PJN
ISSN 1680-5194

# PAKISTAN JOURNAL OF NUTRITION

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Pakistan Journal of Nutrition 2 (4): 242-245, 2003


# Grain Quality Characteristics of Some *Beruin* Rice Varieties of Bangladesh

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**Abstract:** Grain quality characteristics of ten *Beruin* rice varieties were studied in the laboratory of the Grain Quality and Nutrition Division of Bangladesh Rice Research Institute and compared with a popular sticky local rice variety, *Ranga Binni*. Thousand paddy weights of the tested varieties ranged between 14.3 g to 25.5 g. Milling out turn of the tested varieties were satisfactory compared to the check variety and ranged from 68% to 71%. Head rice out turn of four varieties was unsatisfactory out of 10 varieties. Head rice out turn of the tested varieties ranged 33 to 91%. All the *Beruin* varieties had opaque grain but appearance of seven varieties were good and remaining three were fair. The length and breadth of the milled rice ranged from 4.5 to 5.7 and 1.7 to 2.4, respectively. Likewise, length to breadth ratio of the varieties ranged from 2.0 to 2.8 and size and shape of all the varieties were medium bold except two. All the varieties contained low amylose ranged from 7.9 to 10% including the check variety. Protein percent of the varieties ranged from 6.2 to 9.4. Cooking time of the *Beruin* varieties were more or less similar and ranged from 14 minutes to 17.5 minutes. Elongation and Imbibition ratio of the varieties ranged form 1.3 to 1.6 and 3.0 to 4.3, respectively.

**Key words:** Amylose, cooking, milling out turn and physicochemical

## Introduction

*Beruin* rices are mostly cultivated in the Moulvibazar district located in the north-eastern part of Bangladesh. The term "*Beruin*" means sticky and most of the farmers of the district grow *Beruin* rice to fulfill their special demand on special occasions. *Beruin* rices are equally popular among both the tribal and non-tribal people. Old men and children are fond of food items made of *Beruin* rice. But the information regarding the quality of these sticky rices are little known to us. Biswas *et al*., 2001 studied the quality of some sticky rice varieties of Bangladesh known as *Binni* rice, normally grown in the hilly areas of Jamalpur district known as *Garo Pahar*.

Milling out turn is one of the important properties to the millers. The rice millers prefer varieties with high milling and head rice out turn, where as consumers consider physicochemical qualities (Merca and Juliano, 1981). Yield of head rice vary depending on many factory (Adair *et al*., 1973). Size and Shape are also important factors to consumers. Preference for grain size and shape vary from one group of consumer 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 qualities (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 a great extent (Anonymous, 1997). The higher the imbibitions ratio of rice, the 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, 1999). The information on the grain quality of *Beruin* rice varieties are still lacking in Bangladesh and may have some special characteristics to be essential for future breeding program. With that point of view the present study was undertaken to find out the physicochemical and cooking properties of some *Beruin* rices of Bangladesh.

## Materials and Methods

The laboratory analysis was conducted at Grain Quality and Nutrition Division of Bangladesh Rice Research Institute, Gazipur. Ten *Beruin* rice samples were collected for this purpose from different farmers of Moulvibazar district grown in T. Aman 2002 season and *Ranga Binni* was used as a check variety. The samples were milled raw and analyzed for physicochemical properties. Milled rice out turn was determined by dehulling 200 g rough rice in Satake Rice Mill, followed by 75 second polishing in a Satake grain testing mill TM-05. The polished rice was ground by a Udy Cyclon sample mill for chemical analysis. Head rice out turn was determined by separating broken parts from milled rice by hand. Milled rice and head rice out turns were expressed as percentage of rough rice 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 (>6 mm in length), medium (5-6 mm in length) and short (<5 mm in length). The grain were again classified into three classes considering length to

Table 1: Milling properties of some *Beruin* rice varieties

| Name of the varieties | 1000 paddy wt. (gm) | Milling out turn (%) | Head riceoutturn (%) | Moisture(%) |
|---|---|---|---|---|
| *Lal Beruin* | 14.3 | 68.0 | 91.0 | 13.0 |
| *Sada Beruin* | 20.9 | 68.0 | 73.0 | 12.2 |
| *Khara Beruin* | 18.9 | 68.0 | 48.0 | 12.1 |
| *Mow Beruin* | 25.5 | 69.0 | 49.0 | 12.3 |
| *Iekka Beruin* | 24.1 | 69.0 | 70.0 | 12.7 |
| *Kalo Beruin* | 24.3 | 68.0 | 33.0 | 12.3 |
| *Pakh Beruin* | 22.8 | 68.0 | 35.0 | 12.3 |
| *Push Beruin* | 19.9 | 69.0 | 87.0 | 12.4 |
| *Kathali Beruin* | 21.0 | 71.0 | 90.0 | 12.2 |
| *Hatidat Beruin* | 20.8 | 69.0 | 83.0 | 12.3 |
| *Ranga Binni* (ck) | 21.0 | 65.0 | 88.0 | 14.2 |

breadth ratio; slender (ratio>3.0), bold (ratio 2-3) and round (ratio>20). Appearance of the milled rice was ranked through visual observation. Amylose content was determined by the procedure of Juliano (1971). Based on amylose content, milled rice was classified as waxy (1-2% amylose), very low (>2-9% amylose), low (>9-20% amylose), intermediate (>20-25% amylose and high (25-33% amylose), (Juliano, 1972). Alkali spreading value was determined according to procedure of Little *et al.* (1958) and classified as Alkali spreading value 1-3 corresponds to high, 3.0-5.0 corresponds to intermediate, and 6.0 to 7.0 corresponds to low gelatinization temperature. Protein content was determined by micro Kjeldahl method (AOAC, 1970). Elongation ratio was calculated by measuring the length of cooked and uncooked milled rice by slide calipers. Volume of cooked and uncooked 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. Data presented in the tables are the mean of three replications.

## Results and Discussion

**Milling characteristics of *Beruin* rice varieties:** The test of thousand paddy weight particularly useful as a comparative indication of coarseness of the grain and total rice yield. It provides the relative measure of the proportion of unfilled, shriveled and immature kernels. Thousand paddy weights varied from the ranges 14.3 gm to 25.5 gm. The highest paddy weight obtained in *Mow Beruin* and lowest was found in *Lal Beruin*. Milling out turn is the measure of rough rice performance during milling. Milling out turn of the ten *Beruin* rice varieties including the check variety were satisfactory. Highest milling out turn (71%) was found in *Kathali Beruin* and other *Beruin* rices had more or less similar milling out turn (68-69%). The milling out turn of modern rice varieties ranges from 69-73% (Biswas *et al.*, 1992). Less than 67% milling out turn is not acceptable. All the tested varieties gave higher milling out turn than the check variety *Ranga Binni* (Table 1). Head rice out turn is the proportion of the whole grain in the milled rice. It varies depending on the variety, grain type, chalkiness, cultural practices and drying condition. Among the *Beruin* rice highest head rice out turn was observed in *Lal Beruin* (91%), higher than the check variety, followed by *Kathali Beruin* (90%). The lowest head rice out turn was found in *Kalo Beruin* (33%) which was by no means desirable. A quality rice variety should have head rice out turn of at least 70%. Moisture content affects rice quality in several ways. To gain and maintain the optimum milling quality, rice must be harvested at proper moisture content and should be dried carefully up to 14%. All the tested varieties had moisture ranged between 12.1 to 13.0%.

**Physical properties of *Beruin* rice varieties:** Uniformity in shape and size is considered as the first quality characteristics of rice. Length and breadth of all the *Beruin* varieties was higher than that of check *Ranga Binni* (Table 2) except *Push Beruin*. Highest length (5.7 mm) was observed in *Mow Beruin* followed by *Khara Beruin* (5.5mm). Highest breadth (2.4mm) was observed in *Kalo Beruin* followed by *Iekka Beruin* (2.3mm). Among the *Beruin* varieties lowest length and lowest breadth were measured in *Push Beruin* and *Lal Beruin*, respectively (Table 2). Highest length breadth ratios were measured in *Lal* and *Khara Beruin*. The lowest was *Push Beruin*. Consumers' preference for grain size and shape vary from one group to another. Most of the tested *Beruin* rice varieties were medium bold except one (*Push Beruin*) was short bold. The grain size and shape of most modern rice varieties is short to medium bold with translucent appearance (Biswas *et al.*, 1992). The appearance of the processed kernel is extremely important for judging the quality of rice. All the *Beruin* varieties had opaque kernel which is an undesirable trait. The greater amount of chalkiness in the grain, the more prone to grain breakage during

Table 2: Physical properties of some *Beruin* rice varieties

| Name of the varieties | Chalkiness | Appearance | Length (mm) | Breadth (mm) | L/B ratio | Size & Shape |
|---|---|---|---|---|---|---|
| *Lal Beruin* | Opaque | Good | 5.3 | 1.9 | 2.8 | MB |
| *Sada Beruin* | Opaque | Good | 5.2 | 2.0 | 2.6 | MB |
| *Khara Beruin* | Opaque | Fair | 5.5 | 2.0 | 2.8 | MB |
| *Mow Beruin* | Opaque | Fair | 5.7 | 2.1 | 2.7 | MB |
| *Iekka Beruin* | Opaque | Good | 5.4 | 2.3 | 2.3 | MB |
| *Kalo Beruin* | Opaque | Good | 5.3 | 2.4 | 2.2 | MB |
| *Pakh Beruin* | Opaque | Good | 5.3 | 2.2 | 2.4 | MB |
| *Push Beruin* | Opaque | Good | 4.5 | 2.2 | 2.0 | SB |
| *Kathali Beruin* | Opaque | Fair | 5.3 | 2.0 | 2.7 | MB |
| *Hatidat Beruin* | Opaque | Good | 5.3 | 2.1 | 2.5 | MB |
| *Ranga Binni* (ck.) | Translucent | V. good | 4.8 | 1.7 | 2.8 | SB |

Table 3: Chemical properties of some *Beruin* rice varieties

| Name of the varieties | Alkali spreading value | Amylose(%) | Protein(%) |
|---|---|---|---|
| *Lal Beruin* | 7.0 | 8.5 | 7.0 |
| *Sada Beruin* | 6.9 | 10.0 | 6.5 |
| *Khara Beruin* | 6.9 | 8.7 | 8.4 |
| *Mow Beruin* | 7.0 | 7.9 | 6.2 |
| *Iekka Beruin* | 7.0 | 9.0 | 7.0 |
| *Kalo Beruin* | 6.4 | 9.5 | 6.7 |
| *Pakh Beruin* | 6.8 | 9.0 | 7.3 |
| *Push Beruin* | 7.0 | 9.0 | 8.1 |
| *Kathali Beruin* | 7.0 | 8.7 | 7.3 |
| *Hatidat Beruin* | 6.3 | 9.3 | 6.9 |
| *Ranga Binni* (ck.) | 4.3 | 27.1 | 9.4 |

milling, results in lower head rice yield (Khush *et al*., 1979). Although, all the *Beruin* rice varieties had opaque grain, it produces high percentage of head rice yield except *Khara*, *Mow*, *Kalo* and *Pakh Beruin*. However weather condition and cultural practices also influence the incidence of chalkiness in rice and also by neck blast and drought by stress during ripening.

**Chemical properties of some *Beruin* rice varieties:** All the *Beruin* rice varieties showed high alkali spreading value than the check *Ranga Binni* and ranged from 6.3-7.0 (Table 3). Highest alkali spreading value was found in five *Beruin* varieties and the lowest was in *Hatidat Beruin*. High alkali spreading value corresponded to low gelatinization temperature. Perez and Juliano (1979) also found low gelatinization temperature among the waxy rices.

High amylose content rice shows high volume expansion (not necessarily elongation) and high degree of flakiness. The grains cook dry, are less tender, and become hard upon cooling. In contrast, low amylose rice cooks moist and sticky. Intermediate amylose rice are preferred in most rice growing areas of the word, except where low amylose Japonicas are grown. All the *Beruin* rice varieties contained less amylose than check variety *Ranga Binni* and ranged from 7.9-10.0%. In *Beruin* rice the highest amylose was found in *Sada Beruin* and the lowest was *Mow Beruin*. The result indicated that all the Beruin rices are low amylose content varieties (Table 3). The modern rice varieties of BRRI were found to have high amylose (Biswas *et al.,* 1992). The majority people of Bangladesh prefer high amylose rice. But a portion of its people still prefers low amylose rice for making their special dishes on special occasions. Amylose content can vary as much as 6% depending upon environmental condition. High temperature during ripening may result relatively lower amylose content.

The nutritional value depends on the total quantity and quality of protein. Rice is an important source of protein and supplies more than 60% of the total protein consumed in Bangladesh. Protein content of *Beruin* varieties ranged from 6.2 to 8.4% and the highest and lowest were found in *Khara* and *Mow Beruin*, respectively. The protein content is higher with wider plant spacing, where more nitrogen is available to plants. It also increases with better water management and better weed control, probably because of higher efficiency in nitrogen utilization.

**Cooking properties of some *Beruin* varieties:** Cooking time of the rice depends on coarseness of the grain and its gelatinization temperature. It varied from 14.0 to 17.5 minutes in the tested *Beruin* rice varieties. Elongation ratio is the ratio of the length of cooked rice over the

Table 4: Cooking properties of some *Beruin* rice varieties

| Name of the varieties | Cooking Time(min.) | Elongation Ratio | Imbibition Ratio |
|---|---|---|---|
| *Lal Beruin* | 14.0 | 1.3 | 3.0 |
| *Sada Beruin* | 15.0 | 1.4 | 3.7 |
| *Khara Beruin* | 15.5 | 1.3 | 4.0 |
| *Mow Beruin* | 15.0 | 1.3 | 3.0 |
| *Iekka Beruin* | 17.5 | 1.3 | 3.7 |
| *Kalo Beruin* | 16.5 | 1.4 | 3.4 |
| *Pakh Beruin* | 16.0 | 1.4 | 3.3 |
| *Push Beruin* | 15.0 | 1.6 | 3.0 |
| *Kathali Beruin* | 15.5 | 1.4 | 4.2 |
| *Hatidat Beruin* | 14.5 | 1.4 | 4.3 |
| *Ranga Binni* (ck.) | 17.0 | 1.4 | 3.7 |

length of uncooked rice. It varied between 1.3 to 1.6 among the tested varieties. Highest elongation ratio was found in *Push Beruin* (Table 4). The tested varieties did not show high elongation ratio upon cooking although, opaque grain, was expected to show extreme elongation (Juliano, 1972). Imbibition ratio of the volume of cooked rice over the volume of uncooked rice. High volume expansion is associated with high amylose. It ranged from 3.0 to 4.3 in the tested varieties (Table 4).

**Conclusion:** The *Beruin* rice varieties are mostly of low amylose type. The physicochemical properties of these varieties are acceptable except for the low amylose content. These varieties are easily digestible and so good for the elderly people and the children. The conservation of these varieties is, therefore, essential for future breeding program to develop high yielding *Beruin* rice varieties. Moreover, Bangladesh could earn foreign currency by exporting the *Beruin* rice or its byproducts where low amylose rices are popular in the world.

## Acknowledgement

Funding was obtained from the program for Enhancement of Research Capacity in Developing Countries (ENRECA), Ministry of Foreign Affairs, Denmark.

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