

# Black Rice Revolution: Exploring Value-addition Opportunities

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From ancient times, rice has been a dietary staple across various regions of the world. Different varieties of rice, including white, purple, red, brown, and black rice, are distinguished based on their outer bran layer. Black rice, scientifically known as *Zizania aquatica*, is a rice strain that originates from a mutation of the Kala4 gene. Predominantly cultivated in Southeast Asian nations such as China, Thailand, and India, with China alone contributing to 62 % of the global production. Additionally, countries like Sri Lanka, India, Indonesia, and the Philippines also cultivate black rice. It is present in the outer layers (bran) of the rice kernel. Black rice is enriched with other rich nutrients like tocopherols (vitamin E), iron and antioxidants which accounts for high levels of protein, fiber, vitamins (Vitamin B<sub>1</sub>, Vitamin B<sub>2</sub>, folic acid) and minerals (iron, zinc, calcium, phosphorous and selenium) compared to that of white rice. It accounts for various health benefits like antioxidant activity, anti-inflammatory properties, lipid oxidation, anti-diabetic, anti-ageing and anti-cancer effects are due to the presence of good amount of essential amino acids like lysine and tryptophan in black rice

## Health benefits of black rice

1. **Antioxidant properties** Black rice is rich in anthocyanins, helps to neutralize harmful free radicals in the body, reducing oxidative stress and inflammation, which are linked to various chronic diseases such as heart disease, cancer, and neurodegenerative disorders.
2. **Heart Health:** It may contribute to heart health by reducing cholesterol levels, improving blood vessel function, and lowering the risk of cardiovascular diseases.
3. **Digestive Health:** Black rice is a good source of dietary fiber, which is important for digestive health. Fiber promotes regular bowel movements, prevents constipation, and supports a healthy gut microbiome.

4. **Weight Management:** The fiber content in black rice helps promote satiety and reduce hunger, which can aid in weight management and prevent overeating.
5. **Diabetes Management:** Black rice has a lower glycemic index than white rice, meaning it causes a smaller and slower increase in blood sugar levels after consumption.
6. **Cancer Prevention:** Antioxidants and phytochemicals present in black rice may have anti-cancer properties, helping to prevent the growth and spread of cancer cells.
7. **Skin Health:** The antioxidants in black rice may help protect the skin from damage caused by free radicals and UV radiation, potentially reducing the signs of aging and promoting overall skin health.



Fig. 1 Black rice

## Different value-added products from black rice

1. **Black Rice Flour:** The black rice flour contains 60.40 % starch, 7.94 % protein, 2.17 % fat, 1.38 % ash, 12.71 % water, and 0.049 % total phenolics. Black rice can be milled into flour, which can then be used as a gluten-free alternative in baking recipes. Excellent option for individuals with gluten intolerance or celiac disease. Black rice flour adds a rich, nutty flavor and striking color to baked goods such as bread, muffins, pancakes,

and cookies. It may also be labeled as "forbidden rice flour" or "purple rice flour."



Fig. 2 Black rice powder

2. **Black Rice Breakfast Cereal:** A nutritious breakfast cereal made from cooked black rice, served hot or cold with milk or yogurt, fresh fruit, and a drizzle of honey or maple syrup. Black rice breakfast cereal is a wholesome and satisfying way to start the day. Approximately 100 kg of black rice, some broken grains, were stored in plastic bottles under refrigeration ( $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ) and light protection before being processed in an analytical mill. The rice flour ( $\geq 60$  mesh to  $\leq 250$   $\mu\text{m}$ ) was treated with water for 5 minutes in a kitchen mixer 24 hours before the extrusion. The exact amount of water that should be added to the rice flour to get the desired consistency. ZKS 30 Werner and Pfleiderer co-rotating twin-screw extruder was used for the extrusion. Extrusion was carried out at 75, 100, and  $125^{\circ}\text{C}$  in the first, second-, and third-barrel zones, respectively. The screw speed (250 rpm) and feed rate (15 kg/h) were kept constant. Following extrusion, the material was dried in a forced-air tunnel until it reached a moisture content of  $\leq 7\%$ . Extrusion was applied to successfully manufacture very appealing colored breakfast cereal with desirable expansion, texture, and color attributes from black rice varieties
3. **Black Rice Noodles:** Black rice noodles, also known as "forbidden noodles," are made from black rice flour and water. These gluten-free noodles have a distinctive color and slightly chewy texture, making them a popular choice for stir-fries, soups, and cold noodle salads.
4. **Black Rice Crackers:** Crunchy crackers made from black rice flour and other ingredients such as sesame seeds, seaweed, or spices. Black rice

crackers are a nutritious and flavorful snack option that pairs well with dips, cheeses, or enjoyed on their own.

5. **Black Rice Pudding:** A creamy and indulgent dessert made by simmering black rice with coconut milk, sweeteners like sugar or honey, and aromatic spices such as cinnamon and cardamom. Black rice pudding is a delicious and nutritious alternative to traditional rice pudding, often served warm or chilled with fruit toppings or nuts.
6. **Black Rice Energy Bars:** Nutrient-rich energy bars made from a blend of black rice, nuts, seeds, dried fruits, and natural sweeteners like dates or honey. Black rice energy bars are a convenient and portable snack option, providing sustained energy and a satisfying crunch.
7. **Black Rice Salad Mix:** Pre-packaged salad mixes featuring cooked black rice as the base, combined with colorful vegetables, herbs, and a flavorful dressing. Black rice salad mixes offer a convenient and nutritious meal option that can be enjoyed as a side dish or a light main course.
8. **Black Rice Sushi Rolls:** Sushi rolls made with black rice instead of traditional white sushi rice. Black rice sushi rolls, also known as "forbidden sushi," are visually striking and offer a unique flavor profile, often filled with ingredients like avocado, cucumber, seafood, or tofu.
9. **Black Rice Beverage:** A refreshing and nutritious beverage made from blending cooked black rice with water, coconut water, or fruit juice. Black rice beverages can be enjoyed chilled or blended with ice for a cool summer treat.
10. **Black Rice Protein Powder:** A plant-based protein powder made from ground black rice, which can be added to smoothies, shakes, or baked goods to boost their protein content. Black rice protein powder is a vegan-friendly option that provides essential amino acids and nutrients.

## Conclusions

The valorization of black rice into value-added products presents a promising avenue for innovation in the food industry. Through processing and product development, black rice can be transformed into a

range of high-value offerings that appeal to consumers seeking nutritious, flavorful, and visually appealing options. The unique nutritional profile of black rice, enriched with antioxidants, vitamins, minerals, and dietary fiber, lends itself well to the creation of functional foods with potential health benefits. Additionally, the distinctive color and flavor of black rice add a sensory dimension to value-added products, enhancing their appeal and marketability.

### References

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