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QUALITY AND PREFERENCE OF INNOVATIVE ANALOG RICE FROM PURPLE SWEET POTATO, GOROHO BANANA, AND BARUK SAGO

Christine Fransin Mamuaja*, Daisy Inkiriwang, Jolanda Lamaega

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Abstract

Analog rice or artificial rice is one of the solutions that can be developed in overcoming the problem of people's dependence on the staple food rice. this problem, either as a new food source or for food diversification. In this research, analog rice is made from a combination of purple sweet potato, goroho banana, and baruk sago. This study aimed to evaluate the level of preference of panelists and to analyze the nutrient content of analog rice. The research was performed using a complete randomized design method with 3 combinations of purple sweet potato flour, sago flour, and goroho banana flour namely P1 (25%:50%:25%), P2 (50%:25%:25%), and P3 (25%:25%:50%). The proximate analysis of the analog rice showed that moisture content was 9.16% - 12.32%, ash content 2.11% - 2.45%, protein content 7.5% - 7.91%, fat content 0.25% - 1.04 %, crude fiber content 0.22% - 0.30%, and carbohydrates 77.83% - 79.82%. Observational variables are the proximate test and organoleptic test of preference level. The organoleptic test results showed that the panelists liked the most were color 5.08 (rather like), taste 4.64 (rather like), aroma 4.44 (neutral), and texture 4.72 (rather like). All of these values of the organoleptic and proximate analysis showed that the combination of purple sweet potato, goroho banana, and baruk sago can be a potential source of staple food.

Keywords: analog rice, purple sweet potato, goroho banana, baruk sago, food diversification

Department of Agricultural Technology, Faculty of Agriculture, Sam Ratulangi University, Jl. Kampus Unsrat, Manado 95115, Indonesia

*Corresponding author: mamuajachristine@unsrat.ac.id

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1. Introduction

Rice is a staple food for Indonesian people. From year to year, people's dependence on rice consumption is increasing, so the Indonesian people implement a food diversification program to achieve food security. Food diversification has been carried out from various products as a substitute for paddy rice, namely analog rice derived from carbohydrate-rich basic ingredients in the form of starch.

Local food ingredients containing carbohydrates, especially tubers, are a hidden potential as a functional food source. Root crops contain antioxidants, such as purple sweet potatoes, apart from being a source of carbohydrates, they also have great potential for bioactive compounds that are beneficial to health (Kaemba). Purple sweet potato (*Ipomea batatas* L.Poiret) is a type of tuber with a high carbohydrate content. **Terahara et al., (2004)** found that the anthocyanin compounds in purple sweet potato range from 110–210 mg/100 grams.

Goroho bananas are widely consumed by the people of North Sulawesi and can be made into various products. Goroho banana is a food that contains carbohydrates. Increasing goroho bananas into other processed forms will increase the added value of goroho bananas. Goroho banana flour has a carbohydrate content of 75.18% (**Nurali, et al. 2012**).

Baruk sago is one of the plants that most in the Sangihe Regency area that contains carbohydrates in the form of starch. Baruk sago starch also has several characteristics, namely chemical composition such as 14.52% water content, 82.00% starch content, and 0.13% ash content with a gel strength (newton) of 1.93 **(Samad, 2003)**. Sago starch has an oval shape and its granule size (20–80) is relatively larger than other starch granules (**Ramadhan, 2009**).

Analog rice or artificial rice is one of the solutions that can be developed as a source of staple food to overcome dependence on rice. Making analog rice can be developed very easily with variations in taste and nutritional content that can be adjusted because it comes from the raw materials used, namely tubers or cereals which have quite high nutritional value. In this research, analog rice will be made from purple sweet potato, goroho banana, and baruk sago. These ingredients are local food from tubers which are quite high in carbohydrates to be a source of calories. **Slamet (2012)** stated that analog rice's nutritional composition can exceed paddy rice's nutritional content.

This research aims to produce compact textured analog rice using a combination of three raw materials, namely purple sweet potato, goroho banana, and baruk sago with high nutritional content. In this study, organoleptic tests and laboratory analyses were carried out on analog rice products, namely the chemical analysis of their nutritional content.

2. Materials and methods

2.1 Materials

The purple sweet potatoes, goroho bananas, and baruk sago were purchased in the local market at Manado. These raw materials were prepared into flour. The skin of sweet potatoes was peeled. Afterward, the sweet potatoes were washed and sliced into 2 mm. Then the slices were washed and dried in the oven at 60 ^{o}C. Furthermore, the dried slices were ground into flour and sifted. The same procedure was performed to produce goroho bananas flour. Meanwhile, the baruk sago flour was prepared as follows. The sago was washed and dried in the oven at 60 ^{o}C and then sifted. The sifted sago is then ready for the next step. All the flour was kept in an airtight container for further treatment.

2.2 Preparation of analog rice

The analog rice was prepared by mixing the

ingredients according to the treatment: P1 (25% purple sweet potato flour: 25% goroho banana flour: 50% baruk sago flour)), P2 (50% purple sweet potato flour: 25% goroho banana flour: 25% baruk sago flour), P3 (25% purple sweet potato flour: 50% goroho banana flour: 25% baruk sago flour). The mixed dough was added with water and then stirred slowly until the dough becomes smooth. Then the dough is printed using a noodle mold and then cut into pieces roughly the size of rice. Steamed for 20 minutes. Dry in the oven at 60 ^{o}C for 6 hours.

2.3 Analytical procedure

Analog rice that has been formed from purple sweet potato, goroho banana, and baruk sago with several treatment combinations, then the analog rice product is chemically analyzed, namely its nutritional content including ash content, water content, protein content, fat content, total carbohydrates, nutritional value energy, water absorption, rehydration time.

2.4 Organoleptic test

Analog rice is cooked into the rice and then for each treatment combination, an organoleptic test is carried out, namely the level of preference by the hedonic method.

3. Results and Discussion

3.1 Nutritional Content

The results of observations of the nutritional content of analog rice from purple sweet potato flour, goroho banana flour, and baruk sago flour can be seen in Table 1.

Table 1. The nutritional content of analog rice from sweet potato, goroho banana, and baruk sago

No	Parameter	Unit	Treatment		
			P1	P2	P3
1	Moisture	%	12.32	9.16	9.38
2	Ash content	%	2.11	2.32	2.45
3	Protein	%	7.4	7.8	7.91
4	Fat	%	0.25	0.91	1.04
5	Crude Fiber	%	0.30	0.28	0.22
6	Carbohydrate	%	77.83	79.82	79.22

Note:

P1 (25% purple sweet potato flour: 25% goroho banana flour: 50% baruk sago flour)

P2 (50% purple sweet potato flour: 25% goroho banana flour: 25% baruk sago flour)

P3 (25% purple sweet potato flour: 50% goroho banana flour: 25% baruk sago flour)

Moisture Content

The results of observing the water content of analog rice have an average value ranging from 9.16% - 12.32%. Based on the analysis value, the highest average water content was found in P1 (12.32%) and the lowest water content value was in P2 (9.16%). This showed that the more the proportion of sago flour is added, the less water content will be produced. The

increase in water content was caused by sago flour which contains higher fiber than purple sweet potato flour.

According to Sede et al., (2015), time and temperature in heating (drying process) can affect the decrease in water content in analog rice. According to SNI 01-3551-2000, the moisture content of rice is generally a maximum of 14.0% (w/w). So it can be concluded that analog rice's water content is lower than paddy rice's (Zukryandry, 2014).

Ash Content

The results of observations of the ash content of analog rice have an average value ranging from 2.11% - 2.45%. Based on the analysis value, the highest average ash content was found in P3 (2.45%) and the lowest ash content value was in P1 (2.11%). Ash content is the total mineral content in the material. The high ash content is caused by the materials used containing high amounts of minerals. The greater the ash content, the higher the minerals contained in the food (Zukryandry, 2014). The ash content of goroho banana flour is 2.29% (Nurali et al., 2012) and the ash content of sago flour is 0.5% (Widaningrum et al., 2005). Thus, the greater the proportion of goroho banana flour, the higher the ash content produced by analog rice.

Protein content

The results of observations of analog rice protein levels have an average value ranging from 7.5% - 7.91%. Based on the analysis value, the highest average protein content was at P3 (7.91%) and the lowest protein content was at P1 (7.5%). This proves that the formulas for goroho banana flour, purple sweet potato flour, and sago flour contain high levels of protein. The biggest source of protein is goroho banana flour made in a larger proportion. According to Wang (1986) in Korompis et al., (2016) the protein content in foodstuffs affects the quality of the food products produced, especially their physical and nutritional properties.

Fat Content

The results of observations of the fat content of analog rice have an average value ranging from 0.25% - 1.04%. Based on the analysis value, the highest average fat content was found in P3 (1.04%) and the lowest fat content value was in P1 (0.25%). The greater the amount of goroho banana flour, the higher the fat content of analog rice. This is because the fat content of analog rice is influenced by the ingredients used.

Crude Fiber Content

The results of observations of the crude fiber content of analog rice have an average value ranging from 0.22% - 0.30%. Based on the analysis value, the highest average crude fiber content was in P1 (0.30%) and the lowest crude fiber content was in P3 (0.22%). The higher the concentration of sago flour, the higher the crude fiber content of analog rice. The highest crude fat content was obtained in analog rice with a concentration of 50%. The addition of sago flour to analog rice will improve the quality of the analog rice produced, by increasing the crude fiber content. According to Cuenca et al., (2008), dietary fiber has important characteristics needed in the formulation of functional foods. Dietary fiber is a carbohydrate component that cannot be hydrolyzed by digestive enzymes.

Carbohydrate Content

The results of observations of analog rice carbohydrate levels have an average value ranging from 77.83% - 79.82%. Based on the analysis value, the highest average carbohydrate content was found in P2 (79.82%) and the lowest carbohydrate content value was in P1 (77.83%). The

highest carbohydrate content was found in P2 (79.82). This is caused by the raw materials used in this study which have high levels of carbohydrates. According to Winarno (2002), carbohydrates have an important role in determining the characteristics of foodstuffs.

3.2 Organoleptic Test

Color

The results of the organoleptic test for determining the panelists‘ preference for the color of analog rice made from purple sweet potato and sago flour can be seen in Table 2. The value was ranged from 4.68 to 4.88 (like slightly) for all the samples.

Table 2. Average Value of Preference for Analog Rice Colors

Treatment	Score	Criteria
P1 (25% purple sweet potato flour: 25% goroho banana flour: 50% baruk sago flour)	4.68	Like slightly
P2 (50% purple sweet potato flour: 25% goroho banana flour: 25% baruk sago flour)	4.88	Like slightly
P3 (25% purple sweet potato flour: 50% goroho banana flour: 25% baruk sago flour)	4.80	Like slightly

Based on the results of the analysis, it was shown that the level of preference of the researcher for the color of analog rice was the most favorable in treatment P2 (50%: 25%: 25%). The highest average value for color preference was 4.88 in treatment P2, while the lowest average value was 4.68 in treatment P1. The color of the analog rice is influenced by purple sweet potato flour with a large proportion giving the color of dark purple analog rice. The lower the proportion of purple sweet potato flour, the color of the analog rice produced is bright purple. Purple sweet potato contains quite high anthocyanins, namely 519 mg/100g wet weight (Kumalanengsih, 2018 in Hardoko et al., 2010), as a color giver to analog rice. So, goroho banana flour and sago flour have no effect on the color of the analog rice produced.

Taste

The results of the observations show that the researcher's preference level for the taste of analog rice made from purple sweet potato flour and sago ranges from 4.2 to 4.64 (neutral - somewhat likes) can be seen in Table 3.

Table 3. Average Value of Preference for Analog Rice Taste

Treatment	Score	Criteria
P1 (25% purple sweet potato flour: 25% goroho banana flour: 50% baruk sago flour)	4.20	Like slightly
P2 (50% purple sweet potato flour: 25% goroho banana flour: 25% baruk sago flour)	4.64	Like slightly
P3 (25% purple sweet potato flour: 50% goroho banana flour: 25% baruk sago flour)	4.52	Like slightly

Based on the results of the analysis, it was shown that the level of preference for analog rice flavors made from purple sweet potato and sago flour indicated that treatment P2 (25%:50%:25%) was at the most favorable level.

The highest average value for taste preference was 4.64 in treatment P2, while the lowest average value was 4.2 in treatment P1. The higher the proportion of purple sweet potato flour, the more it gives a sweeter taste to the analog rice, compared to other treatments, the lower the proportion of purple sweet potato flour, the resulting analog rice taste is more difficult to define. According to Nurdjanah et al., (2017), purple sweet potato flour is rich in resistant starch which is composed of amylose and amylopectin, the sugar content contained in purple sweet potato flour that has been heated has increased amount compared to the amount of sugar in purple sweet potato flour. raw. So, goroho banana flour and sago flour have no effect on the taste of the resulting analog rice.

Aroma

The results of the observations show that the level of preference of researchers for the aroma of analog rice made from purple sweet potato flour and sago ranges from 4 to 4.44 (neutral) can be seen in table 4.

Table 4. The average value of preference for the aroma of analog rice

Treatment	Score	Criteria
P1 (25% purple sweet potato flour: 25% goroho banana flour: 50% baruk sago flour)	4.07	Like slightly
P2 (50% purple sweet potato flour: 25% goroho banana flour: 25% baruk sago flour)	4.24	Like slightly
P3 (25% purple sweet potato flour: 50% goroho banana flour: 25% baruk sago flour)	4.00	Like slightly

Based on the results of the analysis, it was shown that the level of preference of the researcher for the aroma of analog rice made from purple sweet potato flour and sago indicated that the P2 treatment (50%: 25%: 25%) was at the most favorable level.

The highest average value for aroma preference was 4.24 in treatment P2, while the lowest average value was 4 in treatment P3. The higher the proportion of purple sweet potato flour, the more the distinctive aroma of purple sweet potato flour is felt, this is because the proportion of purple sweet potato flour is more compared to goroho banana flour and sago flour. According to Rodrigues et al (1988) in Dewandari et al., (2014), the formation of aroma and flavor is caused by the degraded carbohydrate content in sweet potatoes.

Texture

The observations showed that the researcher's preference for the texture of analog rice made from purple sweet potato flour and sago ranged from 4.24 to 4.64 (neutral-rather-like) can be seen in table 5.

Table 5. Average Value of Preference for Analog Rice Texture

Treatment	Average	Criteria
P1 (25% purple sweet potato flour: 25% goroho banana flour: 50% sago flour)	4.24	Like slightly
P2 (50% purple sweet potato flour: 25% goroho banana flour: 25% sago flour)	4.64	Like slightly
P3 (25% purple sweet potato flour: 50% goroho banana flour: 25% sago flour)	4.32	Like slightly

Based on the results of the analysis, it was shown that the level of preference for analog rice texture made from purple sweet potato and sago flour indicated that P2 (50%:25%:25%) was at the most favorable level.

The highest average value for texture preference was 4.72 in treatment P2, while the lowest average value was 4.24 in treatment P1. The texture of analog rice produced is stickier because it is influenced by the starch content contained in the raw materials used. According to Lai *et al.* (2011), the sticky texture is due to the sugar content found in sweet potatoes. At the time of heating, the starch content contained in sweet potatoes undergoes a breakdown into simple sugars.

4. Conclusion

On the basis of all results, it can be concluded that the nutritional content of rice analogs of purple sweet potato flour, goroho banana flour, and baruk sago flour are water content (9.16-12.32%), ash content (2.11-2.45%), protein (7.5 - 7.91%), fat (0.25-1.04%), fiber (0.22-0.30%), carbohydrates (77.83-79.82%). In addition, the level of preference for rice analogs of purple sweet potato flour, goroho banana flour, and baruk sago flour for color 4.68 – 4.88 (like slightly), taste 4.2 – 4.64 (like slightly), aroma 4 – 4.44 (like slightly), and texture 4.24 - 4.64 (like slightly). Accordingly, this analog rice has the potential to be developed as an additional staple food besides rice.

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