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Physicochemical and Cooking Properties of Some Fine Rice Varieties

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Abstract: The experiment was conducted to know the Physico-chemical and cooking properties of six fine rice varieties. Among the varieties, milling and head rice out-turn ranges from 64 - 70% and 61 - 82%, respectively. The highest milling out-turn (70%) was found in the variety Superfast and lowest in Khazar. On the other hand, head rice out-turn was the highest (82%) in Khazar and lowest (61%) in Bashmati PNR. Grain length and breadth of the varieties ranges from 3.6 – 6.5 mm and 1.7 – 3.7 mm, respectively. The highest length (6.5 mm) was found in Khazar and the highest length-breadth ratio were found in Khazar and Superfast. Lowest grain length (3.6 mm) and length-breadth ratio (1.3) were found in Badshabhog and Bashmati 4488, respectively. Amylose content of the varieties ranges from 18.6 - 28.0% and the highest protein (8.6%) was found in BRRI dhan28 followed by Badshabhog and Superfast. All the varieties contain more or less standard rate (7%) of protein. Maximum cooking time (25 min.) were required in the variety of Bashmati 4488 and minimum (14.5 min.) in Badshabhog. Elongation and imbibition ratio were greater than 1.3 and 4.0 respectively in all the varieties except Khazar. Lowest elongation ratio (1.2) was found in Khazar.

Key Words: Rice (*Oryza sativa* L.), amylose, rice varieties, protein

Introduction

Rice (*Oryza sativa* L.) is the staple food for the people of Bangladesh and will continue to remain so in the future. It provides about 75% of the calorie and 55% of the protein in the average daily diet of the people (Anonymous, 2002). After the achievement of sufficient yield in high yielding varieties, the demand for fine rice is increasing day by day both in home and abroad. The fine grain rice is relatively low yielding but has good demand in the market with relatively higher price. It is also used in preparing special dishes on special occasions. The rice millers prefer varieties with high milling and head rice out-turn, whereas consumers consider quality (Merca and Juliano, 1981). Yields of head rice vary depending on many factors such as variety, grain type, chalkiness, cultural practice, drying, storing and milling conditions (Wasserman and Calderwood, 1972; Witte, 1972; Adair *et al.*, 1973). To attract the consumers' attention, appearance of rice is important which depends on the shininess and chalkiness of the kernel. Size and shape are also important factor to consumer. Preference for grain size and shape vary form one group of consumers to another (Khush *et al.*, 1979). High income group of people in Bangladesh prefer long slender grain, where as, lower income group prefer bold grain (Anonymous, 1997). The amylose content of rice is considered as the main parameter of cooking and eating quality (Juliano, 1972). Amylose content, volume expansion, water absorption influences many of the starch properties of rice (Juliano, 1979; 1985). Cooking time is important as it determines tenderness of cooked rice as well as stickiness to great extent (Anonymous, 1997). Higher the imbibitions ratio of rice lower will be the energy content per unit volume or weight of cooked rice, as they will have more water and solid materials (Anonymous, 1999). High volume expansion of cooking is still considered to be the good quality by the working class people who do not care whether the expansion is lengthwise or crosswise. Urban people, on the other hand, prefer the varieties that expand more in length than in breadth (Choudhury, 1979). Fine rice may be graded as export quality rice with normal nutritional quality. Under the above circumstances, the present study was undertaken to analyze and evaluate the physicochemical and cooking properties of some fine rice varieties.

Materials and Methods

The laboratory experiment was conducted at Grain Quality and Nutrition Division of Bangladesh Rice Research Institute (BRRI), Gazipur from March to May 2002. For this purpose six fine rice varieties collected from Genetic Resources and Seed Division of BRRI. Out of the 6 varieties, 4 varieties namely, Superfast, Basmati 4488, Khazar and Basmati PNR were imported, Badshabhog, was a local aromatic and BRRIdhan 28 was a high yielding variety released by BRRI. The rough rice was dehulled by Satake rice mill. The resulting brown rice was polished for 75 second in a Satake grain-testing mill TM05. This polished rice was ground by a Cyclone sample mill. Milled rice out-turn was expressed as percent of milled rice. Slide Calipers was used for measurement of grain length and breadth. Milled rice was first classified into three classes based on length, long (>6 mm in length), medium (5-6 mm in length), and short (<5 mm in length). They were again classified into three classes, according to the length/breadth ratio; slender (ratio more than 3); bold (ratio 2-3); round (ratio less than 2) to determine size and shape. Amylose content was determined by the procedure of Juliano (1971) and alkali spreading value was determined according to the procedure of Little *et al.*, 1958. Protein contents were calculated from nitrogen and was determined by Micro Kjeldahl method. Volumes of cooked and milled rice were measured by water displacement method. Five gram of milled rice was placed in a graduated cylinder containing 50 ml of water and the change in volume was noted. For cooked rice volume 5 gm of milled rice was cooked and the cooked rice was placed in the same cylinder and the change in volume was measured. Cooking time was measured when 90% of cooked rice was totally gelatinized.

Results and Discussion

Physical properties of six fine rice varieties: The six tested fine rice varieties contained satisfactory milling out-turn range from 69-70% and only one variety, Khazar had 64% milling out-turn (Table 1). The head rice out-turn was the proportion of the whole grain in milled rice. It depends on varietal character as well as the

Table 1: Physical properties of some fine rice varieties

Variety	Milling out-turn (%)	Head rice(%)	Chalkiness (%)	Length (mm)	Breadth (mm)	Length/ Breadth	Size and shape ratio	Appearance
Superfast	70	71	Opaque	6.1	1.7	3.6	Long slender	Fair
Basmati 4488	70	79	White belly	4.7	3.7	1.3	Short round	Good
Khazar	64	82	Translucent	6.5	1.8	3.6	Long slender	Very good
Basmati PNR	70	61	White centre	6.3	1.9	3.2	Long slender	Good
Badshabhog	69	75	White centre	3.6	2.0	1.8	Short round	Good
BRRIdhan 28	71	70	Translucent	5.8	1.9	3.1	Medium slender	Very good

Table 2: Chemical properties of six fine grain rice varieties

Variety	Alkali spreading value	Amylose (%)	Protein (%)
Superfast	3.2 c	24.2 b	7.6 c
Basmati 4488	3.0 d	23.7 c	7.0 de
Khazar	3.1 cd	18.6 e	6.9 e
Basmati PNR	3.9 a	18.6 e	7.1 d
Badshabhog	3.6 a	20.3 d	7.9 b
BRRI dhan 28	3.8 a	28.0 a	8.6 a

Within column means followed by same letter (s) did not differ significantly at P<0.05.

Table 3: Cooking properties of six fine rice varieties

Variety	Cooking time	Elongation Ratio	Imbibition Ratio
Superfast	18.5	1.4	4.3
Basmati 4488	25.0	1.5	4.6
Khazar	17.5	1.2	4.3
Basmati PNR	16.0	1.3	4.6
Badshabhog	14.5	1.5	4.3
BRRIdhan 28	17.5	1.5	4.3

drying condition (Witte, 1972; Adair *et al.*, 1973). The head rice out-turn of all the tested varieties were not satisfactory. It varied from 61 - 82% (Table 1). A quality rice variety should have head rice out-turn at least 70%. Kernels of two varieties (Khazer and BRRIdhan 28) were translucent and looked very good in appearance. The variety Basmati 448 contained white belly and Badshabhog contained white center (Table 1). Only one variety (Superfast) had opaque kernel which is not a good varietal character.

All slender type and short bold rice are known as fine grain rice in the market and sold at higher price. Three varieties (Superfast, Khazar and Basmati PNR) had long slender grain. One variety BRRIdhan 28 was medium slender and other two varieties were short round. Length and breadth of the reported varieties ranges from 3.6 – 6.5 mm and 1.7 – 3.7 mm, respectively. The highest grain length and length breadth ratio were found in Khazar and Superfast followed by BRRIdhan 28 (Table 1).

Chemical properties of six fine rice varieties: Amylose content of the tested varieties varied ranges from 18.6 to 28.0% . The highest amylose (28 %) was estimated in BRRIdhan 28 followed by Superfast (24.2%) and lowest (18.6%) were in Khazar and Basmati PNR (Table 2). Amylose content of rice determines the hardness and stickiness of cooked rice. Amylose content higher than 25% gives non sticky soft or hard cooked rice. Rice having 20-25% amylose gives soft, and relatively sticky cooked rice (Anonymous, 1997). Alkali spreading value ranges from 3.0 to 3.9 of the tested varieties. The highest alkali spreading value (3.9) was found in Basmati PNR and the lowest (3.0) in Basmati 4488. Others four varieties remained between the above mentioned values (Table 2). Alkali spreading value and amylose content varied significantly by 5 % DMRT.

Protein content of rice is important from nutritional point of view. Protein content of the varieties ranges from 6.9 to 8.6%. The highest protein content (8.6%) was found in BRRIdhan 28 followed by Badshabhog. On the basis of nutritional value all the varieties contained sufficient amount of protein except Khazar which remain very little below the standard rate 7%. The protein content of fine grain rice is usually lower (Kaul, *et al.*, 1982; Dutta *et al.*, 1998) which is consistent with the findings of the present study.

Cooking properties of some fine rice varieties: Cooking time varied from 14.5 minutes to 25 minutes among the tested fine rice varieties. Only one variety Basmati 4488, having more than 20 minutes (i.e. 25 minutes) given comparatively hard cooked rice (Table 3). Elongation ratio of the fine rice varieties ranges from 1.2 to 1.5 (Table 3). It is an important parameter for cooked rice. If rice elongates more lengthwise it gives a finer appearance and if expands girthwise, it gives a coarse look (Anonymous, 1997). However, of the tested varieties only one variety (Khazar) had the elongation ratio less than 1.3 which was by no means desirable. The imbibition ratio all the tested varieties was more than 4 (Table 3) and it is considered as a positive quality in our country particularly by the lower income people as they want to fill up their belly without considering how much energy they will get from it. However, higher to imbibition ratio of rice, lower will be the energy content per unit volume or weight of cooked rice as they will have more water and less solid materials (Anonymous, 1997).

Conclusion: In general, fine rice in Bangladesh are low yielding and can not compete with high yielding varieties (HYV) of rice. Rice production technologies regarding HYV are now well developed and adopted by farmers in Bangladesh for maximum production. It is now time to emphasize to the improvement of the productivity of fine rice including its quality. It is urgently needed to characterize the fine rice as regard to their physico-chemical properties. Thus, the knowledge may be utilized for devising breeding strategy to their improvements for yield keeping intact their physico-chemical qualities.

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