

Study on quality and milling recovery of different varieties of rice at varying degree of polishing under Khumaltar condition

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Abstract

In Khumaltar, under NARC, rice varieties; Khumal-4, Khumal-8 and Radha-32 as slender varieties and Khumal-11, Taichung, Chainung-242 as bold varieties were studied for assessing their qualitative traits during 2006-08. These were milled in Satake Sheller and polished in Yamamoto polisher at different degree of polishing (0, 4, 8 and 12%). The mean milling recovery (73.4%), head rice (84.8%), broken rice (15.1%), protein (7.71%), ash (0.84%) and fat (1.34%) were recorded from the experiments. Among them, milling recovery, head rice, protein, fat, and ash were found significant ($P < 0.05$) with increasing degree of polishing. These attributes (head rice, protein, ash, and fat) were recorded increased at 8 and 4% degree of polishing compared to that of 12%. However, for 12% degree of polishing the milling recovery, head rice, protein, fat and, ash content were low as against 4 and 8% degree of polishing. The study showed that nutritional value of protein, fat and, ash contents were found high at 4 and 8% degree of polishing compared to that of 12%. Similarly, the percentage of head rice also increased at 4 and 8% than at 12% degree of polishing. The percentage of broken rice was also increasing with the increasing degree of polishing. Therefore, the result could be concluded that lowering the degree of polishing from 12% to 8% to 4% for both slender and bold rice could be increased rice stock by 4% in country's total rice production. Hence, the result of this study would help strengthen the food and nutritional security and improve quality of rice in the country as well.

Key words: Bold and slender varieties, degree of polishing, head rice, milling recovery, nutritional value

Introduction

Rice is a staple food of Nepalese people. A more than half of the world population eats rice as the main food in their daily diets. Rice is obtained from rice after milling which removes bran and husk. The main objective of milling is to obtain whole grain rice and preserve most of the rice kernels in their original shape. Some varieties of rice do not yield much head rice because of their inherent poor milling quality or due to the effects of climatic condition or uneven processing. The percentage of head rice is an indicator of quality of rice. Higher the % of head rice indicates high quality, lower the head rice and higher % of broken in the rice indicates poor quality.

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A pre-harvest and post-harvest factor affects the breakage of rice during milling. Pre-harvest factors include varieties characteristics, agronomical practices and environmental conditions, whereas post-harvest factors include unevenness in processing condition, during mechanical handling, drying, storage and type of milling machinery used and its adjustment.

It is reported that percentage of head rice depends on the different type of drying system and types of milling (Thapa and *et al.*, 2008). It is reported that most of the nutrients are concentrated in the outer layer of bran of the rice kernel which are lost during milling (Huston and Kohler, 1970). The loss of nutrients present may be reduced to a certain extent by low degree of polishing. It is also reported that breakage during polishing increases in the case of both raw and par-boiled rice although the increment is more rapid in raw rice (Raghavendra Rao *et al.*, 1967). The type and design of the milling machinery influences milling results (Bhattacharya, 1969). For the conversion of brown rice into milled rice, the conventional rice mills used only whitening cones in single pass, double pass, or multipass operations (Van Ruiten, 1985). The Lipid content of the milled rice can be used as an indicator of degree of milling and Satake milling meter MMIB can be also used for measuring the whiteness, transparency and degree of milling of the rice grain (Juliano, 2003).

Methodology

Rice varieties like Khumal-4, Khumal-8, Radha-32 as slender and Taichung, Khumal 11, Chainung 242 as bold were collected from Agronomy Division, Khumaltar and National Rice Research programme, Hardinath, Dhanusha under the Nepal agricultural Research Council (NARC) during 2006-08. The rice samples were shelled in Satake Sheller to obtain the brown rice. The brown rice were polished at different degree of polishing like 0, 4, 8, and 12 i.e. removal of bran layer of rice in Yamamoto polisher. The total yield of rice (whole and broken rice), were calculated at different degree of polishing. Here the milling recovery of rice is calculated on the basis of rough rice.

The milled rice about 140 g were put in the sample divider taking 70-80 g of milled rice at different degree of polishing and grading (separation of head and broken rice) was carried out manually and calculated percentage of head rice and broken at different degree of polishing. Proteins, fats, total ash of rice obtained at different degree of polishing were analyzed by Association of Official Analytical Chemists Method (AOAC, 2005). The milling recovery in different degree of polishing and other results of the study were done by MSTATC statistical software package.

Results and discussion

In Table 1, the mean shelling, milling recovery, head rice, broken, protein, ash and fat percentage were 73.361, 84.835, 15.144, 7.708, 0.838 and 1.342% respectively in variety wise. Here shelling, milling recovery and head rice percentage were shown high in bold than

slender varieties as well as percentage of broken were shown high in slender than in bold varieties. It is also shown that there were no differences in protein, ash and fat content in varieties wise of rice. In table 2, the milling recovery, head rice, protein, fat and ash were found significantly lower ($P > 0.05$) with increasing degree of polishing. The degree of polishing at 12% shown that milling recovery, head rice, protein, fat and ash were low as compared to 4 and 8 % degree of polishing but the whiteness of rice increased. The milling recovery, head rice, protein, ash, and fat % are high at 0 degree polishing (100% bran content) and the bran is the main source of vitamins and minerals. As the degree of the polishing increases the nutritional value of rice like protein, ash and fat were decreases. The nutritional value as protein, fat and ash content were shown high at 4 and 8% than at 12% degree of polishing. Similarly the percentage of head rice also increased at 4 and 8% than at 12% degree of polishing and percentage of milling recovery decreasing with the increase of degree of polishing. From this result, it can be concluded that the milling recovery can be increased by 4% of rice by fixing the degree of polishing at 4 to 8% in both slender and bold varieties of rice, which means the 4% increment in total production of rice. So, result of this study will help to strengthen the food security, nutritional security and quality of rice in the country.

Table 1. Mean percentage of shelling, milling recovery, broken rice, protein, ash, and fat for rice varieties tested at Khumaltar during 2006-08^a

Variety	Shelling (%)	Milling recovery (%)	Head rice (%)	Broken rice (%)	Protein (%)	Ash (%)	Fat (%)
Radha-32	77.36c	71.29c	64.33d	35.54a	7.696abc	0.8714a	1.293ab
Khumal-8	78.04c	72.22c	79.59c	20.41b	8.359a	0.8494ab	1.378ab
Khumal-4	75.74d	69.79d	88.03b	11.98c	7.690abc	0.9340a	1.476a
Chainung-242	81.42b	75.47b	93.86a	6.138d	7.572bc	0.7147c	1.254b
Khumal-11	82.98a	77.03a	90.78ab	9.225cd	7.033c	0.7635bc	1.181b
Taichung	80.38b	74.36b	92.43a	7.575d	7.876ab	0.8951a	1.471a
Grand mean	79.318	73.361	84.835	15.144	7.708	0.838	1.342
LSD ($P < 0.05$)	1.103	1.134	3.729	3.727	0.7857	0.0913	0.2043
SE of mean	0.3770	0.3877	1.2747	1.2741	0.2685	0.0329	0.0697
CV %	1.34	1.49	4.25	23.80	9.86	11.12	14.69

^a Mean data of two years (2064/065, 2065/066) 2006-08

Table 2. Mean percentage of shelling, milling recovery, broken rice, protein, ash, and fat at varying degree of polishing of rice varieties at Khumaltar during 2006-08^a

Polishing (%)	Shelling (%) (Brown rice)	Milling recovery (%)	Head (%)	Broken (%)	Protein (%)	Ash (%)	Fat (%)
0	78.80a	78.80a	87.94a	12.01c	8.507a	1.238a	2.223a
4	79.28a	75.26b	85.58ab	14.39bc	7.782b	0.9966b	1.666b
8	79.66a	71.78c	84.35bc	15.65ab	7.518bc	0.6952c	0.9963c
12	79.53a	67.61d	81.46c	18.53a	7.011c	0.4226d	0.4830d
Grand mean	79.318	73.361	84.835	15.144	7.708	0.838	1.342
LSD (P<0.05)	0.9005	0.9259	3.045	3.043	0.6415	0.08012	0.1668
SE of mean	0.3078	0.3166	1.0408	1.0403	0.2192	0.0269	0.0569
CV %	1.34	1.49	4.25	23.80	9.86	11.12	14.69

^a Mean data of two years (2064/065, 2065/066) 2006-08

Conclusion

From the two years' result of the experiment, following were the conclusions:

- If we make policy on fixing the degree of polishing of rice at 4 to 8% for rice mills of Nepal, the milling recovery of rice can be increased by 4% which is the equivalent to 4% increase in the total production of rice i.e. it could strengthen the food security in the country.
- It also increases nutritional value of the rice i.e. strengthen the nutritional security.
- It also improves the quality of rice (high percentage of head rice recovery) which is again increase in market value of rice.

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