Nutritional Quality of Rice Variety in Sabah, Malaysia

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ABSTRACT Five rice samples collected in Sabah (white, red, black, brown and aroma rice) were evaluated for protein content and nutritional quality. Protein content of the rice samples obtained ranged from 13.13 to 24.60%. Mineral contents were significantly higher in brown rice than the others The phosphorus (P), sodium (Na), potassium (K), magnesium (mg) and copper (Cu) contents ranged from 3.48 to 4.28, 19.95 to 27.60, 74.98 to 627.17, 68.40 to 126.73 and 0.57 to 1.63 mg/100 g, respectively among the rice samples. The lowest contents of these elements were observed in white rice. Traditional rice varieties found in Sabah have better nutritional quality than white rice due to much more availability of minerals. These rice varieties may be utilized in rice breeding for specific grain quality.

KEYWORDS: Rice, Grain quality, Nutritional value, Mineral content

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INTRODUCTION

Rice (*Oryza sativa*) has been the major staple food in the world, especially Asian countries since ancient time. It feeds more than one third of the world's population by supplying high value of carbohydrate and consisting of more than 50% of the human's daily calories intake (Sautter *et al.*, 2006; Anjum *et al.*, 2007; Oko and Onyekwere, 2010). Generally, quality of rice is the focus point of consumer during selecting the rice varieties they wanted. Quality of rice can be categorized into cooking quality and nutritional quality (Yadav *et al.*, 2007; Shabbir *et al.*, 2008). It is necessary to understand the rice grain quality in order to meet the demand of consumer in high grain quality. Rice produced in Sabah show variations in the colour. There are white, black, red and brown rice can be found in the market. This traditional rice has largely contributed in the rice market but they have not yet been documented. Therefore, it is important to have a proper study and research on this traditional rice. This study aimed to determine the protein and mineral contents of five rice samples collected in Sabah, Malaysia as extension of the previous work (Lum, 2017).

METHODOLOGY

Materials

Five rice samples found in Sabah were selected for this study. Samples were collected and stored in glass containers with 12% moisture content prior to study.

Methods

(A) Nutritional measurements

Rice samples were ground into flour prior to analysis. Minerals were extracted from the flour using the method as described by Amissah *et al*. (2003) and Adu-Kwarteng *et al*. (2003). The protein content of rice was determined using Biuret reagent (Chanput *et al*., 2009). The mineral contents (Na, Mg, K, and Cu) were determined using an atomic absorption spectrophotometer (Perkin Elmer) according to method of AOAC (2000). The P content was determined using the method as described by Nag (2006).

(B) Statistical analysis

Data obtained was analyzed statistically (one way - ANOVA) using SPSS 17.0 software package and the statistical significance was $p \leq 0.05$. All analyses were carried out using three replicates.

RESULTS AND DISCUSSION

Figure 1 shows the protein content ranged from 13.13 to 24.60% for the five rice samples. There were significant differences ($p \leq 0.05$) in protein content between the five rice samples. Red rice showed the highest protein content with 24.60% followed by black rice (19.23%), brown rice (16.08%) and aroma rice (13.19%) while white rice showed the lowest protein content of 13.13%.

Phosphorus content for the rice samples ranged from 3.48 to 4.28 mg/100 g, with red rice having the highest phosphorus content and aroma rice the lowest (Figure 2). There was no significant difference in phosphorus content between the rice samples ($p \leq 0.05$). The magnesium content ranged from 68.40 mg/100 g to 126.73 mg/100 g (Figure 3). Aroma rice had the highest magnesium content while white rice contained the lowest. Significant differences resulted in the potassium content between the rice samples except for white rice and aroma rice ($p \leq 0.05$). Brown rice contained the highest potassium content with 627.17 mg/100 g whereas the other samples ranged between 74.98 to 157.23 mg/100 g (Figure 4). White rice and aroma rice contained the lowest potassium content with 74.98 and 78.15 mg/100 g respectively. Sodium content of the five rice samples ranged from 19.95 to 27.40 mg/100 g (Figure 5). Brown rice had the highest sodium content with 27.40 mg/100 g followed by red rice (25.08 mg/100 g), black rice (24.15 mg/100 g) and aroma rice (23.00 mg/100 g) while white rice had the lowest sodium content of 19.95 mg/100 g. Copper appeared to be of the lowest content in the rice grains ranging from 0.57 to 1.63 mg/100 g as compared with other minerals (Figure 6). White rice had the highest copper content (1.63 mg/100 g) and black rice the lowest (0.57 mg/100 g).

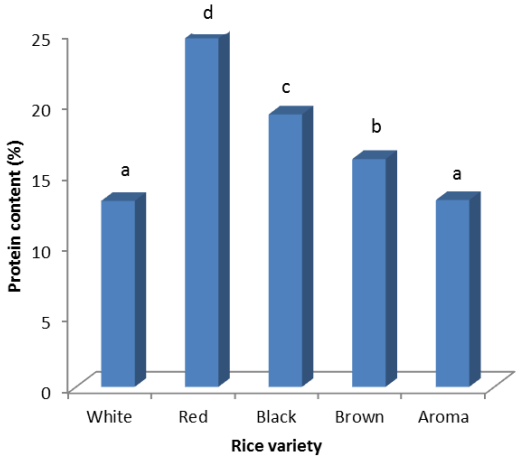

Figure 1. Protein content of the five rice varieties.

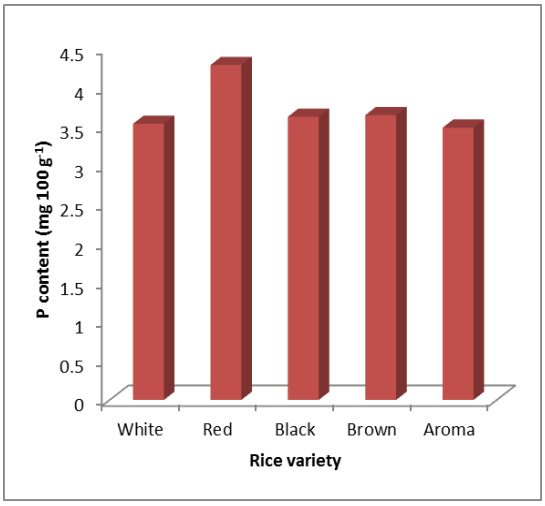

Figure 2. Phosphorus (P) content of the five rice varieties.

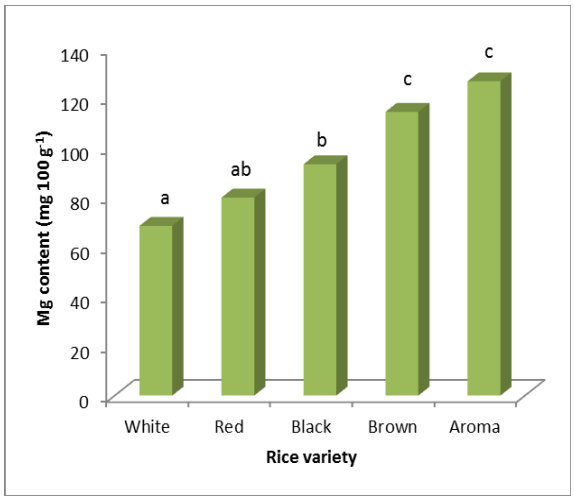

Figure 3. Magnesium (Mg) content of the five rice varieties.

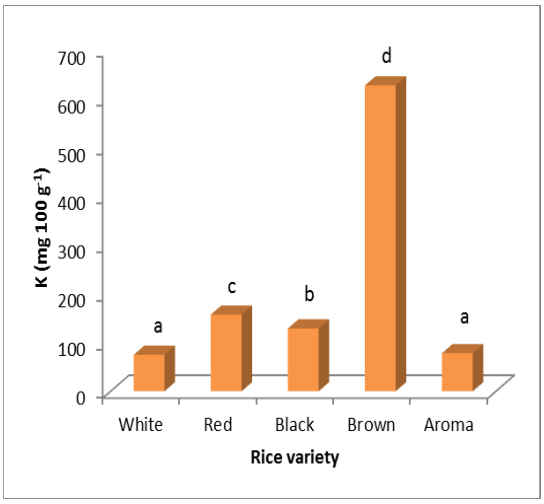

Figure 4. Potassium (K) content of the five rice varieties.

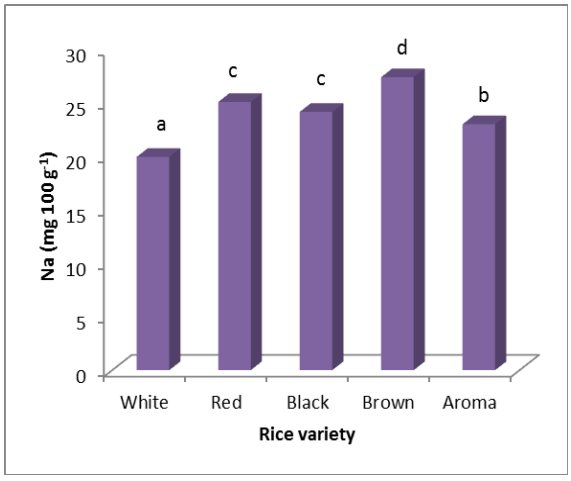

Figure 5. Sodium (Na) content of the five rice varieties.

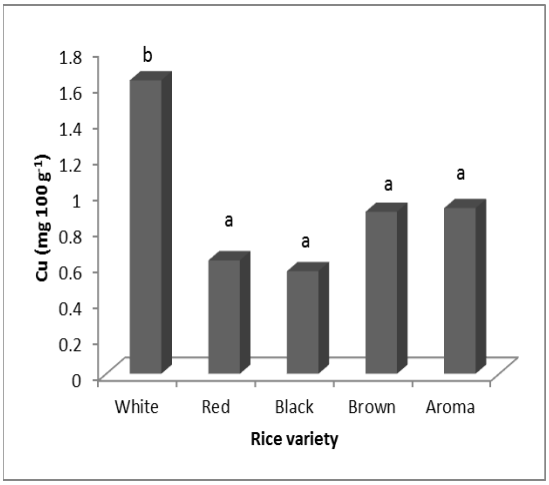

Figure 6. Copper (Cu) content of the five rice varieties.

The mineral content of colored rice (red and black rice) was higher than cultivated white rice. Swain *et al.* (1977) and Deepa *et al.* (2008) also found that wild rice (*Zizania aquatica*) contained higher mineral content compared to cultivated rice. Brown rice is an excellent source of minerals. The significant difference between brown rice and other rice samples may due to the bran portion that brown rice possesses. Rice bran is rich in minerals which significantly increased the mineral contents of brown rice as has been reported by other researchers (Anjum *et al.*, 2007; Deepa *et al.*, 2008; Shabbir *et al.*, 2008). The Na:K ratio in the body is of great concern for prevention of high blood pressure (hypertension) and arteriosclerosis since K depresses and Na enhances blood pressure (Yoroshimura *et al.*, 1991; Hassan and Umar, 2006). Na:K ratio less than one is recommended (FND, 2002; Akubugwo *et al.*, 2007). Hence, consumption of all the five rice samples would probably reduce high blood pressure as all the rice samples showed Na:K ratios of less than one (Figure 7).

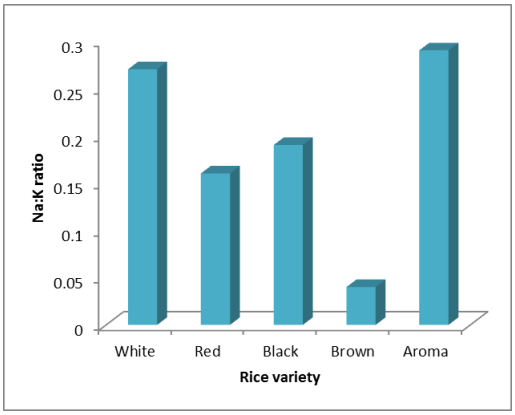

Figure 7. Sodium : Potassium (Na:K) ratio of the five rice varieties.

CONCLUSION

Generally, the traditional rice found in Sabah (red, black and brown) showed higher nutrients content compared to white rice. Therefore, these rice varieties can serve as gene sources in rice breeding programmes for grain quality.

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