RESEARCH ARTICLE

Analysis of Nutrient Content in Bangke Cake with the Addition of Brown Rice Flour

Lydia Fanny[1(CA)], Theresia Dewi Kartini B[2]
[1(CA)]Department of Nutrition, Poltekkes Kemenkes Makassar, Indonesia; lydiafanny1968@gmail.com
(Corresponding Author)
[2]Department of Nutrition, Poltekkes Kemenkes Makassar, Indonesia

ABSTRACT

Efforts to provide additional food to cronic lack of energy pregnant women aim to increase the intake of macro and micro nutrients (iron and vitamin A). Bangke cake is one of the traditional Indonesian pastries in South Sulawesi Province. Knowing the acceptability and analysis of macro and micro nutrients content in macro and micro nutrients in Bangke cake with the addition of brown rice flour. The assessment method uses 4 hedonic scales and the criteria for the panelists selected to perform the hedonic test are untrained panelists consisting of 50 pregnant women. The data from the test results of nutrient levels were analyzed by two-way ANOVA test and the data from the organoleptic test results, namely the hedonic test on acceptability was analyzed by the Kruskal Wallis test. The brown rice flour substitution cake that was most acceptable to panelists from all aspects was the F3 formula. Nutrient levels in the brown rice flour substitution showed an increasing trend of nutrient levels of macro nutrients and beta-carotene, except for iron.

Keywords: brown rice; bangke cake; pregnant women; chronic energy deficiency

INTRODUCTION

Background

Pregnant women at risk of chronic energy deficiency (CED) have an upper arm circumference threshold of 23.5 cm. The nutritional status of pregnant women can affect the weight of the expelled baby[1]. The results of nutritional status monitoring in 2017 showed that the percentage of pregnant women in Indonesia was 14.8% and the prevalence of CED in pregnant women was 15.9% in South Sulawesi Province[2]. Data of *Riskesdas* (Basic Health Research) in 2018 showed that the prevalence of CED in pregnant women of childbearing age (15–49 years) nationally amounted to 17.3%, equivalent to the province of South Sulawesi[3].

Research conducted by AI'zul at the Paccerakkang Daya Health Center in 2019 obtained the number of CED pregnant women from January to December 2018 at 42.3% of first trimester gestational age, 26.9% of second trimester gestational age, and 30.7% of third trimester gestational age[4]. Efforts to provide additional food to pregnant women CED aims to increase macro- and micronutrient intake (iron and vitamin A). Enough Bangke cake brown rice flour is one of the local products that are the basic ingredients of food sources of carbohydrates. Bangke cake is a local food that is made with mostly sago flour and brown rice flour. Brown rice is a functional food that has long been associated with health benefits. Brown rice, with its main content of carbohydrates, also contains protein, antioxidants, beta-carotene, and iron[5].

Flour is an alternative form of semi-finished products that is recommended because it will be more resistant to being stored, easily mixed (composite), enriched with nutrients (fortified), formed, and more quickly cooked according to the demands of modern life. Brown rice per 100 g of material contains 333 kcal of energy, 0.50 g of glenmark, 9.4 g of protein, 5 mg of calcium, 140 mg of phosphorus, 3.3 mg of vitamin B, 4.6 g of fiber, 80 g of carbohydrates, 12 g of water, and 364 calories[6].

Bangke pastries, or *Beppa Bengke-Bengke* (Bugis language), are a traditional pastry that must be present during Eid in South Sulawesi in general. South Sulawesi local snacks are generally made from carbohydrate sources such as wheat flour, glutinous rice, and sago flour, with a sweet taste[7]. Based on the description above, the author intends to make a modification of food by making cake Bangke with the basic ingredients of brown

rice flour, and then the acceptability and analysis of nutrient content (carbohydrates, proteins, fats, beta-carotene, and Fe) in the cake Bangke with the substitution of brown rice flour as supplementary feeding in the treatment group of pregnant women will be examined.

Purpose

Knowing the acceptability and analysis of nutrient content (carbohydrates, protein, fat, -carotene and iron) in Bangke cake with the addition of brown rice flour.

METHODS

This research was an experimental study with a Completely Randomized Design (CRD) approach with 3 replications. The RAL design in making Bangke cake uses 4 treatments, coding F0, F1, F2, and F3. This design was intended to determine the best treatment in making bangke cake with brown rice substitution.

The parameters observed in this study were the manufacture of red rice cake product development, analysis of macronutrient and iron levels, acceptance test using organoleptic methods (color, texture, aroma and taste). The stage of determining the content of macronutrients was obtained from the results of Luff Schroll, Shoxlet, Micro Kejldhal and spectrophotometry tests.

The assessment method used 4 hedonic scales and the criteria for the panelists selected to conduct the hedonic test were untrained panelists consisting of 50 pregnant women in the Sudiang Raya Community Health Center area.

The data from the test results of nutrient levels were tabulated in a table and then analyzed by using the two-way ANOVA test in the SPSS program.

RESULTS

Making Bangke Cake Substitution of Brown Rice Flour

This trial succeeded in getting the original formula (F0), because margarine and eggs were beaten separately and sago flour had been roasted. This technique is called the sponge method which has a special characteristic of the resulting cookie products, namely the cake is porous like foam, but is crunchy and easily crumbles when in the mouth[8].

Quality Nutrients Cake Bangke

Table 1 shows the average value of the analysis of the protein content of Bangke cake with brown rice flour substitution that the protein content increased with the increasing number of substitutions of brown rice flour in the cake dough. Proteins are polypeptide macromolecules composed of several L-amino acids by peptide bonds. Proteins from vegetable sources are protected by cell walls consisting of cellulose. This condition causes the digestibility of vegetable protein sources is generally lower than animal protein sources[9].

Table 1. Average value of protein content in bangke cake substitution of brown rice flour

No	Formula	Unit	Results I	Results II	Results III	Average
1	F0	%	2.46	2.39	2.14	2.33
2	F1	%	2.82	2.85	3.13	2.93
3	F2	%	3.22	3.11	3.31	3.21
4	F3	%	3.54	3.44	3.37	3.45

Table 2. Average value of fat content in bangke cake substitution of brown rice flour

No	Formula	Unit	Results I	Results II	Results III	Average
1	F0	%	11.43	11.84	12.32	11.86
2	F1	%	12.55	13.67	13.07	13.10
3	F2	%	13.39	12.69	12.56	12.88
4	F3	%	13.34	13.80	12.39	13.18

Table 2 shows the average value of the analysis of the fat content of bangke cake with the substitution of brown rice flour that the fat content increased from F0 to F1 and from F2 to F3, but from F1 to F2 decreased along with the increasing number of substitutions of brown rice flour in the cake dough.

Table 3 shows the average value of the results of the analysis of carbohydrate content in bangke cake with brown rice flour substitution, the carbohydrate content increased from F0 to F1 and from F2 to F3, but from F1 to F2 decreased 0.13% along with the increasing number of substitutions of brown rice flour on cake batter.

Table 3. Average value of carbohydrate levels in bangke cake with red rice flour substitution

No	Formula	Unit	Results I	Results II	Results III	Average
1	F0	%	76.19	75.96	75.79	75.98
2	F1	%	77.04	76.34	76.51	76.63
3	F2	%	76.31	76.50	76.68	76.50
4	F3	%	76.62	76.05	77.26	76.64

Carbohydrates are one of the macronutrients that function to produce energy for the human body. Carbohydrate compounds in everyday life are found in sugar, fruits, cane sugar, milk, rice, corn, wheat, sweet potatoes, potatoes, cassava, and sago.

Table 4. Average value of vitamin A (β-Carotene) levels in bangke cake with red rice flour substitution

No	Formula	Unit	Results I	Results II	Results III	Average
1	F0	mg/kg	18.97	18.78	19.45	19.07
2	F1	mg/kg	19.28	20.59	20.07	19.98
3	F2	mg/kg	21.79	21.55	22.34	21.89
4	F3	mg/kg	22.81	25.12	25.51	24.48

Table 4 shows the average value of the results of the analysis of vitamin A levels examined in the form of -carotene in red rice flour substitution cakes. The results of hypothesis testing with two-way ANOVA (α = 1%) resulted in p value = 0.000, meaning that there is at least one different treatment in making bangke cake, if it is based on the level of vitamin A it contains. Furthermore, Duncan's test results determined that the most different vitamin A levels of the 4 treatments were in the F3 treatment. This means that based on the levels of vitamin A contained in the bangke cake, the best composition in making bangke cake is the addition of 20% brown rice.

Table 5. Average Fe content in bangke cake with red rice flour substitution

No	Formula	Unit	Results I	Results II	Results III	Average
1	F0	mg/kg	457.81	569.76	430.40	485.99
2	F1	mg/kg	416.93	266.92	229.57	304.47
3	F2	mg/kg	368.62	310.64	408.57	362.61
4	F3	mg/kg	379.50	493.49	414.29	429.09

Table 5 shows the average value from the analysis of iron content in bangke cake with brown rice flour substitution. It was found that iron levels decreased from F0 to F2, but increased from F2 to F3. This condition occurs along with the increasing number of substitutions of brown rice flour in cake dough. The results of hypothesis testing with two-way ANOVA (α = 1%) resulted in p value = 0.068, meaning that there is no difference in the manufacture of bangke cake, if it is based on the Fe content it contains. This means that based on the level of Fe contained in the bangke cake, the entire composition of the addition of brown rice, either 10%, 15% or 20%, will produce Fe levels that are no different.

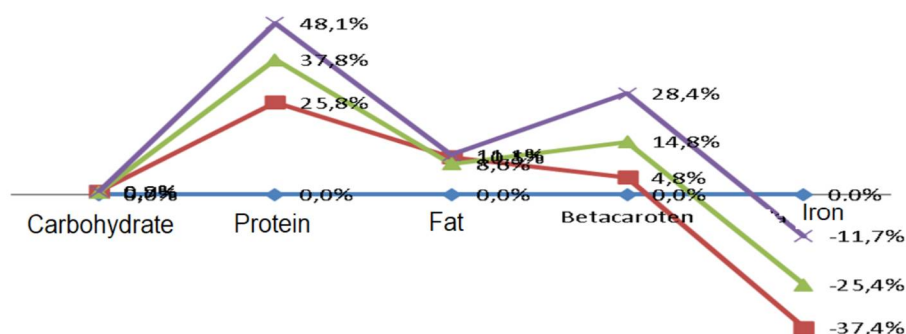**Changes in Nutrient Levels of Bangke Cake Substitution of Brown Rice Flour**

Figure 1. Graph of changes in nutrient levels of bangke cake substitution of brown rice flour based on the percentage of average value

Acceptance

Table 6 is the result of the panelists' acceptance assessment of the red rice flour substitution cake based on the color aspect, showing that the highest acceptable F1 formula product was 76.4%. Friedman test results show a significant value of p = 0.011 which means there is a significant difference for panelists' acceptance of the color aspect. The results of further tests with Wilcoxon showed that there was a difference between the F1 and F2 formulas, and the F1 and F3 formulas.

Table 6. Distribution of bangke cake acceptance from the color aspect

Formula	Acceptance										p
	Really like		Like		Rather Like		Not like		Total		
	n	%	n	%	n	%	n	%	n	%	
F1	15	27.3	27	49.1	8	14.5	5	9.1	55	100	
F2	9	16.4	22	40.0	19	34.5	5	9.1	55	100	0.011
F3	10	18.2	20	36.4	17	30.9	8	14.5	55	100	

Table 7. Distribution of bake cake acceptance from aroma aspect

Formula	Acceptance												p
	Really like		Like		Rather like		Not like		Very not like		Total		
	n	%	n	%	n	%	n	%	n	%	n	%	
F1	9	16.4	26	47.3	17	30.9	1	1.8	2	3.6	55	100	
F2	6	10.9	17	30.9	20	36.4	10	18.2	2	3.6	55	100	0.001
F3	12	21.8	20	36.4	16	29.1	6	10.9	1	1.8	55	100	

Table 7 shows the results of the panelists' acceptance of the bangke sago cake substituted with brown rice flour from the aspect of aroma. The most acceptable formula by the panelists was F1 as much as 63.7%. Friedman test results show a significant value of p = 0.001 which means that there is a significant difference for the panelists' acceptance of the aroma aspect. Wilcoxon's further test results showed that there was a difference between F1 and F2 samples, F2 and F3 samples.

Table 8. Distribution of bake cake acceptance from texture aspects

Formula	Acceptance												p1
	Real like		Like		Rather like		Not like		Very not like		Total		
	n	%	n	%	N	%	n	%	n	%	n	%	
F1	9	16.4	24	43.6	14	25.5	8	14.5	0	0.0	55	100	
F2	5	9.1	17	30.9	15	27.3	15	27.3	3	16.4	55	100	0.006
F3	13	23.6	17	30.9	18	32.7	6	10.9	1	1.8	55	100	

The results showed that the texture of the cake with the substitution of brown rice flour was the most preferrednamely the formula F1. This acceptance is due to the cake bangke substitution with 15% and 20% brown rice flour tends to have a harder and coarser texture than the 10% brown rice flour substitution. Furthermore, the Friedman test results showed a p value = 0.006, which means that there was a significant difference in the panelists' acceptance of the texture of the four Bangke cake formulas substituted with brown rice flour.

Table 9 shows the results of the panelists' acceptance of the bangke sago cake substituted with brown rice flour from the aspect of taste, which was different from other aspects. Formula F3 is the most acceptable formula by the panelists, as much as 54.5%.

Table 9. Distribution of cake bangke acceptance from the aspect of taste

Formula	Acceptance												p1
	Real like		Like		Rather like		Not like		Very not like		Total		
	n	%	n	%	n	%	n	%	n	%	n	%	
F1	10	18.2	20	36.4	21	38.2	3	5.5	1	1.8	55	100	
F2	4	7.3	18	32.7	15	27.3	14	25.5	4	7.3	55	100	0.007
F3	17	30.9	13	23.6	11	20.0	12	21.8	2	3.6	55	100	

The Friedman test results showed a significant value of p = 0.007, meaning that there was a significant difference in the panelists' acceptance of the flavors of the four sago cake formulas substituted with brown rice flour, so it was continued with the Wilcoxon test. The result is a different product is a different formula F1 with F2 and different F2 with F3.

Table 10. Determination of the best formula

Nutrient level	Carbohydrate	Protein	Fat	Vitamin A	Fe	Conclusion
Best formula	F1/F2/F3	F2/F3	F1/F2/F3	F3	F1/F2/F3	F3
Acceptance test	Color	Scent	Texture	Flavor	-	
Best formula	F1	F1/F3	F3	F1/F3	-	F1/F3
Food safety test	Water	ALT	when	Yeast	-	
Best formula	F1/F2/F3	F1/F2/F3	F1/F2/F3	F1/F2/F3	-	F1/F2/F3

Table 13 shows that the best formula for nutrient levels is Formula 3 (F3), for acceptability test the best formula is F1 or F2, while for food safety test the best formula is F1 or F2 or F3. If you take into account the frequency of occurrence, then the best formula for cake bangke is formula 3 (F3). This formula will be given to the subject, namely the third trimester cronic lack of energy pregnant women in the Sudiang Raya Community Health Center Working Area in research activities in the 2nd year (2022).

DISCUSSION

Quality Nutrients Cake Bangke

The resulting bangke cake has a white to brown color, with a distinctive aroma of sago cake, a soft and crunchy texture, especially when the bangke cake is eaten and has a sweet and savory taste. The weight per piece of bangke cake is 8 grams and in 100 grams there are 12-13 pieces of bangke cake.

The protein content of the two ingredients according to the Indonesian Food Composition Table is 7.3g/100g and 12.4g/100g respectively[2]. The results of hypothesis testing with two-way ANOVA (α = 1%) resulted in p value = 0.000, meaning that there is at least one different treatment in the manufacture of bangke cake, if it is based on the protein content contained in the bangke cake. Furthermore, Duncan's test results determined that the most different protein levels from the 4 treatments were in the F2 and F3 treatments. This means that based on the protein content contained in the bangke cake, the best composition in the manufacture of bangke cake is the addition of 15% or 20% brown rice.

Fats are composed of organic bonds such as carbon, hydrogen and oxygen. As a producer of energy, protecting organs, providing a long-lasting feeling of fullness, producing essential fats and dissolving vitamins A, D, E, and K are functions of fat in the body[10].

The results of the study proved that there was an increase in the carbohydrate content of Bangke cake along with the increase in the substitution concentration of brown rice flour, which ranged from75.98% to 76.64%. This is due to the high carbohydrate content in brown rice flour and also from sago flour. The Indonesian Food Composition Table notes that brown rice contains 76.2g/100g carbohydrates and sago flour contains 86.9g/100g[2]. However, from the results of hypothesis testing with two-way ANOVA (α = 1%) the resulting p value = 0.188, meaning that there is no difference in the manufacture of bangke cake, if it is based on the carbohydrate content it contains. This means that based on the carbohydrate content contained in the bangke cake, the entire composition of the addition of brown rice, either 10%, 15% or 20%, will produce carbohydrates that are no different.

Beta-carotene is one of 600 carotenoid components found in plants. Beta-carotene is widely used as a precursor of vitamin A and supplements[11]. Beta-carotene (β-carotene) is an organic compound and is classified as a terpenoid. Eating foods that contain beta-carotene is expected to meet nutritional needs and increase immunity, because of the antioxidant properties contained in beta-carotene[12].

The results showed that the levels of iron (Fe) in Bangke cake substituted with brown rice flour ranged between304.47 mg/Kg to 485.99 mg/Kg. The highest Fe content is found in the F0 formula, namely the original bangke cake. This situation is caused by increasing the concentration of substitution of brown rice flour, it will increase the total weight of the bangke cake dough, causing Fe levels to decrease. This condition is because brown rice contains a limited amount of Fe, not as the main source of Fe and in non-heme form because it comes from cereals.

Acceptance

The results of the acceptability test showed that the F1 formula was the most acceptable from the aspect of the color of the bangke cake substituted with brown rice flour. This is because the color of the F1 formula is more

attractive than the original bangke cake color. The decreasing level of panelists' preference for formulas F2 and F3 namely bangke cake with 15% and 20% substitution of brown rice flour makes the color of the bangke cake too dark (brown red).

The results of the acceptability test showed that the F1 formula was the most preferred by the panelists from the aspect of the aroma of bangke cake substituted with brown rice flour. This is due to the color of the F1 formula. If viewed from the Friedman test results, it shows a significant value of p = 0.001 which means that there is a significant difference in the panelists' acceptance of the aroma of the four cake formulas substituted with brown rice flour. This is due to the distinctive aroma of brown rice flour and pandan leaves that affect the bangke cake. The use of pandan leaves when boiling coconut milk has proven to reduce the distinctive aroma of brown rice flour, which some panelists do not like. Aroma is an important factor that affects the acceptability of a food product, so that the aroma aspect becomes one of the determinants of the assessment of food delicacy. Aroma is included in the assessment of preference for food products because before tasting food someone will inhale the aroma first[13].

Thes increasing concentration of brown rice flour substitution causes the Bangke cake texture to become denser and harder, because brown rice flour has stronger water binding properties than sago flour. The texture of the bangke cake is also influenced by the baking process of the bangke cake at a temperature of 125°C for 45 minutes. The heating process can cause starch gelatinization where the starch will swell due to water absorption, so that the starch granules will break and water evaporation occurs. The gelatinization process of amylopectin starch will produce a high gel viscosity, so that the resulting food product will be harder.

The increasing concentration of brown rice flour substitution causes the Bangke cake texture to become denser and harder, because brown rice flour has stronger water binding properties than sago flour. The texture of the bangke cake is also influenced by the baking process of the bangke cake at a temperature of 125°C for 45 minutes. The heating process can cause starch gelatinization where the starch will swell due to water absorption, so that the starch granules will break and water evaporation occurs. The gelatinization process of amylopectin starch will produce a high gel viscosity, so that the resulting food product will be harder.

CONCLUSION

Nutrient levels in the brown rice flour substitution showed an increasing trend of nutrient levels of carbohydrates, protein, fat and beta-carotene, except for iron. The brown rice flour substitution cake that was most acceptable to panelists from all aspects was formula 3 (F3) with a total score of 221. The best formula for bangke cake with brown rice flour substitution, taking into account the three categories, namely nutrient content, acceptability test and food safety test, namely formula 3 (F3).

REFERENCES

1. Adriani M. The Role of Nutrition and the Life Cycle. Prenada Media Group; 2012.
2. MoH-RI. Nutritional Status Monitoring Pocket Book. Jakarta: MoH-RI; 2017.
3. MoH-RI. Results of Basic Health Research 2018. Jakarta: MoH-RI; 2018.
4. Muhammad A. Overview of Macronutrient Intake of Pregnant Women CED at Puskesmas Paccerakkang Biringkanaya District Makassar. Final Project. Makassar: Department of Nutrition. Poltekkes Kemenkes Makassar; 2018.
5. Suprianto. Effect of Brown Rice Flour (*Oryza nivara*) as Binder on Organoleptic Quality of Dangke Nugget. 2017.
6. MoH-RI. Indonesian Food Composition Table. Jakarta: MoH-RI; 2017.
7. Hamidah SF. Bangke Cake Recipe by the Lanrang Sidrap Residents [Internet]. 2016 [cited 2022 Aug 2]. Available from: http://makassar.tribunnews.com/2016/06/28/resep-kue-bangke-ala-warga-lanrang-sidrap
8. Diahdidi. Tricks and Keys to Success in Making Pastries [Internet]. 2013 [cited 2022 Aug 2]. Available from: http://www.diahdidi.com/2013/06/trik-dan-key-success-make-cakes
9. Probosari E. Effect of Dietary Protein on the Glycemic Index. Journal of Nutrition and Health. 2019;7(1):33-39.
10. Furkon LA. Know Nutrients. Nutritional Health Sciences. 2014;1-53.
11. Winarsih H. Natural Antioxidants and Free Radicals. Canisius; 2007.
12. Parwata IOA, Ratnayani K, Listya A. Free Antiradical Activity and Beta Carotene Levels in Randu Honey (*Ceiba pentandra*) and Longan Honey (*Nephelium longata L.*). Journal of Chemistry. 2010;4(1):54-62.
13. Setyaningsih D, Apriyantono A, Sari MP. Sensory Analysis for the Food and Agro Industry. Bogor: IPB Press; 2010.