Physicochemical and Nutritional Quality of Some Local and Modern Aromatic Rice Varieties of Bangladesh

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Abstract

Physicochemical properties of five local and three modern aromatic rice varieties were studied. The parameters used for this study were milling outturn, head rice outturn, grain length, length breadth ratio, 1000 grain weight, amylose content, protein content, cooking time, grain elongation ratio, volume expansion ratio, gelatinization temperature, appearance and aroma. The parameters were found highly significant. Milling outturn of the studied varieties ranged from 69 to 71% and head rice outturn from 58 to 68%. All the rice varieties had translucent kernels and good in appearance. Eight samples had either medium slender, medium bold or short bold grains. The varieties had 6.1-6.9% protein and 23.6-25.5 % amylose content. Chinigura and BRRI dhan34 had highest protein and amylose content respectively. 1000 grain weight varied from 7.9 to14.2 g. The cooking time of the varieties varied from 11.5 to 19.0 minutes. Kalizera and Badshabhog were more aromatic than other varieties. Elongation ratio and volume expansion ratio varied from 1.8 to 2.3 and from 3.5 to 4.6 respectively. Gelatinization temperatures of all varieties were low to intermediate.

Key words: Physicochemical properties, nutritional quality, aromatic rice

Introduction

Rice is the staple food of Bangladesh. Rice supplies more than 80% of the calories and about 50% of the protein in the diet of the general people of Bangladesh[1]. It is also a source of some B vitamins. Along with nutritional qualities, the physical, cooking and eating qualities of rice are also important. Grain quality of rice is getting prominence in breeding programmes in the countries self sufficient in its production. Aromatic rice constitutes a small but an important sub- group of rice. These are rated best in quality and fetch much higher price than non-aromatic rice in the domestic and international market. Consumers' preference largely determines the commercial success of a rice variety.

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Preference for grain size and shape vary from one group of consumers to another[2]. The rice millers prefer varieties with high milling and head rice outturn, whereas consumers consider quality[3]. The amylose content of rice is considered as the main parameter of cooking and eating quality[4]. Cooking behavior is one of the important determinants of quality[5]. The aroma of rice was significantly influenced by variety[6]. However; such rice should possess excellent physical and chemical characteristics acceptable to the local consumers and those abroad. The objective of this study was to determine the physicochemical properties associated with rice quality of five local and three modern aromatic rice varieties.

Materials and Methods

Five local and three modern aromatic rice varieties were grown in Hajee Mohammad Danesh Science and Technology University Farm, Dinajpur, Bangladesh during aman season of 2004 with three replications in randomized complete block design. They were milled raw and analyzed for physicochemical properties. Grain physicochemical parameters were measured at Grain Quality and Nutrition Division Laboratory, Bangladesh Rice Research Institute, Gazipur. Milled rice outturn was determined by dehulling 200g rough rice in a Satake Rice Mill, followed by 75 second polishing in a Satake Grain Testing Mill TM-05. Head rice outturn was determined by separating broken from milled rice by hand. Milled rice outturn and head rice outturn were expressed as percent of rough and milled rice respectively. Grain length and breadth were measured by slide calipers. In determining the size and shape, milled rice was first classified into three classes based on length, long (more than 6mm in length), medium(5-6mm in length) and short (less than 5mm in length).Then again classified into three classes according to the ratio of length to breadth; slender (ratio more than 3); bold (ratio2-3); round (ratio less than 2). Amylose content was determined by the procedure of Juliano[7]. Protein content was calculated from nitrogen and it was determined by the micro Kjeldahl method[8]. Appearance of the grain mainly depends on the amount of chalkiness, size, shape and colour of the grain. Aroma of cooked kernels was tested by the procedure of Sood and Siddiq[9].Gelatinization temperature was determined according to the procedure of Little *et al*[10]. Volumes of cooked and milled rice were measured by water displacement. Data presented in the tables are mean of three replications.

Results and Discussion

Milling outturn of the studied samples varied from 69 to 71%. Most of the varieties had more than 70%. The head rice outturn varied between 58% and 68%. Out of eight varieties, 6 varieties had more than 66 % head rice outturn but long grain modern varieties BRRI dhan37, BRRI dhan38 had 58% and 59% head rice outturn respectively (Table 1). Biswas *et al*[11] studied 34 rice genotypes and found that milling outturn (%) ranged from 68 to 72 %.The head rice outturn was the proportion of the whole grain in

milled rice. It depends on the varietal character as well as drying condition[12]. Translucent grains are attractive and fetch high market price. All the local and modern tested aromatic rice varieties had translucent kernels and good in appearance. Length and length breadth ratio of the reported varieties were 3.7 to 5.6 mm and 2.0 to 3.1 respectively (Table 1).

Table1. Physical properties of five local and three modern aromatic rice varieties

Variety	Milling outturn (%)	Head rice outturn (%)	1000 grain wt.(g)	Grain length (mm)	Length: breadth	*Size & shape	Appearance
Local							
Kataribhog	71	67	11.1	5.2	2.8	MB	Good
Radhunipagal	71	66	9.0	3.8	2.0	SB	Good
Chinigura	70	66	8.1	3.7	2.0	SB	Good
Badshabhog	71	68	7.9	3.7	2.2	SB	Good
Kalizera	71	66	8.8	3.8	2.1	SB	Good
Modern							
BRRI dhan34	71	67	8.4	3.8	2.1	SB	Good
BRRI dhan37	70	58	13.9	5.5	3.1	MS	Good
BRRI dhan38	69	59	14.2	5.6	3.1	MS	Good

*MS= Medium slender; MB= Medium bold; SB= short bold

Length of BRRI dhan37 (5.5mm) and BRRI dhan38 (5.6mm) were similar which were significantly higher than that of Kataribhog (5.2mm), Radhunipagal (3.8mm), Chinigura (3.7mm), Badshabhog (3.7mm), Kalizera (3.8mm) and BRRI dhan34 (3.8mm). Length breadth ratio of BRRI dhan37 (3.1) and BRRI dhan38 (3.1) were same, which was significantly higher than other varieties (Table1). Eight samples had either medium slender, medium bold or short bold. BRRI dhan37 and BRRI dhan38 had medium slender grains. On the other hand, Kataribhog had medium bold but Radhunipagal, Chinigura, Badshabhog, Kalizera and BRRI dhan34 were short bold. Amylose content influences the quality of cooked rice. High amylose rice varieties have high volume expansion and fluffy cooked rice. Amylose content of the tested varieties varied between 23.6% and 25.5% (Table 2). All the varieties were of intermediate amylose content (20-25%) except BRRI dhan34, which contained high amylose (more than 25 %). Intermediate amylose rice is preferred types in most of the rice growing areas of the world. Protein content of rice, which does not have much

Table 2. Protein content, amylose content and some cooking properties of five local and three modern aromatic rice varieties

Variety	Protein (%)	Amylose (%)	*Aroma	Cooking time (min.)	Elongation ratio	Volume expansion ratio	Gelatinization temperature
Local							
Kataribhog	6.3	24.7	++	15.0	1.8	4.0	Low
Radhunipagol	6.7	24.8	++	14.0	1.9	3.5	Low
Chinigura	6.9	23.6	++	12.5	2.0	3.7	Intermediate
Badshabhog	6.8	23.7	+++	11.5	2.0	3.7	Low
Kalizera	6.5	24.8	+++	12.0	2.0	3.7	Intermediate
Modern							
BRRI dhan34	6.1	25.5	++	13.0	2.3	3.9	Low
BRRI dhan37	6.2	23.8	+	19.0	2.0	4.6	Low
BRRI dhan38	6.1	23.8	++	19.0	2.0	4.4	Low

* Aroma: Mild aromatic (+), moderately aromatic (++), strongly aromatic (+++)

influence on cooking properties, is important from nutritional point of view only. Protein content of the varieties varied from 6.1% to 6.9 % in brown rice (Table 2). The cooking time of these tested varieties varied between 11 and 19 minutes. BRRI dhan37 and BRRI dhan38 required maximum cooking time. Elongation ratio varied from 1.8 to 2.3 and volume expansion ranged from 3.5 to 4.6 (Table 2). BRRI [13] observed that among 12 scented rice varieties amylose content varied from 22.0 to 25.9%, protein content varied from 6.5 to 9.0%, length of grain varied from 3.4 to 5.1 mm, length to breadth ratio varied from 1.9 to 3.4, cooking time varied from 11 to 14 minutes, elongation ratio ranged from 1.3 to 1.5 and volume expansion ratio ranged from 3.2 to 3.4. Gelatinization temperatures of all tested varieties were low to intermediate (Table 2). Dutt *et al* [14] reported that Kataribkog was with less aroma in contrast to Kalizera, Badshabhog with intense aroma.

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