International Journal of GEOMATE, March, 2020, Vol.18, Issue 67, pp. 51-56
ISSN: 2186-2982 (P), 2186-2990 (O), Japan, DOI: https://doi.org/10.21660/2020.67.5696
Special Issue on Science, Engineering and Environment

VITAMIN AND MINERAL CONTENT OF SIX NATIVE VARIETIES OF RICE IN THAILAND

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ABSTRACT: The objective of this research was to examine the vitamin and mineral contents present of the native varieties of six rice varieties (Sangyod, Khaw kin, Mali nil surin, Khaw heniyw lum phaw, Khaw kla heniyw and Thabthim chumphae) in Thailand. Results showed that Mali nil surin had the highest vitamin E content (0.25 mg/100 g) and Khaw kin had higher iron (5.08 mg/100g) than that of other rice. Khaw kla heniyw had high folic acid content (88 mcg/100g) and niacin content (4.12 mg/100g). Folic acid and niacin of Khaw heniyw lum phaw had the lowest (9 mcg/100g and 3.11 mg/100g) while, Khaw kin and Khaw kla heniyw had the lowest vitamin E and iron (0.09 and 0.30 mg/100g). While Khaw heniyw lum phaw had higher total phenolic content and antioxidant capacity than that of the other sample at 212.42 µg Gallic acid/mL and 391.85 µg Trolox/mL, respectively. Thus, rice is a good source of nutritional and medicinal attributes and may be developed of rice-based beauty products, functional foods, drugs, and natural food preservatives.

Keywords: Native varieties of rice, Folic acid, Iron

1. INTRODUCTION

Rice (*Oryza sativa*), is understood as the grain of life and is similar to aliment for Asians [1]. More than two billion people in Asia alone arise 80% of their energy needs from rice, which contains carbohydrates (80%), protein (7-8%), fat (3%), and fiber (3%) [2]. Paddy rice is a good specialist of thiamine (vitamin B1), niacin (vitamin B3), and vitamin B6 [3]. The B-complex vitamins, especially thiamin, riboflavin and niacin presented by natural brown rice promote youthful energy and nourishment to skin and blood vessels [1]. Vitamin E family (tocopherols and tocotrienols) contained rice bran, which holds beneficial antioxidation [4]. The human body needs iron (Fe) and minerals from red and black rice which are required for enzymatic processes and haemoglobin production, respectively [1, 5]. Iron is a considerable factor affecting its assimilation and so affects iron identity. In grain foods, phytate is the most essential absorption inhibitor, binding nonheme zinc, iron, and calcium in an insoluble complex in the intestine, perform it unavailable for absorption [6, 7]. Folates are an important B vitamin and essential nutrition component in the human diet, concerned in carbon transfer reactions such as amino acid inter-conversions and pyrimidine and purine biosynthesis [8]. Folates survive as vitamers (one carbon folate derivatives) that are polyglutamate with varying oxidation states and substituents [9]. Folates are found informs foods and the human body (metabolically active) [10]. Folates are synthetic form folic acid found in fortified and supplements foods. This is the more stable form and occurs unusually in foods or the human body [8]. The aim of the research was to examine the vitamin and mineral contents present of the native varieties of six rice varieties (Sangyod, Khaw kin, Mali nil surin, Khaw heniyw lum phaw, Khaw kla heniyw, and Thabthim chumphae) in Thailand, they're a good select for natural sources of nutritional and medicinal characteristics.

2. EXPERIMENT

1. Preparation of Paddy

Rice, six varieties of Sangyod, Khaw kin, Mali nil surin, Khaw heniyw lum phaw, Khaw kla heniyw, and Thabthim chumphae, Thailand were used. Rice grains were ground by the mortar and pestle and analyzed according to the technique described above.

2. Vitamin E

The following vitamin E was measured by high performance liquid chromatographic methods. Vitamins E (a-tocopherol) were determined after alkaline saponification [11].

3. Iron

Iron content was measured by the method described by AOAC, 2016. 984.27 [12]

4. Folic acid

Folic acid was determined by In house method based on AOAC 2016. 960.46 [13].

5. Niacin (Vitamin B3)

Niacin was determined by the colorimetric method (AOAC 2016. 961.14) [14].

6. Total phenolic content

Total phenolics content in six varieties of Sangyod, Khaw kin, Mali nil surin, Khaw heniyw lum phaw, Khaw kla heniyw, and Thabthim chumphae were considered according to the Folin-Ciocalteau procedure [15]. Briefly, 5 g of rice was extracted with 80% ethanol. Aliquot of sample extract to 0.1 mL, 2.9 mL distilled water, 0.5 mL of Folin-Ciocalteau reagent (1 N) and 2 mL 20% Na_2CO_3 was added. Then, the incubation time for 60 min and the absorbance of the mixture was measured at 760 nm using at UV-visible spectrophotometer. The results were showed in Gallic acid as µg of Gallic acid per mL of fresh weight of the sample.

7. Antioxidant capacity

The antioxidant capacity in rice was determined by 2, 2-diphenyl-1-picryl hydrazyl (DPPH) radical scavenging the modified method of Brand-Williams *et al*. [16]. DPPH solution was provided by DPPH dissolving 0.025g in 100 mL of 70% methanol. After, 3.9 ml DPPH and 0.1 mL of the sample extract were added and mixed well-using vortex. The mixture was incubated in a dark room for 30 min. The absorbance was taken using a UV-visible spectrophotometer at 517 nm and methanol (70%) as blank. The result was expressed in µg Trolox/mL.

8. Ash and protein

The ash and protein contents of six varieties of rice were analyzed following the method of Association of Official Analytical Chemists (AOAC) [17].

3. RESULTS AND DISCUSSION

The color of the varieties is deep red (Sangyod), light red (Khaw kin), purple rice (Mali nil surin and Khaw heniyw lum phaw), red and purple (Khaw kla heniyw) and light red (Thabthim chum phae) (Figure 1A-F). The deep red and purple colors of varieties are comparable more nutritious. The red/purple or brown unpolished rice is a healthy food because it gives rice bran, a byproduct of the rice to the conversion from brown rice to white rice, and it provides mankind greatest nutritional needs [18].

Fig. 1 Characterizes of paddy in Pathum Thani Rice Province; Sangyod (A), Khaw kin (B), Mali nil surin (C), Khaw heniyw lum phaw (D), Khaw kla heniyw (E) and Thabthim chumphae (F).

In Chhattisgarh of India, Layacha variety is effectively used to cure boil caused on the scalpel of the newly born child. The mother of the child eats cooked rice of the variety, useful to heal the boil of the child who consumes mother milk. Laicha disease can be prevented by cooked grains of Layacha variety [18].

The rice Mali nil surin had the highest vitamin E content (0.25 mg/100g) and Khaw kin had the lowest vitamin E content (0.09 mg/100g) (Fig. 2). Studies have confirmed beneficial qualities such as the high biological value of vitamin E in brown rice (0.90-2.50 mg/100g) and milled rice (0.75-3.00 mg /100 g) [2]. Rice also holds beneficial antioxidants like Vitamin E family (tocopherols and tocotrienols) and oryzanols [4]. Tocopherols were explored by many researchers can protect cancer activities [19]. While the color of red and purple rice is full in anthocyanin and tannins which have free-radical scavengers and anti-inflammatory foods properties [1].

Mali nil surin of the varieties is purple color and high rich antioxidant of anthocyanin. Khonkaen rice seed center [20] have also found that antioxidants and anthocyanins of Mali nil surin were at 117 mg/kg sample and 219.03 mg/kg. Bioavailability of iron is a considerable factor affecting its absorption and hence affects iron status [1]. For rice levels of phytate informed in the literature range from 0.87 to 3.7 mg/g of dry matter, which equals 0.09-0.37% [21, 22, 23].

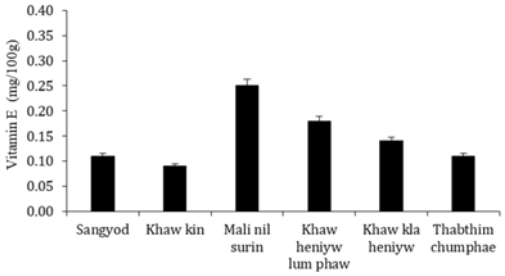

Fig. 2 Vitamin E of six native varieties of rice. Data represent the mean ± SD of three determinations (n=3).

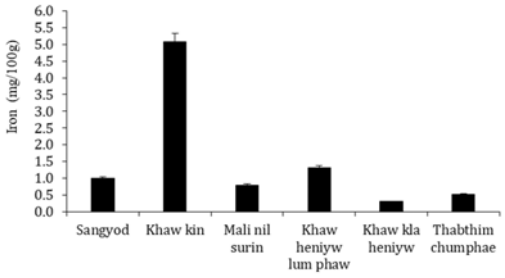

Fig. 3 The iron of six native varieties of rice. Data represent the mean ± SD of three determinations (n=3).

In fig. 3, the iron of Khaw kin was highest as 5.08 mg/100g, while Khaw kla heniyw was lower than the other samples as 0.30 mg/100 g. Iron is demanded by the human body system for enzymatic processes and hemoglobin synthesis, respectively. Iron shows an important role in hemoglobin products which protein called transferrin binds to iron and transports it throughout the body. Hemoglobin produced from red blood cells [1].

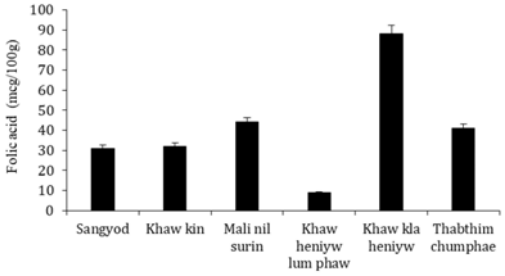

Fig 4. Folic acid of six native varieties of rice. Data represent the mean ± SD of three determinations (n=3).

Khaw kla heniyw had highest folic acid, compared with Sangyod, Khaw kin Mali nil surin, Khaw heniyw lum phaw and Thabthim chumphae (Fig. 4). Folic acid can prevent the perinatal mortality rate and infantile paralysis world [24].

Niacin of Sangyod and Khaw kla heniyw had 4.18 and 4.12 mg/100g, while Khaw kin, Mali nil surin, Khaw heniyw lump haw, and Thabthin chumphae had 3.71, 3.95, 3.11 and 3.19 mg/100 g, respectively (Fig. 5). Niacin or vitamin B3 has basic roles as part of reduction/oxidation coenzymes associated with energy metabolism, amino acid metabolism, and detoxification reactions for medicines and other substances. Niacin has many forms such as nicotinic acid, nicotinamide and other derivatives [25, 26].

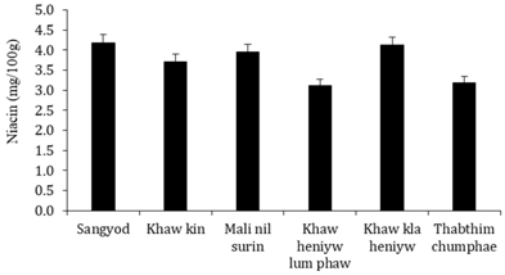

Fig 5. Niacin of six native varieties of rice. Data represent the mean ± SD of three determinations (n=3).

Total phenolic content of Sangyod, Khaw kin, Mali nil surin, Khaw kla heniyw and Thabthin chumphae had 58.50, 42.65, 63.84, 95.19 and 90.02 µg Gallic acid/mL, respectively while Khaw heniyw lump phaw had 212.42 µg Gallic acid/mL (Fig. 6).

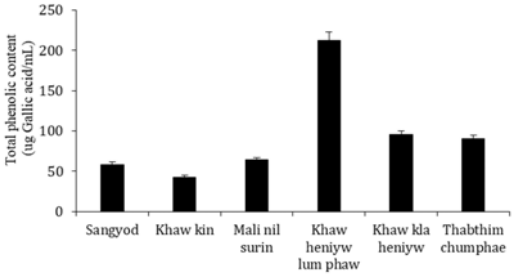

Fig. 6 Total phenolic content of six native varieties of rice. Data represent the mean ± SD of three determinations (n=3).

Antioxidant capacity of Sangyod, Khaw kin, Mali nil surin, Khaw kla heniyw and Thabthin chumphae had 204.92, 126.80, 391.85, 231.22 and

309.27 µg Trolox/mL, respectively while Khaw heniyw lump phaw was lower than the other samples as 12.42 µg Gallic acid/mL (Fig. 7).

Total phenolic content and antioxidant capacity of Khaw heniyw lum phaw had the highest as 212.42 µg Gallic acid/mL and 391.85 µg Trolox/mL, respectively (Figs. 6 and 7). The content of total phenolic in the rice grains has been responsibly involved in the antioxidant capacity [27]. These results showed that the phenolic contents were amongst the main in the part of the antioxidant activity of rice [28]. Khaw heniyw lum phaw, grain with red and black pericarp demonstrated higher antioxidant capacity than those with light brown pericarp color (Khaw kin).

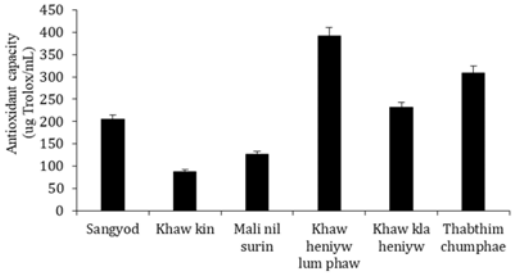

Fig. 7 Antioxidant capacity of six native varieties of rice. Data represent the mean ± SD of three determinations (n=3).

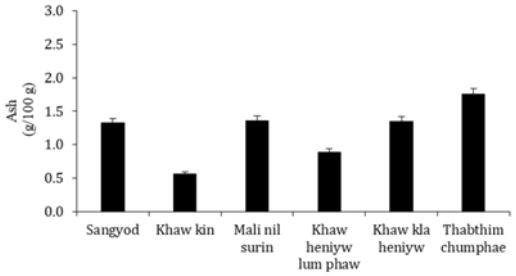

Fig. 8 Ash contents of six native varieties of rice. Data represent the mean ± SD of three determinations (n=3).

The ash contents in Thabthim chumphae (1.75 g/100g) had higher than Khaw kin (0.56 g/100g) and Khaw heniyw lump haw (0.89 g/100g) while Sangyod, Mali nil surin and Khaw kla heniyw had 1.32, 1.36 and 1.35 g/100g, respectively. People in Asia need energy from rice, which contains 80% carbohydrate, 7-8% protein, 3% fat, 3% fiber and 1.4% crude ash of rice [2]. An abundance of minerals in natural brown rice help to nourish the hormonal system heal wounds and regulate blood pressure [1].

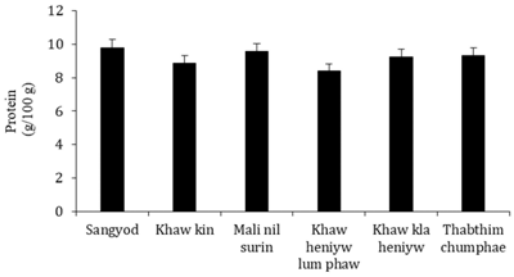

Fig. 9 Protein contents of six native varieties of rice. Data represent the mean ± SD of three determinations (n=3).

The values for the protein contents were similar for six native varieties with ranges between 8.40-9.79 g/100g (Fig. 8) which could be an interesting source of protein in industrial food products. Rice has a high section of lysine and high protein digestibility. The protein of rice, which includes up to 8% of the grain, as it has eight of the essential amino acids in a delicately balanced section [1].

4. CONCLUSION

Thailand is many rice varieties that have medicinal properties and Khaw kla heniyw had higher the folic acid and niacin than other verity rice. While Khaw kin was high the rich of iron and a much vitamin E as Mali nil surin. However, the phenolic content of Khaw heniyw lum phaw was found to greatly correlate with the antioxidant capacity of rice. Therefore, new rice varieties that have medicinal charectezies and development of health food in the style of new in the future time.

5. ACKNOWLEDGMENTS

Financial support for this work was provided the Plant Genetic Conservation Project under the Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn, Thailand. We thank the Faculty of Agricultural Technology and Institute of Research and Development, Rajamangala University of Technology Thanyaburi. Finally, we would like to thank Pathumthani Rice Research Center for the native varieties of rice in Pathum Thani Province.

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