Development and Evaluation of the Organoleptic Properties of a Traditional Snack with Black Rice (Oryza sativa L. indica)

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Abstract

Black rice scientifically known as Oryza sativa L. indica is primarily grown in Asian countries like China, Indonesia, India, Japan, Sri Lanka and Thailand. Black rice is nutritionally superior and its functional properties make it suitable for the preparation of traditional snack items. The aim of the present study is to incorporate black rice in traditional snack item. Black rice flour was incorporated at 25%, 50%, 75% and 100% in the preparation traditional south Indian snack, Chekkalu. Sensory evaluation of the snacks was conducted by untrained panellists. The mean scores for texture and taste of all samples are very close to the control. The scores for color for 25% was better than the other variations. Chekkalu with 25% and 50% black rice flour was found to be more acceptable than the other variations.

Keywords: black rice, snacks, chekkalu

Introduction

Black rice is scientifically known as Oryza sativa L. indica and is primarily grown in Asian countries like China, Indonesia, India, Japan, Sri Lanka and Thailand. Black rice is also called as forbidden rice, purple rice, emperor's rice and longevity rice. It is also reported that during the imperial period common man in China was forbidden to cultivate or store this rice. The names vary from one place to another viz. Chakhao pungdol ambui (Manipur), Kalabati (Odisha), Kavuni (South India), Kola Saul (Assam), Kalabhat (Maharashtra), Karapu Kavani (Tamil), Burma Black (Northeast India). [1]

Worldwide black rice is slowly gaining importance as a result of its superior nutritive values and unique functional properties. It is rich in bioactive compounds like essential amino acids, dietary fiber, phenolic compounds, anthocyanins and oryzanol. [2] Black rice has comparatively more protein, mineral, fiber, anthocyanins and lower sugar and fat content than the regularly used staple, white rice (oryza sativa). [3] Some studies report that the bran of black rice has higher levels of dietary fiber, oryzanols, tocopherols, tocotrienols, phytosterols and phytochemicals. [4] It consists of good amounts of micronutrients like copper, iron, potassium, magnesium, zinc and B vitamins. Black rice has a unique flavor and further studies on its functional qualities are needed to assess its potential for consumer acceptability. [5] Some studies suggest that the phytosterols present in black rice have an important role to play in inhibiting excess lipoproteins and cholesterol. [6,7] Like all types of rice, black rice is also a predominant source of starch. The bran is a rich source of phytonutrients and hence less bran is removed during milling of black rice. [8]

Black rice is beneficial in many ways with its potential to improve health. The anthocyanins in black rice provide protection against inflammation, heart disorders and cancers. Jena et al., reported that black rice consumption is good for diabetes and Alzheimer's disease. [9] Studies suggest that black rice has the ability prevent oxidative damage, reduce lipid and cholesterol in blood, prevent cancers and tumors. [10] The anthocyanins in black rice act as antioxidants and are responsible for several of the health benefits of black rice like improving memory function and coordination, increasing immunity, improving kidney and liver function, preventing atherosclerosis and accumulation of uric acid in the

body. [11] Black rice has the potential to mitigate nutritional deficiencies caused by continuous consumption of white rice.

The sticky nature of the rice makes it suitable for the preparation of several sweet dishes in Asian countries. The health benefits of black rice make it a suitable choice for incorporating into several dishes like bakery products, traditional snacks and other delectable food items. The objective of the present study is to develop a traditional South Indian snack, Chekkalu, by incorporating black rice at 25%, 50%, 75% and 100% and evaluate its organoleptic properties.

Methodology

Procurement of Sample

Black rice was purchased from the local market in Vijayawada. The rice was cleaned of stones and other extraneous matter and stored in a polythene bag at room temperature. Other ingredients for the preparation of the traditional snack were also purchased from the local market.

Preparation of Traditional Snack Item

The snack, Chekkalu, was prepared with white rice flour (Fig 1) using the traditional procedure. Different variations of the snack were prepared by incorporating 25%, 50%, 75% and 100% black rice flour (Table 1) (Fig 2). Chekkalu made with white rice flour was taken as the control sample (CCS).

Table 1: Ingredients for the preparation of traditional snack, Chekkalu

S.No	Variations	White rice flour (g)	Black rice flour (g)
1.	CCS	100	0
2.	CT1	75	25
3.	CT2	50	50
4.	CT3	25	75
5.	CT4	0	100

White rice flour Black rice flour

Fig 1 & 2: White rice flour and Black rice flour

Sensory evaluation

The organoleptic properties evaluation of the control and test samples were done by a group of 15 untrained panellists using the 5-point hedonic scale in which the highest score corresponded to the highest perception of quality (1- dislike very much and 5- like very much). The coded samples were tested for colour, taste, texture, odor and overall acceptability. The panellists rinsed their mouths after each evaluation. The best variation of the traditional snack, Chekkalu, was selected by taking the scores of the overall acceptability of the panellists. Mean values of the scores for color, taste, texture, odor and overall acceptability were calculated and variation was found by calculating the standard deviation.

Results and Discussion

Sensory evaluation of traditional snack, Chekkalu, made with black rice

The sensory evaluation of the traditional snack, Chekkalu, of the control sample (CCS) (Fig 3) made with white rice flour and test samples (CT1, CT2, CT3, CT4) (Figs 4, 5, 6 and 7) made with incorporating black rice flour in different variations of 25%, 50%, 75% and 100% respectively, was conducted. The samples were tested for colour, taste, texture, odour and overall acceptability. Scores of colour of the samples is represented in Table 2 and Fig 8. The scores for the samples incorporated with 75% and 100% black rice flour (CT3 and CT4) showed lowest values of 4.1 ± 0.12 and 4.1 ± 0.20 respectively. Results showed that there was significant difference between the colour of the control sample (CCS) and 75% and 100% samples.

Table 2: Sensory evaluation scores of the traditional snack, Chekkalu (Mean±SD)

Sensory Quality	CCS	CT1	CT2	CT3	CT4
Colour	4.6 ± 0.20	4.3 ± 0.33	4.0 ± 0.80	4.1 ± 0.12	4.1 ± 0.20
Taste	4.5 ± 0.35	4.3 ± 0.45	4.4 ± 0.21	4.2 ± 0.34	4.1 ± 0.30
Texture	4.6 ± 0.58	4.5 ± 0.08	4.6 ± 0.09	4.5 ± 0.42	4.4 ± 0.27
Odour	4.7 ± 0.11	4.6 ± 0.06	4.5 ± 0.10	4.4 ± 0.35	4.3 ± 0.19
Overall Acceptability	4.8 ± 0.17	4.8 ± 0.18	4.7 ± 0.12	4.6 ± 0.67	4.6 ± 0.14

Chekkalu with white rice

Fig 3: White rice Chekkalu (CCS)

Chekkalu with 25% black rice

Chekkalu with 50% black rice

Fig 4 & 5: Chekkalu made with 25% & 50% black rice flour (CT1 & CT2)

Chekkalu with 75% black rice

Chekkalu with 100% black rice

Fig 6 & 7: Chekkalu made with 25% & 50% black rice flour (CT3 & CT4)

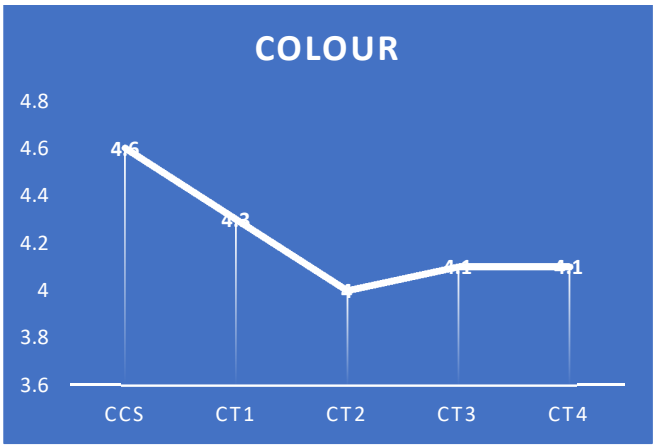

Figure 8: Graphical representation of the colour scores of the traditional snack, Chekkalu

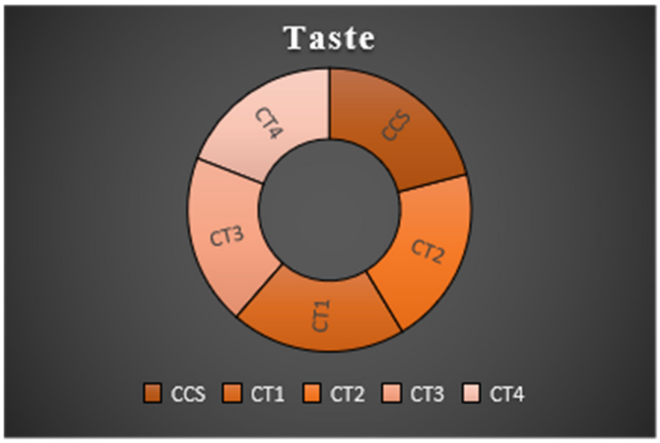

Figure 9: Graphical representation of the taste scores of the traditional snack, Chekkalu

The scores for taste and texture of the control and test samples are shown in Table 2 and Fig 9 and 10 which shows slight variation in taste in the test sample (CCS) and test samples (CT1, CT2, CT3 and CT4). The panellists reported the taste of the black rice flour incorporated Chekkalu to be almost the same as the Chekkalu made with white rice flour. The panellists stated that the texture of the black rice incorporated samples proved to be similar to that of the control sample, CCS, as shown in 3-D 100% Stacked Column (Fig 10). The test scores of odor of the samples is shown in Table 2 and Fig 11. The panellists reported a slightly nutty flavour which was acceptable by them and the scores ranged from 4.7 ± 0.11 to 4.3 ± 0.19 in the control and test samples.

The overall acceptability scores for the traditional snack prepared using white rice flour and variations by incorporating black rice flour is shown in Table 2. The panellists reported that black rice flour Chekkalu at different percentages was acceptable as that of the control sample, white rice flour Chekkalu. Graphical representation of the overall acceptability is shown in Fig 12 which shows a similar acceptability as the control sample. The best acceptability is seen is the 25% and 50% variation (CT1 and CT2) which is 4.8 ± 0.18 and 4.8 ± 0.12 respectively as compared to the control sample (CCS) which is 4.8 ± 0.17. CT3 and CT4 samples had acceptable scores of 4.6 ± 0.67 and 4.6 ± 0.14 respectively. The present study showed similar findings as the studies conducted by Pratyusha et al., 2018 [12] by using quinoa to prepare traditional snack, Chekkalu.

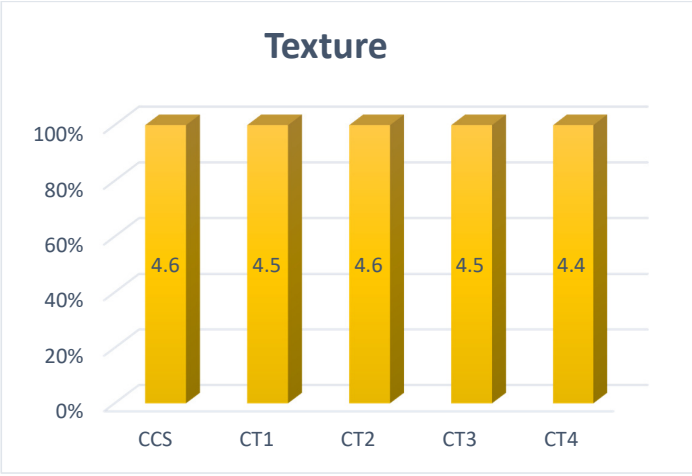

Fig 10: Graphical representation of the texture scores of the traditional snack, Chekkalu

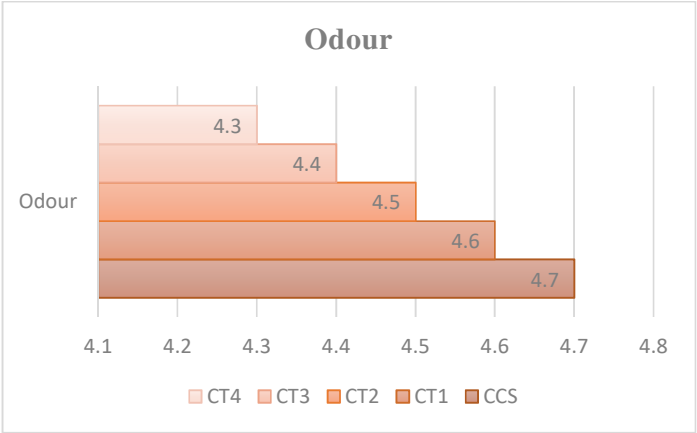

Fig 11: Graphical representation of the odour scores of the traditional snack, Chekkalu

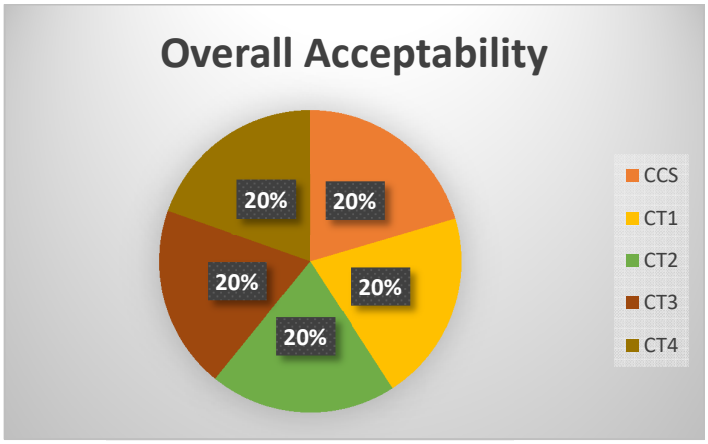

Fig 12: Graphical representation of the overall acceptability scores of the traditional snack, Chekkalu

Conclusion

Black rice is nutritionally superior in the proximate composition, fiber and mineral content as reported by Dhital et al., 2015. [13] The functional properties of bulk density, water and oil absorption and viscosity as studied by Hymie Cherik [14] make it suitable for the preparation of traditional snack items. The aim of the present study is to incorporate black rice in traditional snack items. Black rice flour was incorporated at 25%, 50%, 75% and 100% in the preparation traditional south Indian snack, Chekkalu. Sensory evaluation of the snacks was conducted by untrained panellists. The mean scores for texture and taste of all samples are very close to the control. The scores for color for 25% was better than the other variations. Chekkalu with 25% and 50% black rice flour was found to be more acceptable than the other variations. The findings prove that black rice flour owing to its nutritional components, functional parameters and health benefits can be used in place of white rice in various traditional preparations.

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Conflict of interest

The authors declare no conflict of interest.

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