

**PROXIMATE COMPOSITION AND PHYTOCHEMICAL CONTENTS OF TWO
SCENTED RICE VARIETIES: BIRAN AND KALI KHASA OF TRIPURA, NORTHEAST
INDIA**

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ABSTRACT

Kali khasa and Biran are two important rice varieties of Tripura, Northeast India. The present study was carried out to evaluate the nutritional status and phytochemical contents of Biran and Kali khasa rice varieties. Carbohydrate, protein, lipid, fat, crude fibre, ash and moisture contents were determined for nutritional status analysis and alkaloid, flavonoid, tannin, saponin and phenol contents were analyzed as phytochemicals. In Kali khasa higher contents of protein (9.76%), fat (2.4 %), fibre (1.037%) and carbohydrate (77.09%) were found. Ash (1.85%) and moisture contents (12.5 %) were found higher in amount in Biran. Among phytochemicals, alkaloid (3.7%), tannin (1.83%), saponin (7.3 %) and phenol (21 g%) were found higher in amount in Biran where as flavonoid content (2.3%) was higher in Kali khasa. Kali khasa showed more energy value 363.86 KJ per 100 g than Biran. The study indicated that two rice varieties Kali khasa and Biran possessed functional food ingredients and natural phytochemicals.

KEYWORDS: Biran, Kali khasa, Nutritional status, Phytochemicals

INTRODUCTION

Rice is a major food item throughout the world. Rice varieties are categorized as aromatic and non aromatic varieties based on aroma, aromatic rice hold a scent in their plant parts and grains emit the scent in the fields and retain the scent in storage and cooking (Gibson 1976 and Jefferson 1985). Indian grazier grow a large number of rice varieties which include some of the finest quality of aromatic rice of all shapes, sizes and colours are available in the country represent the greater genetic diversity observed in the various agro climatic regions, 2 acetyl-1-pyrroline content in scented rice is responsible for aroma and it varies with genetic and environmental conditions (Nadaf *et al.* 2006). Traditionally, many varieties of aromatic and non-aromatic rice are grown by Indian farmers and sold at a premium price in local and international markets because of their superior grain quality and pleasant aroma (Nayak *et al.* 2002).

Rice is major staple food of Tripura used in preparation in parched and flaked rice. The entire population consumes it in various form and also in preparation of

wine. In handloom industry starch derived from rice widely used. Various aromatic rice varieties namely Gobinda Bhog (white), Gobinda Bhog (black), Sada khaja, Kalakhau and Kalijira are available in Tripura (Ahuja *et al.* 2018). Aromatic rice possess incompatible flavor of Tripura and owns local varieties namely Kali khasa, Gobinda Bhog, Thakur Bhog, and others. Basmati having the high export potential qualities to earn foreign revenue. The said varieties of paddy grow well under rain fed conditions in Tripura. Aromatic rice varieties are good source of different phytochemical such as phenolic compounds, anthocyanin, flavonoids and components are most likely associated with the reduction of degenerative human diseases due to their antioxidative and free radical scavenging properties (Basu *et al.* 2012). In order to cope with the increasing population, food security, nutrient security, urbanization, climate change and changing food preferences, there is need for not only high yielding varieties but also for nutritionally adequate rice varieties. Hence present study was undertaken to generate details on the nutritional composition and phytochemical

composition of selected two scented rice varieties Kali khasa and Biran of Tripura.

MATERIALS AND METHODS

Sample collection and preparation

Scented rice varieties (Fig.1) namely Kali khasa was collected from Melagharh, Latitude $24^{\circ} 23' 20.08''$, Longitude $92^{\circ} 12' 22.29''$ and Biran was collected from Nadiapur, Dharmanagar, Latitude $23^{\circ} 30' 11.5''$, Longitude $91^{\circ} 18' 40.65''$ of Tripura were shown in (Fig.2). The rice grain were dried in the oven at 50°C for 2 hours. Then, the rice grain were husked manually and ground into powdered using pestle and mortar for further study.



Fig. 1: Rice varieties. (a) Biran and (b) Kali khasa.

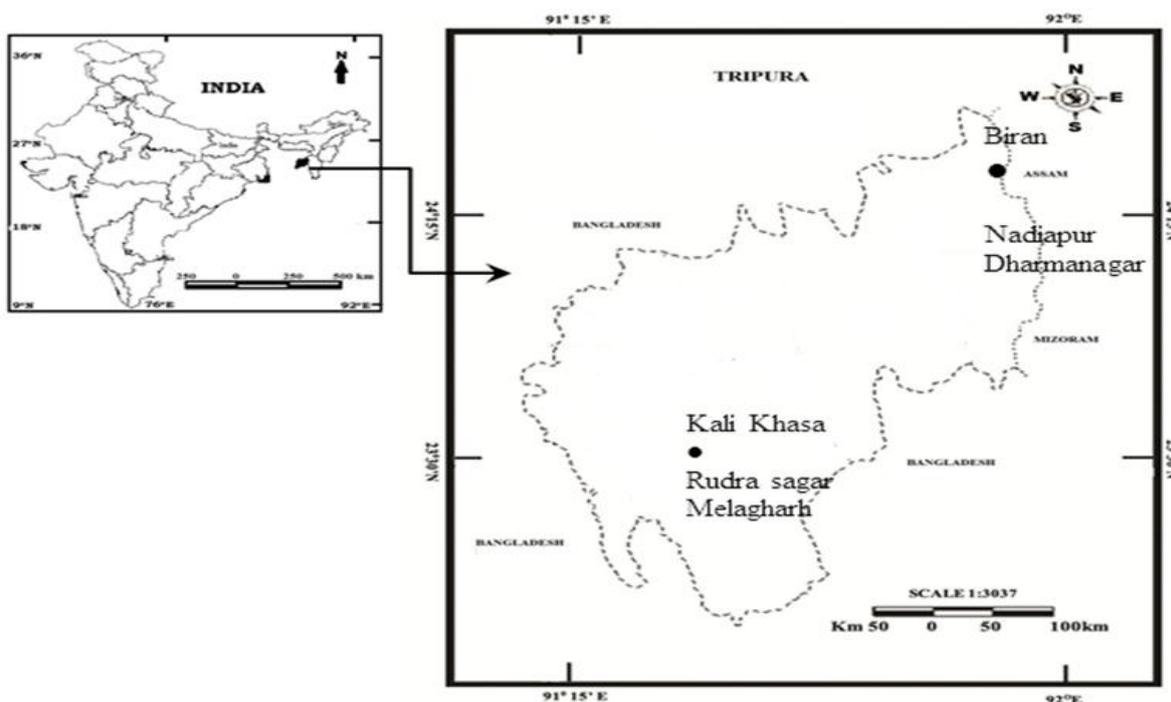


Fig. 2: Map of Tripura showing the cultivation place of rice varieties, Kali khasa and Biran.

Proximate composition

Moisture content was determined by the method of AOAC (1990). Ash content was determined by the method of Raghuramulu (2003). Crude fat content was determined by the method of AOAC (1960). Crude fibre content was determined by the method of AOAC (1990). Total protein content was estimated by the method of Lowry (1951). Rice powdered was extracted with K-P buffer and then cool centrifuged, supernatant was taken for soluble protein estimation and for insoluble protein estimation precipitate dissolved in 2 N NaOH and hydrolyze at 100°C for 10 min in a boiling water bath. Total protein content (soluble + insoluble) was calculated in gram percent. Total carbohydrate were calculated by difference as follows: total carbohydrates (% fresh weight) = $100 - (\text{g water content} + \text{g protein} + \text{g lipids} + \text{g ash})$ (Beluhan and Ranogajec 2011). Total energy was calculated according to the following equation: energy (kcal) = $4 \times (\text{g protein} + \text{g carbohydrate}) + 9 \times (\text{g lipid})$ (Manzi *et al.* 2001).

Phytochemical content

Alkaloid content was determined by using the method Harborne (1973). Tannin content was determined by using the method of Van Buren and Robinson (1981). Flavonoid content was determined by using the method of Bohm and Kocipai (1994). Saponin content was determined by using the method of (Obadoni and Ochuko (2001). Phenolic content were determined by using the method of Malick and Singh (1980). All measurements were carried out in triplicate for each of the sample. All the values are expressed in terms of mean \pm SD using Origin 7.

RESULTS AND DISCUSSION

Nutritional components of two varieties of aromatic rice Kali khasa and Biran are shown in Table 1. Moisture content has a marked influenced on quality and palatability of rice grains (Oko and Onyekwere, 2010), it plays a significant role in determining the shelf life (Webb, 1985). In the present study moisture content 10

g% was found in Kalikhasa and 12.5 g% was found in Biran aromatic rice varieties. This study is under the range of values reported by Oko and Onyekwere (2010), Sompong *et al.* (2011), Saikia *et al.* (2012), Asaduzzaman *et al.* (2013), and Thomas *et al.* (2013) for other rice accessions. Low moisture content in variety may be attributed to long term storage of rice.

Table 1. Proximate composition of two varieties of rice Kali khasa and Biran red.

Proximate composition	In gram percentage	
	Kali khasa	Biran
Moisture	10±0.02	12.5 ± 0.05
Fat	2.4 ±0.01	1.6 ±0.03
Fibre	1.03±0.03	0.95±0.02
Total protein	9.76 ±0.15	7.5 ±0.17
Ash	1.25±0.05	1.85 ± 0.03
Carbohydrate	77.09±0.2	75.55±0.5
Total energy(Kcal)	363.86±0.01	355.6 ± 0.04

Three values are expressed as mean±SD

Proteins are vital to the living process and carry out a wide range of functions essential for sustenance of life. In the present study Protein content of Kalikhasa is 9.76 g% and Biran is 7.5 g%. Sompong *et al.* (2011) reported protein value in rice as 7.16 to 10.85/100 g. Varietal difference in protein content may be attributed to several factors including environmental stresses such as the application of fertilizer (nitrogen content), growing conditions and time and also location of growing areas (Buresova *et al.*, 2010).

In the present study Fat content of Kalikhasa is 2.4 g% and Biran is 1.6g%. These observation is closely similar to the work of Saikia *et al.* (2012). Fat values are significantly different in between studied aromatic rice varieties. Varietal difference in fat content in different rice varieties may be due to oxidation of fat because most of fat in rice grains is unsaturated which undergoes oxidation easily by atmospheric oxygen (Hirokadzu *et al.*, 1979).

The amount of fibre content in a food decreases the blood cholesterol and sugar after meals in diabetics (Yeager, 1998). In the present study fibre content of Kali khasa is 1.03 g% and Biran red varieties is 0.95 g%. In 2015, Nadiger and Kasturiba also reported crude fibre content in aromatic rice varieties varied from 0.83-2.18 g/ 100 g. Kali khasa contains more fibre content than Biran varieties. Higher crude fibre content in studied rice varieties can be attributed to bran portion of the grains.

Ash content plays an important role to determining the levels of essential minerals (Bhat and Sridhar, 2008). Ash content of Kali khasa is 1.25 g% and Biran is 1.85 g%. Results are consistent with literature data on proximate composition of rice varieties reported Nadiger *et al.* (2015). There is no significant difference in ash content of studied aromatic rice varieties.

Carbohydrates of rice are mainly starch which is composed of amylose and amylopectin. High level of starch makes the individual grains stucked to each other while low starch content prevents well from the sticking of the grains together after cooking (Verma and Srivastav, 2017). In the present study carbohydrate content of kali khasa is 77.09 g% and Biran is 75.55 g%. The similar observation of the carbohydrate content of different rice varieties has also been reported by Oko and Onyekwere (2010), Saikia *et al.* (2012), Thomas *et al.* (2013).

According to Thomas *et al.* (2013) food energy is a value that obtained from food via cellular respiration. In the present study we obtained food energy value of aromatic rice Kali khasa is 363.86 KJ per 100g and Biran red 355.6 KJ per 100g. This observation of food energy of studied aromatic rices is closely similar to the values of food energy recorded in the work of Sompong *et al.* (2011).

Phytochemical contents of two varieties of aromatic rice Kali khasa and Biran are shown in Table 2. Flavonoid content of aromatic rice Kalikhasa is 2.3 g% and Biran contains 1.3 g%. These results are closely similar to flavonoid content in different rice varieties reported by Hansakul *et al.* (2011) and Asaduzzaman *et al.* (2013). There is significant difference between studied aromatic rice varieties. Genotype and environmental variation may affect on flavonoid content in different aromatic rice varieties (Asaduzzaman *et al.*, 2013).

Table 2: Phytochemical contents of two varieties of rice Kali khasa and Biran.

Phytochemicals	In gram percentage	
	Kali khasa	Biran
Alkaloid	3.6±0.18	3.7 ± 0.11
Flavonoid	2.3±0.3	1.3 ± 0.25
Tannin	0.385±0.52	1.83± 0.37
Phenol	0.94±0.48	21 ± 0.11
Saponin	6.8± 0.56	7.3 ± 0.03

Three values are expressed as mean±SD

Alkaloid extracts of plant are applied as essential medicinal ingredients for their bactericidal, antispasmodic and analgesic effects (Stray, 1998). In the present study alkaloid content of Kali khasa is 3.6 g% and Biran is 3.7 g%. Results are closely similar to alkaloid content in different rice bran reported by Egbedike *et al.* (2016). There is no significant difference in alkaloid content between studied aromatic rice varieties.

According to Okwu and Omodamoro (2005), the trace quantities of phenolic compounds indicate that the sample could act as immune enhancers, hormone modulators, antioxidant, anti-clothing and anti-inflammatory. Total phenolic content of Kali khasa is 0.94 g catechol/100 g rice flour and Biran is 21 g catechol/100g rice flour. In 2014, Moko *et al.* reported

that total phenolic content of rice bran varieties was in the range of 5.85- 23.90 g%, they used gallic acid as standard. There is significant difference in total phenolic content in the present study of aromatic rice varieties.

Biran contains more tannin content (1.83 g%) than Kali khasa (0.385 g%). The value of tannin content of aromatic rice varieties in this study is lower than tannin content of rice bran varieties reported by Egbedike *et al.* (2016) but greater than the value of tannin content of rice bran varieties reported by Kaur *et al.* (2011). According to Okwu and Okwu (2004) the presence of tannin in the flour will support their use in treating hemorrhoid, varicose ulcers, frostbite, burns in herbal medicine and wound.

Saponin has important role in preventing osteoporosis, peptic ulcer, lowering blood cholesterol and enhance liver function (Kao *et al.*, 2008). Saponin content of Kali khasa is 6.8 g% and Biran is 7.3 g% in the present study. This result is closely related to saponin content of wild rice varieties reported by Umar *et al.* (2013). There is no significant difference in saponin contents of studied aromatic rice varieties.

CONCLUSION

In this study, nutrient and phytochemicals content of two scented rice varieties Kalikhasa and Biran were investigated. The results showed that both varieties were exhibited good nutrient and phytochemical contents. Kalikhasa contains more nutrient contents (fat, fibre, protein and carbohydrate) than Biran varieties and phytochemical contents (alkaloid, tannin, saponin and phenol) are more in case of Biran red varieties than Kalikhasa varieties. Both varieties are good for consumption by human.

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REFERENCES

- Ahuja U, Ahuja SC, Thakur R, Rani NS. Scented rices of India. *Asi Agri-His*, 2008; 12(4): 267-283.
- AOAC. Official Methods of Analysis, Association of Official Agricultural Chemists, 9th (eds), DC, Washington, 1960; 418.
- AOAC. Official methods of analysis of the AOAC. Association of official analytical chemists. 15th (eds), Arlington, VA, USA, 1990.
- Asaduzzaman M, Haque ME, Rahman J, Hasan SM K, Ali M A, Akter MS, Ahmed M. Comparisons of physiochemical, total phenol, flavanoid content and functional properties in six cultivars of aromatic rice in Bangladesh. *Afri J of Food Sci.*, 2013; 7(8): 198–203.
- Basu S, Roychoudhury A, Sanyal S, Sengupta DN. Carbohydrate and Antioxidative potential of the seed of three edible indica rice cultivars. *Ind J of Biochem and Biophy*, 2012; 49: 115-123.
- Beluhan S, Ranogajec A. Chemical composition and nonvolatile components of Croatian wild edible mushrooms. *Food Chem.*, 2011; 124: 1076–1082.
- Bhat R, Sridhar KR. Nutritional quality evaluation of electron beam-irradiated lotus (*Nelumbo nucifera*) seeds. *Food Chem.*, 2008; 107(1): 174–184.
- Boham AB and Ckoeipai A. Flavonoids and converted tannins from leaves of Hawallan *Vaccinium vaticulatum* and *V. calycinium*. *Paci Sci.*, 1994; 48: 458-463.
- Buresova I, Sedlackova I, Famera O, Lipavsky J. Effect of growing conditions on starch and protein content in triticale grain and amylose content in starch. *Plant Soil and Environ*, 2010; 56: 99–104.
- Egbedike CN, Ozo NO, Ikegwu OJ, Odo MO, Okorie PA. Effect of Rice Bran Substitution on the Physicochemical Properties of Water Yam Flour. *Asi J of Agri and Food Sci.*, 2016; 4(5): 246-257.
- Folch J, Lees, Sloane-Stanely GH. A simple method for the isolation and purification of total lipids from animal tissues. *J Biolog Chem.*, 1957; 226: 497-509.
- Gibson J. *As I Saw It. Records of a crowded life in India*, Mukul prakashan, New Delhi. India, 1976; 1937-1969.
- Hansakul P, Srisawat U, Itharat A, Lerdvuthisophon N. Phenolic and Flavonoid Contents of Thai Rice Extracts and Their Correlation with Antioxidant Activities using Chemical and Cell Assays. *J Medi Asso of Thai*, 2011; 94 (7): 122-130.
- Harbone JB. *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis*, Chapman Hall. New York, 1973; 7-41.
- Hirokadzu T, Harue T and Keishi F. Influence of cropping season on lipid content and fatty acid composition of lowland non-glutinous brown rice. *Jap J of Crop Sci.*, 1979; 48(3): 371–377.
- Jefferason J N. Rice quality in world markets In: *Rice grain quality and marketing*. International Rice research Institute, Los Banos, Philippines, 1985; 1-13.
- Kao CC, Huang CJ, Wang MY, Tsai P S. Insomnia: prevalence and its impact on excessive daytime sleepiness and psychological well-being in the adult Taiwanese population. *Qual of Life Res.*, 2008; 17: 1073–1080.
- Kaur S, Sharma S, Nagi HPS. Functional properties and anti-nutritional factors in cereal bran. *Asi J of Food and Agro-Industry*, 2011; 4(2): 122-131.
- Lowry OH, Rosebrough NJ, Farr A L, Randall R J. Protein measurement with the Folin phenol reagent. *J Biol Chem.*, 1951; 193: 265-275.
- Maisont S, Narkrugsa W. Effects of some physicochemical properties of paddy rice varieties on puffing qualities by Microwave 'ORIGINAL'. *Kase J.*, 2009; 43: 566–575.

21. Malick CP, Singh MB. In: Plant enzymology and Histo Enzymology, Kalyani publishers New Delhi, India, 1980; 286
22. Manzi P, Aguzzi A, Pizzoferrato L. Nutritional value of mushrooms widely consumed in Italy. *Food Chem.*, 2001; 73: 321–325.
23. Mbatchou VC, Dawda S. The nutritional composition of four rice varieties grown and used in different food preparations in Kassena- Nankana district, Ghana. *Inter J Res in Chem and Environ*, 2013; 3(1): 308–315.
24. Moko EM, Purnomo H, Kusnadi J, Ijong FG. Phytochemical content and antioxidant properties of colored and non colored varieties of rice bran from Minahasa, North Sulawesi, Indonesia. *Inter Food Res J.*, 2014; 21(3): 1053-1059.
25. Nadaf B, Krishnan S, Wakte K. Histochemical and biochemical analysis of major aroma compound (2-acetyl-11pyroline) in basmati and other scented rice (*Oryza sativa* L.). *Curr Sci.*, 2006; 91: 11-14.
26. Nadiger S, Kasturiba B. Nutritional composition of aromatic rice varieties. *Karna J Agri Sci.*, 2015; 28(4): 580-582.
27. Nayak AR, Reddy J N, Pattnaik A K. Quality evaluation of some Thailand and Vietnam scented rice. *Ind J of plant Gen Res.*, 2002; 15(2): 125–127.
28. Obadoni BO, Ochuko PD. Physicochemical Studies and Comparative Efficiency of the Crude Extracts of Homeostatic Plants in Edo and Delta State Nigeria. *Glob J of Pure and Appli Sci.*, 2001; 8: 203-208.
29. Oko A O, Onyekwere S C. Studies on the proximate chemical composition and mineral element contents of five new lowland rice varieties in Ebonyi State. *Inter J of Biotechnol & Biochem*, 2010; 6(6): 949–955.
30. Okwu DE, Omodamiro OD. Effects of hexane extract and phytochemical content of *Xylopi aethiopila* and *Ocimum gratissimum* on the uterus of guinea pig. *Biol Res.*, 2005; 4(2): 45-51.
31. Okwu DE Okwu ME. Chemical Composition of *Spondias mombia* Linn plant parts. *J of Sustain Agri and Environ*, 2004; 6: 104 – 140.
32. Raghuramulu N, Madhavan NK, Kalyanasundaram S, A Manual of Laboratory Techniques. National Institute of Nutrition. Ind Coun of Medical Research, Hyderabad-500 007, India, 2003; 56-58.
33. Saikia S, Dutta H, Saikia D, Mahanta CL. Quality characterization and estimation of phytochemical content capacity of aromatic pigmented and non-pigmented rice varieties. *Food Res Inter*, 2012; 46(1): 334–340.
34. Sompong R, Siebenh I-Ehn S, Linsberger-Martin G, Berghofer E. Physicochemical and antioxidant properties of red and black rice varieties from Thailand, China and Sri Lanka. *Food Chem.*, 2011; 24(1): 132–140.
35. Stray F. The Natural Guide to Medicinal herbs and plants. Tiger Books International. London, 1998; 12–16.
36. Thomas R, Wan-Nadiah WA, Bhat R. Physicochemical properties, proximate composition, and cooking qualities of locally grown and imported rice varieties marketed in Penang, Malaysia. *Inter Food Res J*, 2013; 20(3): 1345–1351.
37. Umar M A, Ugonor R, Akin-Osanaiye CB, Kolawole SA. Evaluation of Nutritional Value of Wild Rice from Kaduna State, Central Nigeria. *Inter J Sci & Tech Res.*, 2013; 2(7): 140-147.
38. Van Buren JP, Robinson WB. Formation of Complexes between Protein and Tannic Acid. *J Agri Food Chem.*, 1981; 17: 772 – 777.
39. Verma D K, Srivastav P P. Proximate Composition, Mineral Content and Fatty Acids Analyses of Aromatic and Non-Aromatic Indian Rice. *Rice Sci.*, 2017; 24(1): 21–31.
40. Webb BD, St Paul MI, US 2nd(eds). Criteria of rice quality in the In: Juliano B O. *Rice Chemistry and Technology*. The American Association of Cereal Chemists, USA, 1985; 403–442.
41. Yeager S. Fibre: The ultimate healer. In: *The Doctors Book of Food Remedies*. Emmaus, Rodale Press, Pennsylvania, 1998; 184– 185.