Modification of dry grain processing for rice nutrition produced

Modification of dry grain processing for rice nutrition produced

A N F Rahman, J Genisa, A Dirpan and A A Badani

Department of Food Science and Technology, Faculty of Agriculture, Hasanuddin University, Makassar 90245, South Sulawesi, Indonesia.

E-mail: *faidah83@yahoo.com*

Abstract. Rice is a staple food for people in Indonesia that provides high energy and nutrients of up to 360 calories per 100 g. Based on the research it was known that the nutrient content in rice will increased by soaking. This is suspected because the nutrient content in the aleurone layer adsorbed to the endosperm. The purpose of this research was to know the effect of dry grain immersion on the nutrition of rice produced. The method of this research was conducted through some stages: 1. Preparation of raw materials, 2. Grain immersion, 3. Grain drying, 4. Peeling chaff, 5. Testing the nutritional value of rice. The research was processed by using factorial randomized complete random design (RCRD) with three replications. The result showed that soaking the grain for 12 hours has the highest nutritional value increases compared to the control. Proximate test resulted from the best treatment were: protein content of 8.26%, ash content of 0.42% and thiamine content of 0.023%.

1. Introduction

High quality and nutrition of rice produced by several combination of processing to convert paddy into well milled silky-white rice [1]. Well milled silky-white rice (WMR) without bran and aleuron layer is prefer by the majority of consumers due to the fine colour of rice. Processing, variety of rice, methods of cultivation and cooking conditions are some factors that affect rice nutrition produced [2]. The aleurone layer is a layer of rice that contains lots of protein, fat, vitamins, and minerals [3], however these are removed by milling processing. Nowdays, consumers are more selective to consumption of rice milled to lower degrees (partially-milled rice: PMR) or brown rice (BR). In addition, many nutritional rice have also been developed such as germinated brown rice (GBR) and rice bread (RB). Hence, in this research we try to produce nutritious rice by soaking the dry grain in the water for various time. We expected the nutrient which dissolved in water such as thiamine (vitamine B1) and mineral in germ and outer layer could adsorbed into the rice through endosperm.

2. Materials and Methods

2.1 Materials

The fresh rice grain from Ciherang variety was purchased from Sidrap, South Sulawesi, Indonesia. Reagents used were obtained from chemical market in Makassar, Indonesia.

2.2 Methods

2.2.1 Sample preparation. Dry grain 10 kg (water content 10.55%) were soaked in water with different level treatment of water (5, 10, 20 L) and time spans (4, 8, 12 h). The grain was mixed every 2 hours. After drying (water content 13.70%), the grain was then milled and analyzed for the proximate content.

2.2.2 Determination of Protein. Protein was analyzed by using Kjeldahl method [4]. A 0.2 mg of sample was mixed with 1 g of N catalyst (mixture of Na_2SO_4 : HgO (20:1)). Three mL of concentrated sulfuric acid (93-98% free N) was added to the destruction of the protein and heated in the acid room until the solution to be clear and colorless, then cooled. After cool the Kjedahl flask was washed with distilled water and boiled for 30 minutes. Further distillation was carried out with NaOH to alkalis, the distillate was placed in an Erlenmeyer flask containing 5 ml of 4% boric acid solution and methyl red indicator. The distillates are then titrated with HCl 0.02 N. Protein content was determined by the Kjeldahl method using the conversion factor 6.25. Protein was expressed as the percentage of total protein.

2.2.3 Determination of Ash. Before the measurement of ash content, the cup was dried for 1 hour at 750°C. The cup was then cooled for 10 minutes using desiccator and weighed. Five g of sample were then added into cup and heated for 3 hours. After 3 hours, the sample was then cooled in desiccator for 10 minutes then weighed. Ash content was expressed as the percentage of ash [4].

2.2.4 Determination of Thiamine. Thiamine was analyzed by using HPLC method using C18 column, UV-Vis detection at 254 nm and using CH_3OH-0.05 M CH_3COONH_4 as mobile phase [5].

2.3 Statistical analysis

The experimental was designed by using factorial randomized complete random (RAL) with three replications and the data was analysed by using SPSS ver. 22

3. Results and Discussion

3.1 Protein Content

Protein content of rice was analyzed. Figure 1 showed protein content for all treatments increased after 12 hours. The 10 kg dry grain which were soaked in the 5 liters of water;10 liters of water; and 20 liters of water have protein content of 8.30%; 7.91%; and 8.26%, respectively. Two of the results obtained were higher than protein content of grain without soaking treatment (control) that was 8.01%. Based on statistical analysis of variance showed that the treatment of soaking time and water volume ratio at the time of immersion had no significant effect on the 5% level.

The long treatment of immersion may increase the protein content caused by the diffusion of proteins and amino acids from aleurons layers into the endosperm of rice. The types of proteins present in aleurons are distinguished by their solubility, namely albumin (soluble in water), globulin (soluble in salt), prolamin (soluble in alcohol), and glutellin (soluble in alkali). The research results of Paiva *et al*. [6] showed that, an increase of protein levels from red rice were due to the migration of protein to the endosperm. Hasbullah and Riskia [7] showed that, the longer time immersion, the higher increasing of protein levels of rice. And based on statistical analysis, time immersion had significant effect on increase of protein levels.

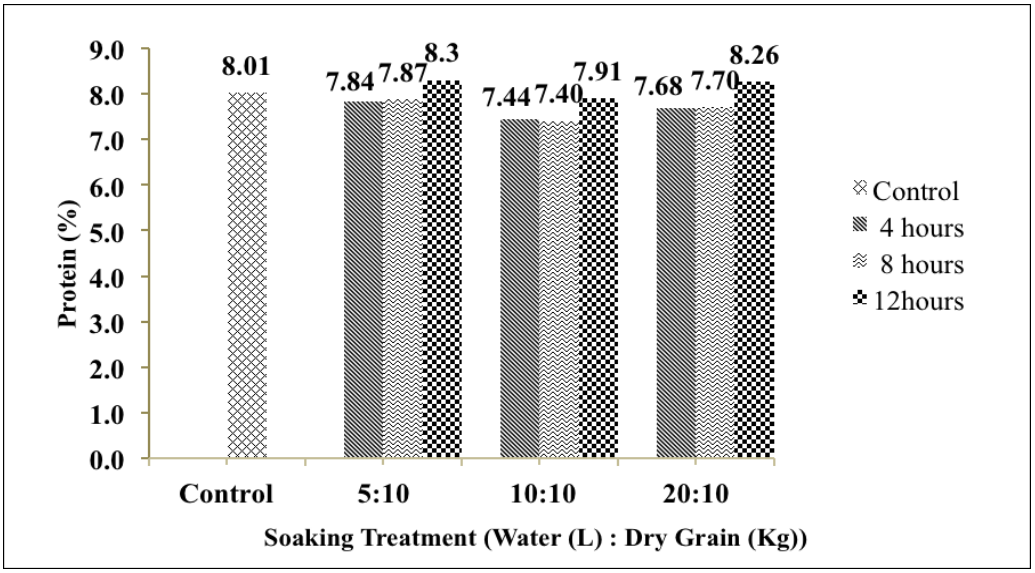

Figure 1. Protein content of dry grain in different treatments

3.2 Ash Content

As shown in figure 2, ash content for all treatments increased after 12 hours. The 10 kg dry grain which were soaked in the 5 liters of water, 10 liters of water and 20 liters of water have ash content 0.39%, 0.36% and 0.42%, respectively. Two of the results obtained were higher than ash content of grain without soaking treatment (control) that is 0.37%. Based on statistical analysis of variance showed that the treatment of soaking time and water volume ratio at the time of immersion had significant effect on the 5% level.

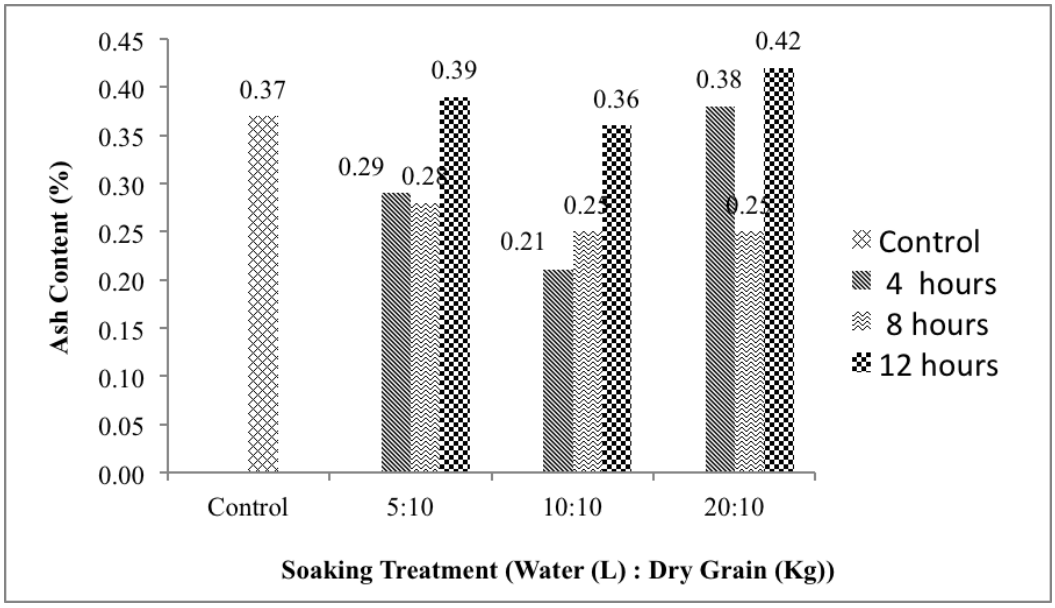

Figure 2. Ash content of dry grain in different treatments

Based on the results of research, ash content decreased after 8 hours of soaking. This occurred due to the dissolution of mineral content from husk into the water during soaking process. But after 12 hours of soaking, the ash level increased due to the opening of the bonds of rice cells and mineral adsorbed into the rice. Widowati *et al*. [8] stated that the increase of ash content in the process of soaking

caused by dissolving of material components including minerals from bran and husk and adsorbed to endosperm of rice.

3.3 Thiamine Content

As shown in figure 3, thiamine content for all treatments increased after 12 hours. The 10 kg dry grain which were soaked in the 5 liters of water, 10 liters of water and 20 liters of water have thiamine content 0.023%, 0.024% and 0.023%, respectively. The results obtained were higher than thiamine content of grain without soaking treatment (control) that was 0.022%. Based on statistical analysis of variance showed that the treatment of soaking time and water volume ratio at the time of immersion had no significant effect on the 5% level.

The effect of immersion on grain could increase thiamine content of rice, because in the process of soaking, water soluble component such as thiamine adsorbed into the endosperm of rice. The aleuron layer is a layer of rice that contains lots of protein, fat, vitamins, and minerals [3].

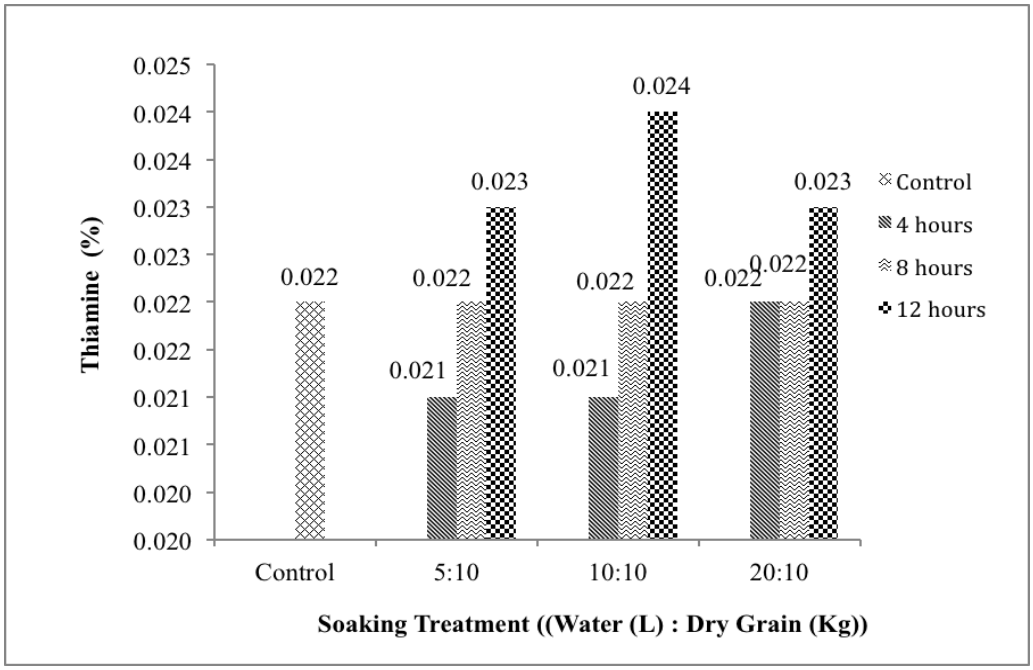

Figure 3. Thiamine content of dry grain in different treatments

4. Conclusions

The grain from Ciherang variety has been soaking in various time and several amounts of water. The results showed that the dry grain 10 kg with 12 hours immersion in 20 L water has the highest increase in nutritional value compared to the control and other treatments.

References

[1] Roberts L R 1979 Composition and taste evaluation of rice milled to different degrees. *J. Food Sci.* **44** 127-129

[2] Roy P, Orikasa T, Okadome H. Nakamura N and Shiina T 2011 Processing conditions, rice properties, health and environment. *Int. J. Environ. Res. Pub. Health* **8** 1957-1976

[3] Juliano B O and Bechtel D B 1985 *The rice grain and its gross composition* (*Rice Chemistry and Technology* 2nd ed.) ed B O Juliano (Eagan, MN, USA: American Association of Cereal Chemists) p 17-57

[4] Sudarmaji S, Haryono, B and Suhardi 1996. *Analisa Bahan Makanan dan Pertanian* [in Bahasa] (Yogyakarta: Liberty)

[5] Moreno P and Salvadó V 2000. Determination of eight water-and fat-soluble vitamins in multi-vitamin pharmaceutical formulations by high-performance liquid chromatography. *J. Chromatogr. A.* **870** 207-215
[6] Paiva F F, Vanier N L, Berrios Jde.J, Pinto V Z, Wood D, Williams T, Pan J and Elias M C 2015 Polishing and parboiling effect on the nutritional and technological properties of pigmented rice *Food Chemistry* **191** 105-112
[7] Hasbullah R and Riskia P D P 2013 The effects of soaking duration on parboiled rice quality of paddy cv IR 64 *J. Keteknikan Pertanian* **27** (1) 53-60
[8] Widowati S, Santosa B A S, Astawan M and Akhyar 2009 Penurunan indeks glikemik berbagai varietas beras melalui proses pratanak [in bahasa] *J. Pascapanen* **6** (1) 1-9