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THE CHANGES ON NUTRITION CONTENT OF VARIETIESRICE FROM WEST SUMATERA THROUGH PARBOILING PROCESS

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Abstract: The purpose of this study was to determine the effect of parboiledprocess on ricenutritionalfrom various varieties in West Sumatra. The varieties used are based on the local yield rice issued by BalaiPengkajianTeknologiPertanian (BPTP) West Sumatra in 2010 that had the texture pera. The varieties used are the Anak Daro, KuriakKusuik, Junjung, CeredekMerah. Each of these varieties will be compared the nutritional value between milled rice and parboiled rice.The result showed an increased of the water level of milled rice11.40 % -12.45 % and parboiled rice 13 % -13.85 %, elevated ash content from 0.36 % - 0.85 % to 0.69 % -1.08 %, elevated levels of Fat Level was 0.28 % -0.51 % to 0.51 % -0.61 %, a decline in Protein Levelwas 4.75 % -5.64 % to 4.38 % -5.42 %, the decline in the starch content was from 61.12 % - 61.66 %. The enhancement of nutrition contentwas caused by soaking and steaming processduring the making of parboiled rice, resulting dispersion of mineral, fat, and dietary fiber of aleuronelayer and embryo into endosperm.The subsidence of protein occurred because protein denatured due to warming, while starch and amylose soluble during soaking and steaming process.
Keywords: milled rice, parboiled rice, nutrition

INTRODUCTION

In everyday sense, rice is the rice grain from rice plant that the crust has been disposed of and Polished, white milled using a peeler and grinder (huller) and also thepolisher. If grain is simply peeled part of the outer skin (husk), it called brown rice (brown rice). While brown rice, whole or part of the husk has been separated in the milling process, called milled rice (milled rice).

According to Patiwiri (2006) although milling is a physical process, grinding also affect the nutritional content of rice. This is caused by the release and polish parts of grains of rice during the milling process that caused some nutrients wasted. Carbohydrate accumulated in the endosperm, which is the biggest part of a rice grain. Proteins are the most numerous compound in embryo, pericarp and aleurone layer. In the endosperm layer also contained protein, but further and further into the center of the endosperm the protein is decreased. Vitamin and fat also accumulated specifically in the pericarp and aleurone layer. For the nutritional content of rice is not wasted, its necessary to do improvement of grain processing methods include using technology of parboiled rice (rice parboiling). The steps of parboiling riceinclude cleaning, soaking, steaming, drying and milling.

The purpose of doing parboiling treatment is to obtain a change in the grain so that increase the nutritional value, quality and shelflife of the rice. The main changes of parboiling treatment resulting dispersion of vitamins and minerals from the aleurone layer and embryo into the endosperm, the dispersion of the lipid layer of aleurone and embryo, inactivation and destruction of fungi and insects. Parboiled rice has a higher nutritional value than ordinary rice, because during the soaking and steaming process a lot of vitamin B, minerals and water-soluble nutrients diffused into the endosperm (Haryadi, 2006).

Based on researchbyWidowati, Santosal, Astawan and Akhyar (2009) on reducing the glycemic index of various varieties of rice through the parboiling process by using two varieties of low amylose (Sintanur and Gilirang), three varieties of medium amylose (IR 64, Mekongga and Ciherang) and two varieties of high amylose (IR 42 and BatangLembang), showed that the impact on the process of parboiled rice was the changes nchemical composition, Based on existing research, which generally use low amylose rice (fluffier), then the researchers will test the rice with a high amylose (pera) that are generally widely consumed by people of West Sumatra through the parboiling process, so that it can be seen the changes in nutrition content.

METHODOLOGY

This research had conducted in the Laboratory of Agricultural Technology Faculty of Universit as Andalas.

Materials and Tools

The materials includeoffour varieties of rice grains obtained from farmers in West Sumatra. Chemicalmaterialssuch as diethyl ether, amylose standard, 95% ethanol, 1N NaOH, a solution of iodine, acetic acid, solvents, diethyl ether or petroleum ether, K2SO4, HgO, H2SO4, H3BO3, HCl, Na2S2O3, boiling stone, distilled, indicator MM-MB , indicator phenolptalin 1%, 0.1 M phosphate buffe, selenium mix, a saturated solution of boric acid, sodium hydroxide-sodium thiosulfate,

The tool used were moisture meter, cups, incineration, hot plate, furnace, clamp the cup, analytical balance, bath steam, wate bath test tube, flask, pipette, pressure cooker, soxhlet complete with condenser, oven, filter paper, cotton, centrifuges, spoon, pot, rice cooker, mats basking, heating Kjeldahl complete associated with suction vapor through the aspirator, Kjeldahl broth, burettes, Erlenmeyer 250 ml, spectrophotometers, soxhlet complete with condenser and fat broth, electric heating, and an analytical balance

Research methods

The method used in this study is explorative experiment of four varieties rice withthree replications. The riceused are varieties of rice in West Sumatra to be made into parboiled rice and milled rice through the process. The varieties used are based on the local yield rice issued by Institute for Agricultural Technology (BPTP) of West Sumatra in 2010 that had pera texture. Rice varieties used are varieties of AnakDaro, KuriekKusuik, Junjung, danCeredekMerah.

Implementation

Making of Parboiled Rice (Rice Parboiling)

The following parboilingprocess is a method developed by Widowati et al., (2007). Grain cleaned of impurities, such as straw, gravel and soil, then soaked in water (temperature 60-70 ° C, 4 hours). Grain moisture content soaking the expected result is 30%. Furthermore, steamed rice (1 atm) for 20 minutes. Then do the two-phase drying. The first phase at a temperature of 100 ° C for one hour (18-20% moisture content) and the second phase at 60 ° C for 25 minutes (maximum moisture content 12%). Grain parboiled resulted then milled into parboiled rice.

Observation

Observations were conducted to compare the nutritional value of parboiled rice with milled rice, the observations consist of moisture content, ash content, fat content, protein content and starch content, analyze used method of Sudarmadji, et.al (1997)

RESULTS AND DISCUSSION

Water Content

Water content of parboiled rice and milled rice can be seen in Figure 1. As we can see in Figure 1 that the water content of parboiled rice was higher than the milled rice, this due the process of making parboiled rice which is a process of soaking and steaming. In the process more water absorbed and bound resulting in high levels of water than milled rice.

The water content increasment ranged from 1.20% to 1.60%. According to research Widowati et al., (2009), which uses fluffier rice varieties, parboiled rice has a moisture content of 11.23-11.99%. The difference may be due to the percentage change in amylose content and fiber content. The lower levels of amylose (high amylopectin), the water content in rice will be higher, since amylopectin is hydrophilic (Rauf, 2015).. High water levels in rice can reduce the quality of the rice. At SNI 01-6128: 2008 maximum water content of the rice is 14%.

Temperature and drying process of rice grains can affect the mechanical properties of rice that determine suitability for grinding. The unselective drying can result cracked grain and lowering the yield of head rice or increased the amount of broken rice, which in turn will lower the quality. Drying process also affected the texture and color of milled rice, the darker color on rice mainly due to the browning reaction (Haryadi, 2006).

Ash Content

The ash content generally describe as the amount of minerals contained in a food. The ash is a mineral residue obtained after the burning of organic materials at high temperatures. The difference between the ash content of parboiled rice with milled rice can be seen in Figure 2.

The average ash content in parboiled rice ranged between 0.69-1.08% while milled rice ranged between 0.36-0.85%. The highest percentage change in Daro Kids varieties of 12.59%, Red Ceredek varieties of 12.54%, KusuikKuriak varieties of 0.25% andJunjung varieties of 0.15%. Meanwhile, according to researchbyWidowati et al., (2009) ash content in parboiled rice ranged from 0.5-0.85%.

Increased ash content on parboiled rice due process of soaking and steaming in the form of rice, resulting the mineral dispersion of aleurone layer and embryo into the endosperm. Minerals are abundant in aleurone layer and agencies, and therefore for the many rice milling mineral that shipped with the bran and rice bran. Thus milled rice has a low mineral content when compared with parboiled rice, because during the soaking and steaming the processin making of parboiled rice, minerals contained in the aleurone layer and embryodispersed into endosperm (Haryadi, 2006)

Differentincreasmentin ash content due to the different mineral content in aleurone layer and embryo in rice. According Muchtadi et al., (2010) the mineral content of plants varies depending on the differences in the composition and availability of soil nutrients where the plants grow.

According Haryadi (2006) minerals contained in rice are phosphorus, magnesium, and potassium. In addition there are also calcium, chlorine, sodium, silica and iron. According Nursalim and Zalni (2007) rice husk has aash content of 1.60%. In addition, the husks also contain calcium, magnesium, manganese, iron, potassium, and sodium

Fat Content

Comparison of fat content in parboiled rice with milled rice can be seen in Figure 3. Fat level in parboiled rice was higher than milled rice. fat content of parboiled rice ranged between 0.51-0.61% while milled rice ranged from 0.28 to 0.51%. While the study according to Widowati et al., (2009) Fat content of parboiled rice ranged from 0.56 to 1.20%.

Increased levels of fat in parboiled rice due to the different amount of fat in the deeper layers in aleurone and embryo of rice. Fat level in the bran layer byNursalim and Zalni (2007) is 1.09%. According to Damardjati (1995) Fat Level influenced by variety, degree of maturity of seeds and extraction methods.

High level of fat in parboiled rice caused by the dispersion of fat from aleurone layer and embryo into the endosperm during the process of soaking and steaming in makingof parboiled rice. While on milled rice, the amount of fat will reduced because of the missing during the grinding and millingprocess (Haryadi, 2006).

According to Haryadi (2006) rice contained of lipids which are mainly found in the embryo and aleurone layers were assembled in the form of small dots lipids. The main fatty acid in rice lipids include palmitic acid, oleic and linoleic. Myristic acid, palmitoleic, stearic, arachidonic present in small amounts.

Protein Content

The different protein content between parboiled rice and milled rice can be seen in Figure 4. Figure 4 shows the Protein content of milled rice was higher than parboiled rice, but the decrease is not too large. The average Protein content in parboiled rice ranged between 4:38% -5.42%, while the milled rice ranged between 4.75% -5.64%. The highest percentage of protein decreasment was found inAnakDarovarietiesof 0.81%, followed byKuriakKusuikof 0:38%, CeredekMerah of 0.23% and Junjung of 12:22%. Meanwhile, according to research by Widowati et al., (2009) protein content ranged between 6.60-7.59%. The differences in percentage of the changes persumably due to denatured proteinsand soluble protein during the parboiling process.

According to Rauf (2015), heat denaturation of the protein occurs due to rupture of hydrogen bonds and hydrophobic interactions of changes in the secondary and tertiary structure. Increasing temperatures caused hydrogen bond that forms a helix to be broken. With the rupture of hydrogen bonds, water forms hydrogen bonds with the new NH and CO of a peptide bond. The presence of water to form a new hydrogen bonds, can weaken the hydrogen bonds nearby, which led to an increase of dielectrical constants. Helical structure frequently to be damaged, a hydrophobic group of proteins in contact with water.

The protein content also influenced by the degree of milling and the place to grow. The more the nitrogen content in the soil in which it grows, causing the higher protein level of the plants (Juliano, 1997), therefore the

low protein level of sample can be caused by low nitrogen content in the soil in which it grows. In addition, the milling processalsocaused the reduced of protein level. Milling process removed partofaleurone so that the protein would go wasted.

Meanwhile, according to Haryadi (2006), using an electron microscope, it is known that protein granules in the endosperm seemed not to be altered by the cooking process or parboiling process. The study of digestibility in vivo and in vitro showed that the protein in parboiled ricehad a lower digestibility value than milled rice. But this weakness was offset by the increase in the value of its biology.

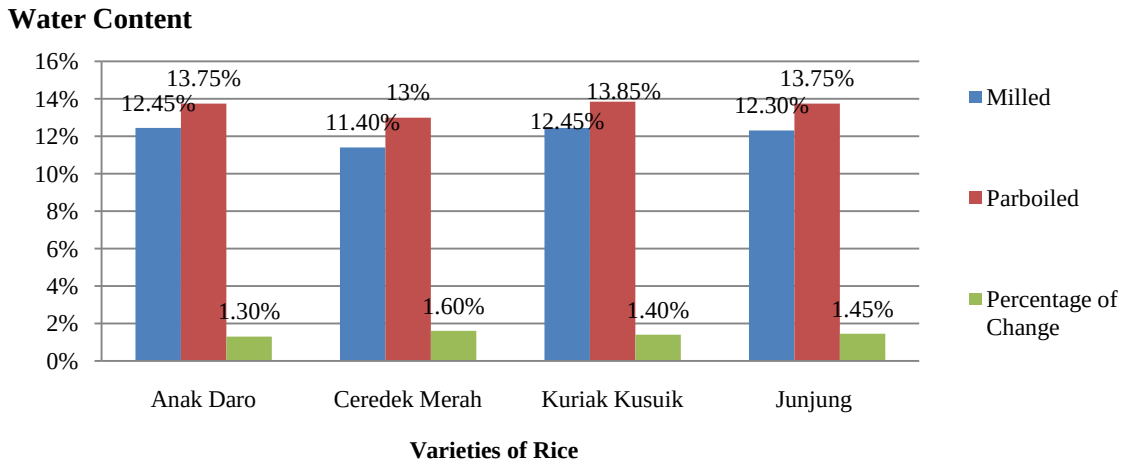

Figure 1. Water Content of Parboiled Rice and Milled Rice

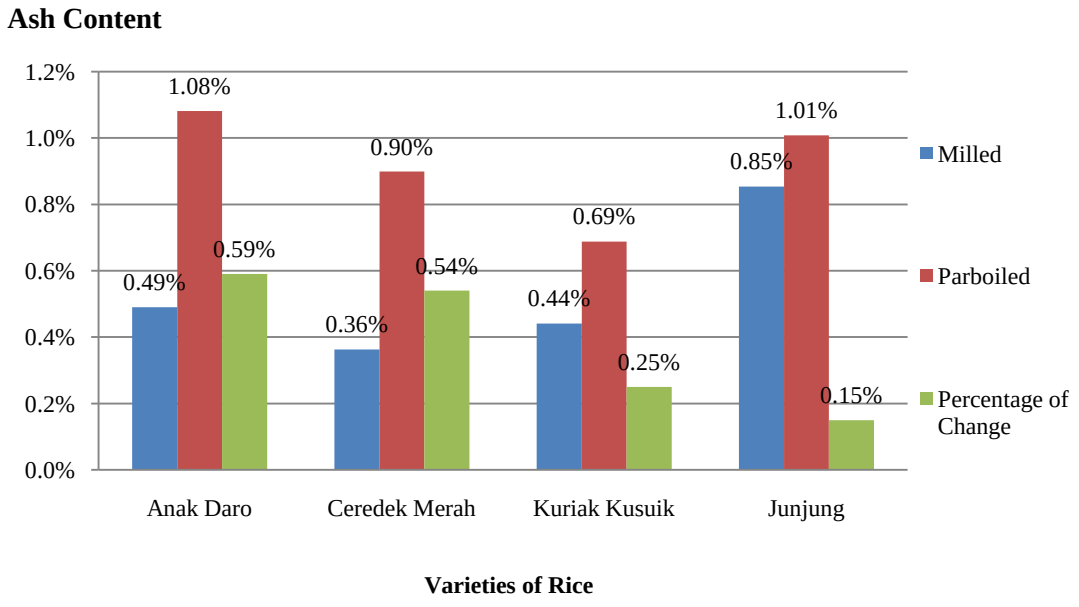

Figure 2. Ash Content of Parboiled Rice and Milled Rice

Fat Content

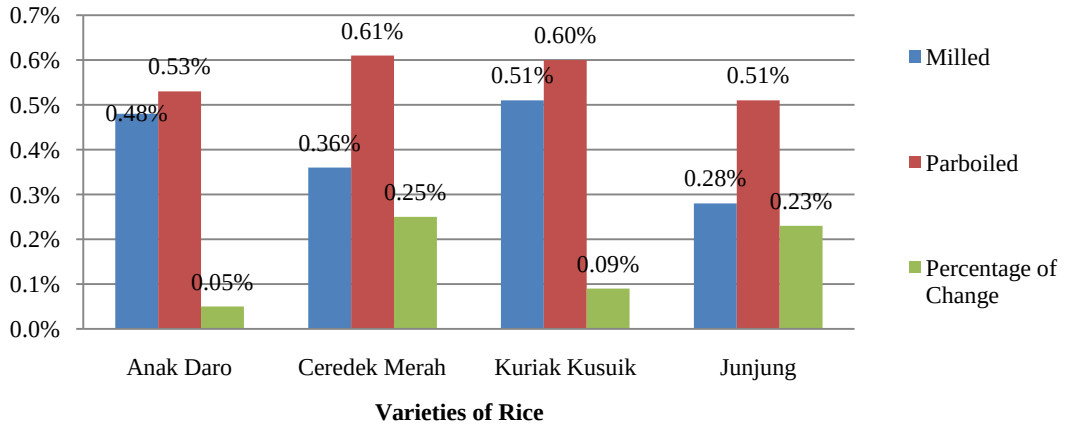

Figure 3. Fat Content of Parboiled Rice and Milled Rice

Protein Content

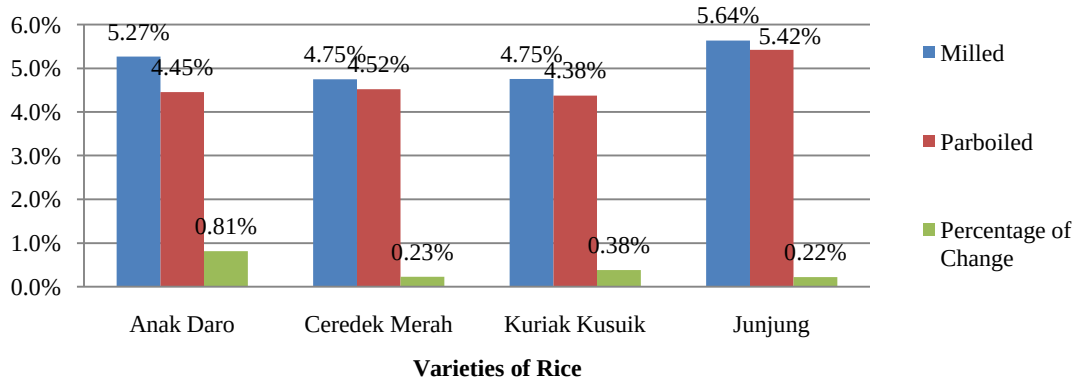

Figure 4. Protein Content of Parboiled Rice and Milled Rice

Starch Content

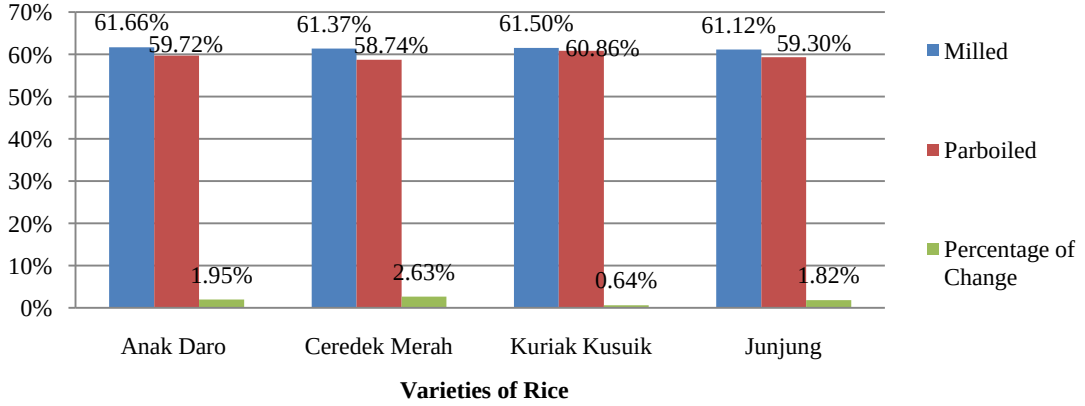

Figure 5. Starch content of Parboiled Rice and Milled Rice

Starch Content

Differences in starch content of parboiled rice and milled rice can be seen in Figure 5. Figure 5 shows that the starch content of parboiled rice more tranquility than the milled rice, but the decline was not a big impact. Parboiled rice had a starch content between 58.74-60.86% while milled rice ranged between 61.12-61.66%. The greatest decrease level of starch in in parboiled rice was found in CeredekMerah of 2.63%, AnakDaro of 1.95%, Junjung of 1.82%, and KuriakKusuik of 0.64%.

The difference in percentage due to the starch dissolved in hot water during the process parboiling proses. The higher the solubility of the starch, the greater the swelling, because amylose has a greater solubility in hot water than amylopectin, so that amylose had a swelling power (swelling power) greater than amylopectin (Rauf, 2015).

Starch content of parboiled rice was lower than milled rice caused by soaking and steaming process in making of parboiled rice. According to Rauf (2015), starch can notdissolve in cold water but in hot water, the starch granules become soluble.

CONCLUSION

Rice parboiling process affected on nutrition content of rice where ash content and fat content increased, it was because the dispersion of nutrients from aleurone layer and embryo into the endosperm, so that the nutrients inparboiledrice was higher than milled rice. Protein and starch content was lowered. The decline occurred due to protein denaturation of proteins caused by heating during the parboiling process, whereas starch dissolved during thesoaking in parboiling process.

Suggestions

A proposal for the next study is to analyze biological nutritionalvalueand glycemic indexofparboiling rice.

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