the literature of the uses of Black rice in various diseases of human due to its high nutrient density, high fibre content, rich in antioxidant activity they help to prevent of various cancers such as breast cancer, prostate cancer, liver cancer and many others, various diseases and illnesses. Black rice also promotes the heart and liver health, weight loss, lipid profile and blood glucose level and help in brain functioning of various levels.

REFERENCES

1. Yang DS, Lee KS, Jeong OY, Kim KJ, Kays SJ. Characterization of volatile aroma compounds in cooked black rice, "J. Agric Food Chem.56:235-240,2003.
2. Kang MY, Kim JH, Rico CW and Nam SHA, Coparative study on the physiochemical characteristics of black rice varieties. *Int J Food Prop.* 14(6), 1241-1254, 2011.
3. Ryu SN, Park SZ and HO CT, High Performance Liquid Chromatographic Determination of Anthocyanin Pigments in some varieties of Black rice. *J. of food and Drug Analysis,* 6:1710-1715, 1998.
4. Stintzing FC, Stintzing AS, Carle R, Fre B and Wrolstad RE. Color and Antioxidant properties of cyaniding-based anthocyanin pigments. *J Agric Food Chem.* 50:6172-81., 2002.
5. Thompson LU. Antioxidants and harmone-mediated health benefits of whole grains. *Crit. Rev Food Sci Nutr.* 34:473-497.1994.
6. Hamid AA etal, Antioxidants: Its medicinal and pharmacological applications. *African J. of Pure and Applied Chemistry.* 4(8), 142-1512010.
7. Black rice: Ingredient of the month, American Culinary Federation Education Foundation, 180 centre place way, St. Augustin, February, 2016.
8. Harbone JB, Williams CA, Advances in flavonoid research *Phytochemistry* since 1992. 55:481-504., 2000.
9. Irakli MN., Samanidou, VF., Biliaderis, CG and Papadoyannis, N., Simultaneous determination of phenolic acids and flavanoids in rice usung solid-phase extraction and RP-HPLC with photodiode array detection. *Journal of Separation Science,* vol.35, pp 1603-1611, 2012.
10. Sriseadka T, Wongpornchai S and Rayanakorn M, Quantification of flavanoids in black rice by liquid chromatography-negative electrospray ionization tandem mass spectrometry, *J Agric. Food Chem.,* vol.60, no.47, pp 11723-11732, 2012.
11. Dong Sik Yang, Kyu- Seong Lee, O-Young Jeong, Kee-Jong Kim, Stanley J. Kays, Characterization of volatile aroma compounds in cooked black rice. *J. Agric. Food Chem,* vol 56, no.1, pp 235-240., 2008.

12. Das KR, Medhabati K, Nongalleima K and Devi HS. The potential of dark purple scented rice from staple to nutraceutical. *Current World Environment*. 9(3):867-876, 2014.
13. Dwijayanti DR, Wiidodo, Ibrahim, M and Rifa'I, M. EMSA eritin polyherbal as an antioxidant can suppress NF-B activation and decrease IL-17 Cytokine in irradiation mice model. *Food and Agriculture Immunology*, 27(3), 422-433. 2015.
14. Liang, Y., Zhou, Y and Shen P. NK- κ b and its regulation on the immune system. *Chinese Society of Immunology*, 1(5), 343-350. 2004.
15. Zhang H, Y .Shao, J. Bao, T. Beta. Phenolic compounds and antioxidant properties of breeding lines between the whole and black rice. *Food Chem*. 172, 630-639. 2015.
16. Chang H, Yu B, Yu X, Yi L, Chen C, Mi M etal. Anticancer activities of an anthocyanin-rich extract from black rice against breast cancer cells in vitro and in vivo. *Nutr. Cancer*. 62:1128-1136.
17. Muserref HS, Ammad AF, Muhammad ZQ etal. Anthocyanins: targeting of signaling networks in cancer cells. *Asian Pac. J Cancer Prev*, 15, 2379-81. 2014.
18. Chang H, Yu B, Yu XP etal. Anticancer activities of an anthocyanin-rich extract from black rice against breast cancer cels in vitro and in vivo. *Nutr. Cancer*, 62, 1128-36. 2010.
19. Faria A, Pestana D, Teixeira D etal. Blueberry anthocyanins and pyruvic acid adducts: Anticancer properties in breast cancer cell lines. *Phytother Res*, 24, 1862-9.2010.
20. Adams LS, Kanaya N, Phung S etal., Whole blueberry powder modulates the growth and metastasis of MDA-MB-231 triple negative breast tumors in nude mice. *J. Nutr*, 141, 1805-12.2011.
21. HO ML, Chen PN, Chu SC etal. Peonidin 3-glucoside inhibits lung cancer metastasis by down regulation of proteinases activities and MAPK pathway. *Nutr. Cancer*, 62, 505-16.2010.
22. Ratasark S. Teera C. Purple rice extract supplemented diet reduces DMH induced aberrant crypt foci in the rat colon by inhibition of bacterial β -glucuronidase. *Asian Pac J Cancer Prev*, 15, 749-55. 2014.
23. Bilal BH. Imitaz AS, Mohammad A etal. A dietary anthocyanidin delphinidin induces apoptosis of human prostate cancer PC3 cells in vitro and in vivo: involvement of nuclear factor - κ b signaling. *Cancer Res*.68,8564-72.2008.

24. Hafeez BB, Siddiqui IA, Asim M et al. A dietary anthocyanidin delphinidin induces apoptosis of human prostate cancer PC3 cells in vitro and in vivo: involvement of nuclear factor κ b signaling. *Cancer Res.* 68 , 8564-72.2008.
25. Stoner GD, Wang LS, Seguin C et al. Multiple berry types prevent N-nitrosomethylbenzylamine-induced esophageal cancer in rats. *Pharm Res*, 27, 1138-45. 2010.
26. Xu M, Bower KA, Wang SY. Cyanidin—3-Glucoside inhibits ethanol-induced invasion of breast cancer cells overexpressing ErbB2. *Mol. Cancer*, 9, 285. 2010.
27. Ling WH, Wang LL, Ma J. Supplementation of the black rice outer layer fraction to rabbits decreases atherosclerotic plaque formation and increases antioxidant status. *J. Nutr.* 132, 20-6.2002.
28. Molla. A. Molla A.M, Rahim A, Sarker SA, Mozaffar Z and Rahaman M.1982. Intake and absorption of nutrients in children with cholera and rotavirus infection during acute diarrhea and after recovery. *Nutr. Res.* 2:233-242.
29. Nalib DR and Cash RA.1971. Oral or nasogastric maintenance therapy in pediatric cholera patient. *J. Pediat.*78:355-358.
30. Hwan-Hee Jang, Mi-young park, Heon-wrong kim, Young-min lee, Kyung A Hwang, Jae-Hak Park, Dong-sik park, Oran kwan. Black rice (*O.sativa*) extract attenuates hepatic steatosis in C57BL/6J Mice fed a high fat diet via fattyacid oxidation. *Nutr. Metab (Lond.)* 30; 9(1):27.2012.