

## Proximate Analysis and Shelf Life Stability Of Black Rice Muffins

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### Abstract

Black rice has been consumed from antique times by the people of Southeast Asian countries. It is said to be a nutrient-rich rice variety among all species of rice. The Phytochemicals present in it are the reason for its health-promoting properties. Muffins were prepared from black rice and refined wheat flour. The nutrient composition, anthocyanin content, and shelf-life stability were assessed. The prepared black rice muffin contained 81.89 % carbohydrates, 2.35% protein, and 3.25% fat. The shelf-life stability of the nutrients decreased on the eighth day from 81.89 to 77.56% carbohydrate and from 3.25% fat to 2.88%. Sensory analysis of the muffin by the panel gave an overall acceptance rate of 4.57 on a hedonic scale of 5 points. Muffins made of black rice and refined flour is a low-gluten snack that can be relished by all. No doubt muffins made of black rice can be guaranteed as a health-promoting functional food.

**Keywords:** Black Rice, Muffin, Snack, Functional Food, Shelf Life.

### INTRODUCTION

Black rice has been considered a functional food due to the presence of flavonoids in it.<sup>[1]</sup> The nutrient composition of black rice is such that when consumed regularly helps to prevent non-communicable diseases.<sup>[2]</sup> When related to normal White rice, Black rice is an amusing source of trace elements which is also known as an elixir for longevity. Black rice gains this potential due to the anthocyanin pigment present in it. <sup>[3]</sup> Apart from the essential amino acids, lipids, and dietary fibre, black rice also contains unique-oryzanols, tocopherols, tocotrienols, and phytosterols that help in alleviating the symptoms of people with celiac diseases.<sup>[4]</sup>

Muffins are used as a source of breakfast and snacks by a large population of people around the globe. Usually, a muffin is prepared by mixing all-purpose flour, butter, eggs, and milk. As a result, people with celiac disease avoid this product since they are made with wheat flour. <sup>[5]</sup> Black rice is gluten-free and has a low level of prolamine and is hypoallergenic.<sup>[6]</sup>

The main ingredient of gluten-free muffins, cakes, or cupcakes is 50 % rice flour and different starch sources, such as corn, potato, and wheat. There has been an enormous development to improve the sensory quality of bakery products that are made from rice so that they can be consumed by people of all ages.<sup>[7]</sup> With the aforementioned background, the objectives of the current study are framed to formulate black rice muffins, compare the nutrient composition with wheat muffins, and also evaluate the shelf-life stability of nutrients.

## Materials And Methods

The study was conducted in the Food Analysis Lab of the Food Technology Department, Hindustan University, Chennai, India. The research work was carried out for a period of three months with trial and error.

Muffins were prepared by use of sugar batter method

- The ingredients used for low gluten black rice muffins such as black rice flour, all-purpose flour, sugar, eggs, butter, leavening agents, and buttermilk, were purchased from the Krishna supermarket of Chennai City. nearby supermarket.
- Sieving of black rice flour along with baking soda was done to eradicate impurities. Butter, and buttermilk was stored cool in refrigerator
- The blackrice flour 100 gm, refined wheat flour 20 g, butter, 50 gms, sugar powder 75 gms were were mixed well using a cake mixer for 15 minutes until the required consistency is reached
- The batter was placed in an oven for 20 -25 minutes at 175 C The muffins are done when a toothpick inserted into it comes out with a few moist crumb

## Proximate analysis of black rice and control muffin

Proximate analysis of black rice muffin and control muffin was carried out for nutrients namely carbohydrate, protein, and fat. Carbohydrate and fat content were assessed by FSSAI standard method. The total protein was assessed by AOAC 950.36 method.

The shelf-life stability of nutrients was evaluated on 0, 3, and 7<sup>th</sup> days by the procedures endorsed by FSSAI.

Sensory **evaluation was** done on a 5-point hedonic scale to find out the overall acceptability of the black rice muffin.

## Results and discussion

Standardized and validated laboratory methods were used to determine the physicochemical characteristics of muffins, in terms of fat, protein, carbohydrates, and energy value. .

From table 1, it can be interpreted that the total carbohydrate percent, fat, and protein percent in black rice muffin was 81.89 %, 3.20 %, and 2.35 % respectively whereas the total carbohydrate percent, fat, and protein percent in wheat muffin was 88.24 %, 5.17 %, and 6.70 %

When compared to the Control muffin which is completely made of all-purpose flour, the black rice muffins contained less amount of carbohydrates and fat.

**Table 1: Comparative nutrient analysis of muffins made from black rice and wheat**

| Nutrients          | Method       | Black rice muffins<br>% of nutrients | Control Wheat muffins<br>% of nutrients |
|--------------------|--------------|--------------------------------------|---|
| Total carbohydrate | FSSAI        | 81.89%                               | 88.24%                                  |
| Total fat          | FSSAI        | 3.20%                                | 5.17%                                   |
| Total protein      | AOAC         | 2.35%                                | 6.70%                                   |
| Calories           | FSSAI        | 323                                  | 348                                     |
| Anthocyanin        | AOAC 2005.02 | 24.05                                | Nil                                     |

The quality characteristics of muffins containing black rice flour have a greater variety of functional components than wheat flour. The results of the pasting properties show that the inclusion of black rice flour in the wheat flour mixture will not affect the pasting temperature but increased the enthalpy, indicating that more energy is needed for starch gelatinization. The total dietary fiber increased with increasing black rice flour content <sup>[8]</sup>

To add value to black rice muffins, black rice flour was incorporated at various levels with (0% as control, 10%, 20%, 30%, 40%, and 50%)., fat, crude protein, and functional properties showed a significant increase ( $p < 0.05$ ) with the increasing quantity of black rice flour with maximum content in 50% substituted formulation

### Shelf-life stability of nutrients

The shelf-life stability of black rice muffins was done on the first day, third day, and seventh day. Since black rice is rich in phenolic and fat-soluble compounds, storing them may produce some type of rancidity and also depletion in the carbohydrate and protein quantity. The nutrients were stable till the third day and did not show any changes during storage for three days. On the seventh day, the carbohydrate value decreased from 81.89 to 77.56gms, protein content from 2.35 to 2.01gms while the fat content changed from 3.20 to 2.88 gms. The quantity of anthocyanin pigment in the black rice muffin decreased from 24.05 to 20.22mgs (table 2).

Shelf-life stability test results (table 2) of muffins revealed a decrease in anthocyanins, carbohydrates, protein, and fat. The added value products showed microbiological stability during the stored period, probably due to the presence of polyphenolic compounds that

possess antimicrobial activity. These results indicate that value-added muffins prepared from black rice flour could be a boon to people with wheat sensitivity and they can also relish muffins as other people.

Black rice pigmented fraction (BRE) containing cyanidin 3-glucoside and peonidin 3-glucoside exhibited marked antioxidant activities and free radical scavenging capacities in vitro model systems. Significant ( $p < 0.05$ ) prevention of supercoiled DNA strand scission induced by reactive oxygen species (specifically, peroxy radical and hydroxyl radicals) and suppression of the oxidative modification of human low-density lipoprotein was obtained with BRE<sup>[9]</sup>

### SENSORIAL EVALUATION

Sensory analysis done by a panel of healthy individuals showed that both the control and black rice muffin tasted alike. Panelists even perceived that samples with black rice flour contain pleasant crispy particles compared with the control sample. The sensory evaluation received a mean score higher than four on a total score of five for all the sensory attributes indicating that the product was good and was acceptable for consumption. The lowest score was rated for taste ( $4.27 \pm 0.69$ ) and the highest score was rated for the color of the muffin. Polyphenols contribute to the sensory and nutritional qualities of muffins.

**Table 2 - Shelf-life stability of nutrients**

| Nutrients              | Method          | 0 Day<br>% of nutrients | 3rd Day<br>% of<br>nutrients | Seventh day<br>% of nutrients |
|------------------------|-----------------|-------------------------|------------------------------|-------------------------------|
| Total carbohydrate gm  | FSSAI           | 81.89                   | 81.00                        | 77.56                         |
| Total fats gm          | FSSAI           | 3.20                    | 3.10                         | 2.88                          |
| Total protein Gm       | AOAC<br>950.36  | 2.35                    | 2.32                         | 2.01                          |
| Anthocyanin pigment mg | AOAC<br>2005.02 | 24.05                   | 23.89                        | 22.22                         |

Muffins were also evaluated on the basis of its texture, color and sensory properties and muffins with 50% black rice flour were given the highest score by the panelist and exhibited a good overall acceptability. Therefore, this combination can be used for making acceptable gluten free muffins loaded with diversified nutritional attributes.<sup>[10]</sup> The colour of bakery products is affected by ingredients, process, and ingredient process interactions, such as Maillard or caramelization reactions .<sup>[11]</sup> The colour of the black rice added muffin was brown in colour and was appealing to eye like chocolate muffins

## CONCLUSION

It is of profound importance to develop gluten-free nutritional diets by incorporating alternative black rice that is naturally rich in nutrients. Black rice is a valuable crop, out of which gluten-free products can be made with increased nutritional quality. Black rice muffin has a complete set of essential amino acids, is also high in iron, and has more copper, zinc, and calcium than other cereal grains.

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