

Effect of Jackfruit Seed Flour Substitution on Tambang Cookies' Calcium, Phosphor and Hedonic Rating

Laili Hidayati¹⁾

Lecturer Staff of Culinary Art Study Program
Universitas Negeri Malang

Lismi Animatul Chisbiyah³⁾

National Yunlin University of Science and Technology
Taiwan

Soenar Soekopitojo²⁾

Lecturer Staff of Culinary Art Study Program
Universitas Negeri Malang

Velina Maretta⁴⁾

Culinary Art Teaching
Universitas Negeri Malang

Abstract— Jackfruit seed flour is flour produced from jackfruit seeds that are dried and mashed. Jackfruit seed flour can be used as an alternative substance for flour or wheat substitution. Tambang cookie is a light meal or snack shaped like a rope with a small size ($\pm 3\text{cm}$). Tambang cookie is made from the dough which consists of wheat flour, sugar, margarine, egg, salt and baking soda. The objective of this study was to determine the chemical contents (calcium and phosphorus), and hedonic rating tests (taste, color, texture) on tambang cookies with jack fruit seed flour substitution. The research design used was Completely Randomized Design (CRD) with one factor, namely jackfruit seed flour substitution in 10%, 20% and 30% with two repetitions. The data were analyzed using ANOVA (Analysis of Variance) followed by Duncan test. The results showed that the content consisted of 38.525 mg calcium, 173.311 mg phosphorus, 4.412 for hedonic taste (like slightly), 4.085 for hedonic color (like slightly), and 4.471 for hedonic texture (like slightly).

Keywords: Tambang Cookies, Jackfruit Seed Flour

I. INTRODUCTION

The jackfruit is a plant that can grow in the tropics, especially in Indonesia. The jackfruit plant produces fruits that are widely used by the community. The unripe jackfruit is made of vegetable, the ripe one is made of light meal by frying, and some people just consume it directly because it tastes sweet. The jackfruit is a multiple fruit in which 8-15% of its weight is seed [1]. The ripe fruit has a unique aroma. To be more efficient, the jackfruit seeds can be processed into flour.

The jackfruit seed contains carbohydrate (36.7 g/100 g), protein (4.2 g/100 g), and energy (165 kcal/100 g), so it can be used as a potential food ingredient [2]. In terms of carbohydrate content, the jackfruit seed contains high enough starch ranging from 40-50%. The starch in the jackfruit seed flour can be used as forming framework for cookies and is used to replace the starch function in wheat flour [3].

The use of jackfruit seed flour is used for making various types of food in terms of diversifying the supply of advanced foods [4] such as, cookies [5], chips and crackers [6]. The jackfruit seed flour can be used as an

alternative of flour substitution and flour substitution ingredients. So, this jackfruit seed flour can be used as the ingredient for making cakes or snacks.

The development of this increasingly modern era has led to the emergence of traditional cake products that are more varied in terms of ingredients and appearances. Another effort made to vary and diversify food is by replacing the main ingredients, substituting the flour with the jackfruit seed flour [4].

Tambang cookie or untir-untir is a kind of traditional cookie that is in a great demand by the people of Indonesia as a light meal for Eid Al Fitr. This cookie is made from the mixture of flour, sugar, salt, egg, margarine and baking soda. Besides, it can be formed like tambang (rope) because the dough is twisted so that it is similar to rope. Tambang cookie is a kind of cookie which is made by frying [7].

Tambang cookie has various types. Based on the color, tambang cookie can be made either uncolored or colored so that it can make this cookie has a pretty interesting appearance. The rationale that forms the basis for this innovation is because tambang cookie is made of ingredient which contains quite high starch [6]. Meanwhile, the jackfruit seed flour contains a lot of starch so it can be substituted into tambang cookie's dough. In addition, the simple making process and the crunchy taste are the reasons why it can be easily used and made as the new innovation in the ingredient use.

Based on the previous explanations, indeed, the purpose of this study was to determine the content of calcium, phosphorus and the hedonic rating tests for color, taste and texture of tambang cookies with the jackfruit seed flour substitution.

II. METHODS

The research conducted was experimental research. The experimental research is a research that is used to find out the effects of certain treatments on others in under controlled conditions [8]. The treatment used in this research was the jackfruit seed flour substitution with different formulations, namely 10%, 20% and 30%. Then, it was continued with chemical tests and the hedonic

rating tests for tambang cookies. The research design used was Completely Randomized Design (CRD). Besides, the data analysis technique used was ANOVA (Analysis of Variance). If the result of ANOVA test showed significant difference in calcium and phosphorus content and significance level 0.05 on the hedonic tests, further testing of DMRT (Duncan Multiple Range Test) was carried out. The panelists used were 35 untrained panelists with two repetitions. The research design could be seen in Table 1.

Table 1. Research Design

Repetition	Treatment		
	A	B	C
1	A1	B1	C1
2	A2	B2	C2

Information:

- A1 : Tambang cookies in 10% of jackfruit seed flour substitution in repetition one
- A2 : Tambang cookies in 10% of jackfruit seed flour substitution in repetition two
- B1 : Tambang cookies in 20% of jackfruit seed flour substitution in repetition one
- B2 : Tambang cookies in 20% of jackfruit seed flour substitution in repetition two
- C1 : Tambang cookies in 30% of jackfruit seed flour substitution in repetition one
- C2 : Tambang cookies in 30% of jackfruit seed flour substitution in repetition two

The making process of jackfruit seed flour could be seen in Figure 1 below.

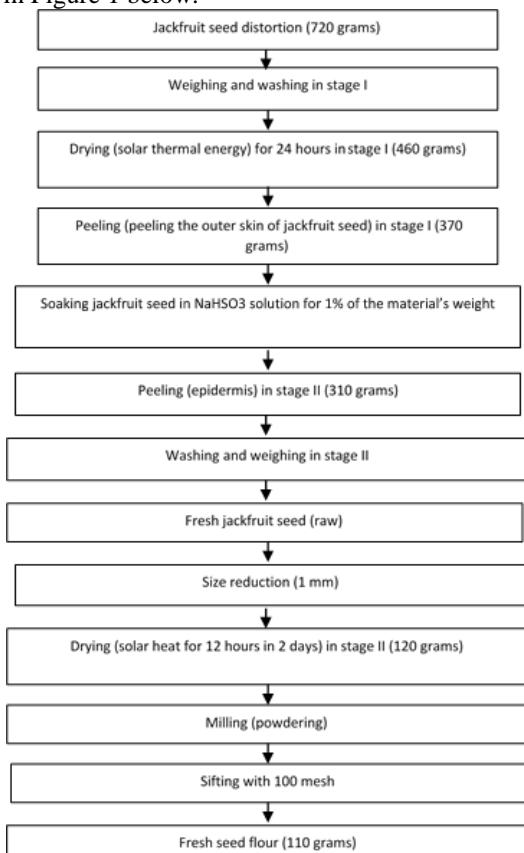


Figure 1. The Flow Chart Diagram of the Making Process of Fresh Jackfruit Seed Flour [9]

Ingredient	Basic Formula	Formula 1 10%	Formula 2 20%	Formula 3 30%
Medium protein flour	240 grams	216 grams	192 grams	168 grams
Jackfruit seed flour	-	24 grams	48 grams	72 grams
Fine granulated sugar	60 grams	60 grams	60 grams	60 grams
Margarine	40 grams	40 grams	40 grams	40 grams
Egg	50 grams	50 grams	50 grams	50 grams
Salt	1½ grams	1½ grams	1½ grams	1½ grams
Baking Soda	1½ grams	1½ grams	1½ grams	1½ grams
Palm oil	250 ml	250 ml	250 ml	250 ml

Table 2. The Recipe of Tambang Cookies

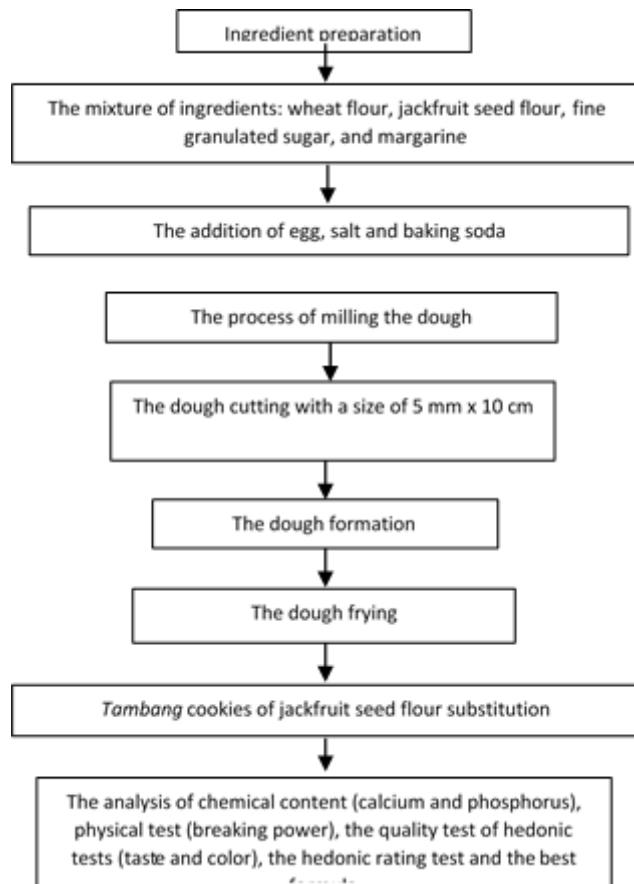


Figure 2. The Flow Chart Diagram of the Making Process of Tambang Cookies with Jackfruit Seed Flour [7] and the Modification.

III. RESULTS AND DISCUSSION

The Calcium Content of Tambang Cookies with Jackfruit Seed Flour Substitution

The mean result of calcium content of tambang cookies with jackfruit seed flour substitution in 30% was 38.525 mg/100g, in 20% was 33.806 mg/100g and in 10% was 28.006 mg/100g. The ANOVA analysis result of calcium content of tambang cookies with jackfruit seed flour substitution was shown in Table 3.

Table 3. The ANOVA Analysis Result of Calcium Content of Tambang Cookies with Jackfruit Seed Flour Substitution

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	111.028	2	55.514	844.917	.000
Within Groups	.197	3	.066		
Total	111.225	5			

The ANOVA analysis result in Table 3 showed that ANOVA sig (0.000) $<\alpha$ (0.05) was obtained at a significance level of 5%. These results indicated that there was a significant difference in the calcium comparison of tambang cookies with jackfruit seed flour substitution. Furthermore, to find out the treatment that caused these differences, further testing was performed using DMRT (Duncan Multiple Range Test). The test results could be seen in Table 4.

Table 4. The Result of DMRT on Tambang Cookies with Jackfruit Seed Flour Substitution

Sampl e	N	Subset for alpha = 0.05		
		1	2	3
10%	2	28.0065000		
20%	2		33.8060000	
30%	2			38.5250000
Sig.		1.000	1.000	1.000

Figure 1. Data on the Boutique Industry's Roles within the Apprenticeship Programmes in Compliance with the IQF

Table 4 showed that the calcium content of tambang cookies with jackfruit seed flour substitution in 10%, 20%, and 30% was significantly different. The calcium content of tambang cookies with jackfruit seed flour substitution in 10% was significantly different from the calcium content of tambang cookies with jackfruit seed flour substitution in 20%, the calcium content of tambang cookies with jackfruit seed flour substitution in 20% was significantly different from the calcium content of tambang cookies with jackfruit seed flour substitution in 30% and the calcium content of tambang cookies with jackfruit seed flour substitution in 30% was significantly different from the calcium content of tambang cookies with jackfruit seed flour substitution for 10%. This indicated that the amount of jackfruit seed flour affected the calcium levels of jackfruit seed flour substitution due to the addition of different jackfruit seed flour in each treatment.

The calcium content of jackfruit seed flour was (253.82 ± 1.02) mg per 100 g flour. The calcium content of fresh jackfruit seed flour did not experience changes in mineral chemical structure. The changes in chemical structure occurred if the ingredient underwent cooking process because the nature of calcium was not easily water-soluble and resistant [9]. The process of adding other ingredients such as wheat flour, egg and margarine also affected the calcium levels of tambang cookies. The calcium content in wheat flour was 16 mg/100 g, in chicken egg was 54 mg/100 g, and in margarine was 20 mg/100 g [10].

The role of calcium for the human body includes the formation of bones and teeth. The calcium requirements are 650-1000 mg per day for children, while for adults are 1000-1200 mg per day [11]. So, if you did not get calcium from other foods, the tambang cookies with jackfruit seed flour substitution could meet the calcium requirement for adults if you consumed ± 2 kg of them in a day. Meanwhile, for children, they could consume ± 1.5 kg of the tambang cookies with jackfruit seed flour substitution per day.

The Phosphorus Content of Tambang Cookies with Jackfruit Seed Flour Substitution

The mean result of phosphorus content of tambang cookies with jackfruit seed flour substitution in 30% was 173.311 mg/100g, in 20% was 161.6035 and in 10% was 149.334 mg/100g. The phosphorus analysis result of ANOVA of tambang cookies with jackfruit seed flour substitution was shown in Table 5.

Table 5. The ANOVA Analysis Result of Phosphorus Content of Tambang Cookies with Jackfruit Seed Flour Substitution

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	574.978	2	287.489	307.788	.000
Within Groups	2.802	3	.934		
Total	577.780	5			

The ANOVA analysis result in Table 5 demonstrated that the sig (0.000) $< \alpha$ (0.05) was obtained at the significance level of 5%. This result indicated that there was a significant difference in the phosphorus comparison of tambang cookies with jackfruit seed flour substitution. Moreover, to figure out the treatment that caused the differences, further testing was done using DMRT (Duncan Multiple Range Test). The test results could be seen in Table 6.

Table 6. The Result of DMRT on Tambang Cookies with Jackfruit Seed Flour Substitution

Sampl e	N	Subset for alpha = 0.05		
		1	2	3
10%	2	149.334500		
20%	2		161.603500	
30%	2			173.311000
Sig.		1.000	1.000	1.000

Table 6 represented that the phosphorus content of tambang cookies with jackfruit seed flour substitution in 10%, 20%, and 30% were significantly different. The phosphorus content of tambang cookies with jackfruit seed flour substitution in 10% was significantly different from the phosphorus content of tambang cookies with jackfruit seed flour substitution in 20%, the phosphorus content of tambang cookies with jackfruit seed flour substitution in 20% was significantly different from the phosphorus content of tambang cookies with jackfruit seed flour substitution in 30% and the phosphorus content of tambang cookies with jackfruit seed flour substitution in 30% was significantly different from the phosphorus content of tambang cookies with jackfruit seed flour substitution in 10%. This indicated that the amount of jackfruit seed flour affected the phosphorus levels of jackfruit seed flour substitution due to the addition of different jackfruit seed flour in each treatment.

The phosphorus content of fresh jackfruit seed flour was more resistant since there was no chemical structure changes because of cooking, so it was difficult to bind with other ingredients. The phosphorus content in food was in the form of phosphate which bound to magnesium and iron to form phosphorus which was not easily soluble in water and in heat [12]. The process of adding other ingredients such as flour, egg and margarine also

influenced the phosphorus content of tambang cookies. The phosphorus content in wheat flour was 106 mg/100 g, in chicken egg was 180 mg/100 g, and in margarine was 16 mg/100 g [10].

The phosphorus is the second most mineral after calcium. The role of phosphorus is similar to calcium, which is for bone and tooth formation and energy storage and expenditure as well. Any kinds of seeds especially for the embryos and the whole grains (hulled grains) also contain lots of phosphorus [13].

The rate of phosphorus sufficiency per day [11] for children under 10 years old was 100-500 mg. Meanwhile, for adults and pregnant and lactating women needed more phosphorus, 700-1200 mg. Hence, if you did not get phosphorus from other foods, the tambang cookies with jackfruit seed flour substitution could meet the phosphorus needs of adults when you consumed \pm 400 g of tambang cookies with jackfruit seed flour substitution in a day.

The Hedonic Rating Tests of Tambang Cookies with Jackfruit Seed Flour Substitution

The hedonic rating tests research for the color of the tambang cookies with jackfruit seed flour substitution had some criteria: like (5), like slightly (4), like or dislike (neutral) (3), dislike slightly (2), and dislike (1).

Hedonic ColorTest

The mean result of hedonic color test of tambang cookies with jackfruit seed flour substitution in 30% was 4.085 (like slightly), in 20% was 4.214 (like slightly) and in 10% was 4.214 (like slightly). The ANOVA analysis result of hedonic color test in tambang cookies with jackfruit seed flour substitution was revealed in Table 7.

Table7.The ANOVA Analysis Result of Hedonic ColorTest of Tambang Cookies with Jackfruit Seed Flour Substitution

Source	Type	III Sum of Squares	df	Mean Square	F	Sig.
Model	3646.305 ^a	72	50.643	77.058	.000	
Panelist	49.662	69	.720	1.095	.323	
Sample	.638	2	.319	.485	.616	
Error	90.695	138	.657			
Total	3737.000	210				

The ANOVA analysis result in Table 7 exhibited that the sig (0.616) $>$ α (0.05) was obtained at the significance level of 5%. This result indicated that there was no significant difference in the hedonic color test of tambang cookies with jackfruit seed flour substitution in 10%, 20%, and 30% because the formulation of jackfruit seed flour was not much different in each treatment.

The parameter of the hedonic test was not just like or dislike, but assessed more on the quality, which was in terms of taste, texture, and color. The panellists involved in this study were untrained panellists. The untrained panellists were selected only limited to their social backgrounds, not at the level of individual sensory sensitivity belonged to the trained panellists [14]. It was suspected that untrained panellists did not have a high

level of sensory sensitivity owned by the trained panellists so that the assessment of the hedonic color test on the tambang cookies with jackfruit seed flour substitution was not different. The more jackfruit seed flour added, the more brownish the color was. This was caused by the mallard reaction, which was a non-enzymatic browning reaction that occurred due to the reaction between reducing sugars and proteins [15].

Hedonic Taste Test

The mean result of hedonic taste test of tambang cookies with jackfruit seed flour substitution in 30% was 4.214 (likeslightly), in 20% was 4.285 (likeslightly) and in 10% was 4.171 (likeslightly). The ANOVA analysis result of hedonic test in tambang cookies with jackfruit seed flour substitution was shown in Table 8.

Table 8. The ANOVA Analysis Result of Hedonic Taste Test of Tambang Cookies with Jackfruit Seed Flour Substitution

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Model	3797.467 ^a	72	52.743	79.51	.000
Panelist	50.481	69	.732	1.103	.310
Sample	.467	2	.233	.352	.704
Error	91.533	138	.663		
Total	3889.000	210			

The ANOVA analysis result in Table 8 displayed that the sig (0.704) $>$ α (0.05) was obtained at the significance level of 5%. This result represented that there was no significant difference in the hedonic taste test of tambang cookies with jackfruit seed flour substitution in 10%, 20%, and 30%.

Taste was an important factor in the acceptance of food products. The taste deviation of the products would affect consumer acceptance. Sensitively, good quality of fried products would have golden yellow color, aroma, and special flavor of fried products and crunchy texture as well[16]. Besides, one of the processes that affected the taste was the making process.

Hedonic Texture Test

The mean result of hedonic texture test of tambang cookies with jackfruit seed flour substitution in 30% was 4.471 (likeslightly), in 20% was 4.3 (likeslightly) and in 10% was 4.342 (likeslightly). The ANOVA analysis result of hedonic texture in tambang cookies with jackfruit seed flour substitution was presented in Table 9.

Table 9. The ANOVA Analysis Result of Hedonic Texture Test of Tambang Cookies with Jackfruit Seed Flour Substitution

Source	Type	III Sum of Squares	df	Mean Square	F	Sig.
Model	4068.448 ^a	72	56.506	118.9	.000	
Panelist	54.362	69	.788	1.659	.006	
Sample	1.114	2	.557	1.173	.313	
Error	65.552	138	.475			
Total	4134.000	210				

The ANOVA analysis result in Table 9 demonstrated that the sig (0.313) > α (0.05) was obtained at the significance level of 5%. This result showed that there was no significant difference in the hedonic texture test of tambang cookies with jackfruit seed flour substitution in 10%, 20%, and 30%.

Texture was one of the parameters in organoleptic testing that could be felt through the skin or taste buds. The most important texture in food was soft and crispy. The texture meant was the crispness level of tambang cookies with jackfruit seed flour substitution.

The more jackfruit seed flour mixed in tambang cookies with jackfruit seed flour substitution, the crispier texture oftambang cookies was. This was because the fresh jackfruit seed flour contained 10.30% water and the amylose and amylopectin levels found in jackfruit seed starch. The starch with high amylopectin content would produce gels that were sticky and elastic [17]. The baking process caused the moisture content of food ingredients shrank because of dry heat. Indeed, the cookies with minimum water content would have crispier texture.

IV. CONCLUSION

The highest calcium content of tambang cookies with jackfruit seed flour substitution was in 30% with 38.525 mg/100g for the mean, and the lowest calcium content of tambang cookies with jackfruit seed flour substitution was in 10% with 28.006 mg/100g.

The highest phosphorus content of tambang cookies with jackfruit seed flour substitution was in 30% with 173.311 mg/100g for the mean and the lowest phosphorus content of tambang cookies with jackfruit seed flour substitution was in 10% with 149.334 mg/100g.

The highest mean result of the hedonic color test of tambang cookies with jackfruit seed flour substitution was in 10% with 4.214 (likeslightly), and the lowest mean of the hedonic color test of tambang cookies with jackfruit seed flour substitution was in 30% with 4.085 (likeslightly). Besides, it produced yellow color because the adding ratio of jackfruit seed flour was lesser.

The highest mean result of the hedonic taste test of tambang cookies with jackfruit seed flour substitution was in 20% with 4.285 (likeslightly), the lowest mean of the hedonic taste test of tambang cookies with jackfruit seed flour substitution was in 10% with 4.171 (likeslightly).

The highest mean result of the hedonic texture test of tambang cookies with jackfruit seed flour substitution was in 30% with 4.471 (likeslightly), and the lowest mean result of the hedonic texture test of tambang cookies with jackfruit seed flour substitution was in 20% with 4.3 (likeslightly). The formula liked by the panellists was tambang cookies with jackfruit seed flour substitution in 30% because the texture of tambang cookies was crispier.

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