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Evaluation Of Nutrient Content On Promossing Lines Of Red Rice Derived From Crossing Silopuk With Fatmawati Varieties

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Abstract

Entering the modernization era, awareness of the public about the importance of health and healthy lifestyle has begun to be applied, one consuming rice is high in protein and low in carbohydrates such as red rice. This study aims to determine the nutrient content on promoting lines crossing Silopuk with Fatmawati varieties. The research took place from September to October 2019. The genetic material used was the F5 generation seed selected from 18 families and selected as many as 6 families to be tested for protein content, food fiber, carbohydrates, and glycemic index. The results showed a protein content range from 12, 24 % to 17.56%. The value of the protein content was lowest for the strain SF5-118-35-15, while the value of the highest protein content found in different lines of SF5-12-26-4. The level of food fiber ranges from 1, 05 % to 4.31%. The highest value of food fiber content is in the SF5-12-48-17 Carbohydrate content ranges from 66, 5122 % to 71.9867%. The highest carbohydrate content is in the SF5-118-35-15. The glycemic index ranging from 46, 56 % to 54.98%, and relatively low criteria.

Keywords: carbohydrates, family, food fiber, glycemic index, protein

1. Introduction

Rice (Oryza sativa L.) is a food crop that is consumed by many Indonesian. As a staple food containing carbohydrates and energy sources, the need for rice continues to increase so that the quantity and quality of rice to be consumed is a joint consideration. Generally, people consume more white rice, especially the people of Indonesia. But in Indonesia found various types of rice that are developed. Red rice is one type of rice that contains potential antioxidants, rich in vitamin B complex, folic acid, fiber, essential fats, and others that are beneficial to human health.

Entering the era of modernization, public awareness of the importance of health and healthy lifestyles have begun to be implemented, one of which is by consuming rice that is high in protein and low in carbohydrates such as red rice. Therefore, red rice is recommended to have promising prospects. In 100 grams of red rice has nutrient content consisting of; 7.5 grams of protein, 0.9 grams of fat, 77.6 grams of carbohydrates, 0.3 grams of iron, 0.00021 grams of vitamin B1, and anthocyanin (Indriyani et al ., 2013). Anthocyanin is a red pigment found in the pericarp and tegmen (skin layer) but also can be in any part of the grain, even on leaf petals. Anthocyanin acts as an antioxidant compound in the prevention of several congenital diseases such as cancer, diabetes, cholesterol, and coronary heart disease (Suardi, 2005 in Swasti, E, and NE Putri 2011). Compared to white rice that is commonly consumed by the public, the nutritional content per 100 grams of white rice is 360 kcal of energy, 6.6 grams of protein, 0.58 grams of fat, and 79.34 grams of carbohydrate (Suliartini et al ., 2011).

Based on research Wahyuni (2017), the results of these crosses have been obtained recombinant genotypes of both parents with the characteristics of such a large grain size and red-colored rice as Silopuk. Genotype recombinants are expected to be found among one genotype that has better nutrient content than the two elders.

Previously, Swasti et al. (2017) have tested the nutrient content of red rice. One of them is the nutrient content test on the crossing of Karajut local cultivars with superior varieties of Fatmawati. From the research results, genotypes that have protein content that have wide diversity and anthocyanin content with narrow diversity. The protein content of the genotypes tested ranged from 7.08% - 16.14% with an average of 12.63% and anthocyanin content ranged from 0.04 ppm to 1.12 ppm with an average of 0.52 ppm. So in the research that has been done, it is known from this research that the Karajut cultivar is one of the elders of the cross that bears the character of the protein content of more than 10.7% in its offspring. Thus it is necessary to test the nutritional content such as protein, carbohydrate, fiber, food, and glycemic index which is one of the requirements for assembling new types of superior varieties (VUTB) from Silopuk crossing with Fatmawati. Today consumers' considerations in choosing food are not only their nutrient content or delicacy but also their effects on health such as looking at their nutrient content and glycemic index. Food was also relied upon in health maintenance and disease prevention, even if it allows the food to be able to cure or eliminate the negative effects of disease certain. This study aimed to determine the nutrient content of the lines from crossing Silopuk with Fatmawati varieties.

2. Materials and Methods

A. Plant Material and Time of Research

Research implemented from September to October 2019 in the Laboratory of Nutrition Faculty of Animal Husbandry, University of Andalas, Padang. The tools used in this study were Erlenmeyer, test tubes, digital scales, kjeltec tubes, aluminum foil, pans, pH meters, kjeldhal flasks, destruction equipment, titration tools, label paper, litmus cases, cameras, and stationery. While the ingredients used are buffer potassium chloride, sodium acetate buffer, selen, concentrated sulfuric acid, HCl, K2SO4, Hg2, concentrated H2SO4, boiling stone, H2BO2, Methylene red, Methylene blue, NaOH-Na2 S2O4, aquadest, water, blood glucose Dr. gluco test meter, and brown rice from two F5 strains (Swasti, et al., 2018).

B. Experimental Details

The research method used is an experimental method with design in the field using Augmented design with genetic material that is 18 families planted were selected as many as 6 families based on family selection following the VUTB criteria to continue the nutrient content test. Families that were made as genetic material were analyzed separately with observed parameters namely protein, carbohydrate, food fiber, and glycemic index.

C. Observations

Determination of protein levels by the Micro Kjeldhal method, (AOAC, 1995):

1. A total of ± 0.2 grams of sample is needed (approximately requires 3-10 ml of HCl 0.01 N / 0.02 N, weighed and put into a 30 ml kjeldhal flask.
2. Added 2 grams of K2SO4, 50 mg HgO, 2 ml of concentrated H2SO4 and boiling stone.
3. Then the sample is destructed for 1-1.5 hours until it is clear and chilled.
4. After that add 2 ml of water that is put slowly into the pumpkin then cooled again.
5. Destruction liquid (liquid X) is put into the distillation apparatus and the flask is rinsed with water. Rinse water is also inserted into the distillation apparatus.
6. Erlenmeyer 125 ml contains 5 ml H2BO3 and 2 indicator drops (Methylene Red: Methylene Blue = 2: 1) placed at the end of the distillation apparatus with the tip of the condenser hose submerged in H2BO3 solution.
7. Liquid X is added with 10 ml of NaOH and distillation is carried out until the solution is in Erlenmeyer ± 50 ml.
8. The solution in Erlenmeyer is then titrated with 0.02N HCl.

9. Mark the endpoint of the titration by changing the color of the solution from green to gray.

Determination of the glycemic index (Miller, et al., 1996 in Albiner Siagian Rimbawan, 2004):

1. In determining the glycemic index, 8 volunteers are needed as many as healthy body requirements, normal weight, no smoking. The single food determined by the IG contains 50 grams of carbohydrates given to volunteers. Volunteers must fast for 10 hours (except water), before consuming the rice being tested.
2. After administering for two hours, a blood sample of 50 μL (Finger-prick capillary blood samples method) is taken, blood samples are taken before consuming rice (0 minutes), then blood samples taken with a duration of time every half an hour ie 30, 60, 90, and 120 minutes after consuming rice. Glucose level was determined by Dr. Glucose Test Meter Gluco.
3. At the same time, the same thing is done by giving 50 grams of pure glucose as a reference food to volunteers. this is done on another day at least 3 days after the first administration twice, this aims to reduce the effect of diversity in the blood sugar response.
4. Glucose response curves are based on blood glucose levels during fasting (0 minutes), 30, 60, 90, and 120 minutes after consuming the tested rice. Stocked on two axes namely the time axis and glucose levels.
5. The area under the curve is calculated geometrically. Can be formulated with: Glycemic index (IG) = Area under-tested food x 100%/Area under glucose standard.

3. Results and Discussion

A. Content of Protein, Food Fiber and Carbohydrates Generation F5 Red Rice

The study, the protein is determined by using the Kjeldahl method. This method is widely used in the determination of crude protein in food or other materials because the reagents used are easily obtained (Ensminger, 1994). The results of analysis of protein content, dietary fiber, and carbohydrates of 6 F5 generation families of red rice are presented in Table 1.

The results of the analysis of protein content showed that the nutrient content was influenced by the strains tested (Table 1). Protein analysis results of the tested strains ranged from 1 2, 24 % to 17.56%. Content value protein showed contained in strain SF5-118-35-15 that is the lowest 12, 24 %, while the value of the content of protein is highest on the type of rice SF5-12-26-4 which amounted to 17.56 %. Strains were tested showed a higher protein content than elders Silopuk which is best except strain SF5-118-35-15 wherein the protein content Silopuk as elders is 13, 3 % (Dalimunthe 2010; Swasti and Daughter, 2011). This shows that there is transient segregation in its derivatives. Of 6 strains tested, strains which protein content above 13.3% and the highest number of total grain is strain SF5-12-26-4, whereas strains that others have a protein content of over 13.3 %. That is, in this case, there is a positive correlation between the character of the yield component and protein content in red rice.

The results of the study of the highest food fiber content of the 6 strains were SF5-12-48-17 lines, which was 4.31% (Table 1). When viewed from the value of protein content, the strain protein SF5-12-48-17 is higher than its best parent, which is 16, 90 %. Then, the lowest food fiber content is in the SF5-118-35-15 strain which is 1, 05 %, and has a lower protein containment value than its best parent. This shows that there is a positively correlated relationship between levels of dietary fiber with protein content value. According to Harmanto (2013), the fiber content in red rice can reduce blood sugar levels and inhibit glucose absorption so that it helps in controlling blood sugar levels in people with diabetes mellitus. Besides, the benefits of fiber are water binding, which serves to increase the water content in the large intestine, to prevent cancer.

The results of the study of the highest carbohydrate content of the 6 strains were SF5-118-35-15 strains which amounted to 71.9867% (Table 1). When viewed from the value of protein content and food fiber, the strain is lower than all strains. Then, the lowest carbohydrate content is in the SF5-12-26-4 line which is 66.5122%, it has the highest protein content of all lines tested.

B. Red Rice F5 Glycemic Index

The glycemic index (IG) is one of the important concepts put forward in choosing appropriate foods for sufferers of Diabetes Mellitus. The Glycemic Index is a measure of the speed at which a portion of food increases blood glucose levels after consumption. so, the glycemic index is only a measurement or benchmark Food sources of carbohydrates with low glycemic index are digested and absorbed more slowly than high foods. The glycemic index value of F5 red rice is presented in Table 2.

Generally, red rice has a low to moderate glycemic index while white rice has a high glycemic index. The amount of glycemic index in rice is influenced by several factors. Such types of rice varieties that depend on processing, cooking time, amylose content.

It is known, the glycemic index of white rice is higher than red rice due to physical and botanical changes in white rice during the grinding process. During grinding white rice almost all layers of bran and some parts of the germ are wasted. It also directly impacts the loss of some fiber, vitamins, magnesium, and other minerals, lignin, phytoestrogens, and phytic acid. All these nutrients and phytochemicals are likely to have a protective effect on the glycemic index.

Table 1. Value of the Content of Food Fiber and Carbohydrates in F5 Generation of Red Rice

Family	Protein (%)	Food Fiber (%)	Carbohydrates (%)
SF5-12-48-17	16.90	4.31	67.1374
SF5-12-24-16	15.27	3.48	68.4755
SF5-118-35-15	12.24	1.05	71.9867
SF5-12-2-8	13.68	1.77	71.0183
SF5-12-2-26	14.71	1.74	69.1354
SF5-12-26-4	17.56	2.07	66.5122

Table 2. Red Rice F5 Glycemic Index

Strain	Glycemic Index (%)	Criteria
SF5-12-48-17	48.36	Low
SF5-12-24-16	46.56	Low
SF5-118-35-15	47.86	Low
SF5-12-2-8	54.35	Low
SF5-12-2-26	50.29	Low
SF5-12-26-4	54.98	Low

4. Conclusions

In this research can be concluded that the protein content, dietary fiber, and carbohydrates are determined by the strains tested, in which the protein content ranges from 12.24 % to 17.56%. the value of the content of protein is highest on the type of rice SF5-12-26-4 which amounted to 17.56 %. The level of food fiber ranges from 1, 05 % to 4.31%. The highest value of food fiber content is in the SF5-12-48-17 strain which is equal to 4.31 %. Carbohydrate content ranges from 66, 5122 % to 71.9867%. The highest carbohydrate content is in the SF5-118-35-15 strain which is 71.9867 The glycemic index ranging from 46.56% to 54.98% and relatively low criteria. In this study the IG value expected by the criteria is low and in the study conducted there is no glycemic index found in the high criteria. all Igs have low criteria so it is not necessary to mention which strain is the highest.

References

[1] Indriyani, F, Nurhidajah, and Agus, S. 2013. Karakteristik fisik, kimia dan sifat organoleptik tepung beras merah berdasarkan variasi lama pengeringan. Jurnal pangan dan gizi. 4 (8) : 27-34.

[2] Suliartini, R., Gusti, W., Teguh, and Muhidin. 2011. Pengujian kadar antosianin padi gogo beras merah hasil koleksi plasma nutfah sulawesi tenggara. J.Crop Agro. 4 (2) : 43-48.

[3] Swasti, E. and Putri, N. E..2011. Pengembangan padi merah dalam rangka meningkatkan kesejahteraan petani. Jur. Embrio. 4 (2) : (90 - 98).

[4] Swasti, E. and Putri, N. E. 2010. Perakitan varietas unggul padi beras merah lokal asal sumatera barat berumur genjah dan mutu produksi tinggi melalui persilangan diallel. Laporan Penelitian Hibah Strategis Nasional Tahun I.Lembaga Penelitian.UNAND.

[5] Swasti, E., Sayuti, K., Kusumawati, A., and Putri, N. E. 2017. Kandungan protein dan antosianin generasi f4 turunan persilangan padi merah lokal sumatera barat dengan varietas unggul fatmawati. J. Floratek. 12 (1) : 49-56.

[6] Swasti, E., Putri, N. E., and Hikmah, D. 2016. Pola pewarisan karakter gabah persilangan padi lokal sumatera barat. Prosiding Seminar BKS PTN Wilayah Barat Bidang Ilmu Pertanian Lhokseumawe.NAD. 5-6 Agustus 2016. ISBN : 978-602-1373-78-2.

[7] Swasti, E. 2018. Respon tiga calon varietas unggul padi merah terhadap pemberian berbagai dosis pupuk organik. Laporan Penelitian BOPTN.

[8] Wahyuni, H., Swasti, E., and Yusniwati. 2019. Genetic diversity of age, plant height and number of grain per panicle characters of f3 generation derived from crossing silopuk with fatmawati varieties. JERAMI (Indonesian Journal of Crop Science). 1 (2) : 1-11.

[9] Wahyuni, H. 2018. Pendugaan parameter genetik generasi f4 hasil seleksi pedigri persilangan padi merah silopuk dengan varietas unggul fatmawati. Tesis. Fakultas Pertanian. Universitas Andalas.