

Porang Flour as an Alternative Substitute for Wheat Flour in Food Production

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ABSTRACT

Porang can be used as an alternative substitute for wheat flour in food production because it contains insoluble and insoluble fiber and has low levels of glucose and fat to anticipate the potential cardiovascular disease. This study aims to determine the effect of differences in the substitution of wheat flour with porang flour on the level of panelists acceptance. Experimental research method with the design of 2 variations of substitution of wheat flour and porang flour respectively 0:100% and 20:80%. The results showed that 100% porang flour substitution was preferable to 80% porang flour substitution. Significant and real differences were proven by using Kruskal-Wallis test and Mann Whitney test on the criteria for color, aroma, texture and taste, with a p-value less than 0.05 and an average value above 3.00. It was concluded that panelists preferred Ketapang Seed cookie using 100% porang flour as a substitute for wheat flour.

SARI PATI

Porang dapat digunakan sebagai alternatif pengganti tepung gandum dalam produksi makanan karena mengandung serat larut dan tidak larut serta memiliki kadar glukosa dan lemak yang rendah untuk mengantisipasi potensi penyakit kardiovaskular. Penelitian ini bertujuan untuk menentukan pengaruh perbedaan penggantian tepung gandum dengan tepung porang terhadap tingkat penerimaan panelis. Metode penelitian eksperimental dengan desain 2 variasi penggantian tepung gandum dan tepung porang masing-masing 0:100% dan 20:80%. Hasil penelitian menunjukkan bahwa penggantian tepung porang 100% lebih disukai dibandingkan dengan penggantian tepung porang 80%. Perbedaan yang signifikan dan nyata terbukti dengan menggunakan uji Kruskal-Wallis dan uji Mann Whitney pada kriteria warna, aroma, tekstur, dan rasa, dengan nilai p kurang dari 0,05 dan nilai rata-rata di atas 3,00. Dapat disimpulkan bahwa panelis lebih menyukai kue biji Ketapang yang menggunakan tepung porang 100% sebagai pengganti tepung gandum.

INTRODUCTION

Food products from a food industry that are consumed by Indonesian people mostly use flour as the basic ingredient. The flour that is often consumed by the public is wheat flour made from wheat. This causes high wheat imports because wheat cannot grow in Indonesia. In addition, wheat flour contains several substances that are harmful to health, namely alloxan which causes an increase in blood sugar and gluten compounds which can cause auto-immune and digestive tract disorders. Wheat can also cause cardiovascular disease which is one of the highest causes of death in the world (Setyadi et al., 2022). One effort to overcome this problem is to consume foods that contain low fat and high dietary fiber (R. Sari & Suhartati, 2019).

Referring to these two aspects of consideration, flour raw materials are needed with high fiber and protein content, and low glucose and fat. Porang can be used as an alternative to substitute wheat in the production of wheat flour. Porang tubers contain insoluble fiber (soluble fiber) and insoluble fiber. Soluble fiber can lower cholesterol levels by binding to it in the digestive tract and carrying it out. Meanwhile, insoluble fiber can help digestive problems such as constipation and maintain the health of the digestive organs. Another benefit of fiber for the body is that it helps control sugar levels, helps you lose weight, and reduces the risk of cancer (Barber et al., 2021). Porang flour is a material produced from processed porang tubers (*Amorphophallus Muelleri Blume*) which has a relatively long shelf life and has great potential in the field of food processing. Porang flour contains a high level of glucomannan, which is 64.98%. Glucomannan or food fiber can dissolve in water which is a strong hydrocolloid and low in calories (Widjanarko et al., 2015). In addition,

glucomannan is an important substance contained in porang flour which is good for diet and for health. The glucomannan content in porang flour is commonly known as Konjac Glucomannan (KGM). The benefits of KGM are reducing blood cholesterol, slowing stomach emptying, accelerating satiety making it suitable for diet food and for diabetics, and as a substitute for agar-agar and gelatin (Aryanti et al., 2015). Ketapang Seed Cookie are classified as dry cookie originating from Betawi which are made from flour, sugar, coconut milk, eggs and vanilla. These ingredients are mixed together to form a dough. The dough is then cut into small pieces resembling ketapang seeds and fried until golden yellow. Its shape is similar to ketapang seeds, making this cookie from Betawi called ketapang seed cookie. This study aims to determine whether there is an effect on Taste, Color, Texture, and Aroma by replacing the main ingredients of ketapang seed cookie, namely wheat flour with porang flour with the composition of the recipe from experiments that have been carried out on public acceptance.

METHODS

This research was conducted at the kitchen laboratory at Sekolah Tinggi Pariwisata Bogor. The equipment used in this study included scales, steamer pans, bowls, basins, spoons, pans, spatulas, frying pans, cutting boards and knives. The materials used were “porang flour” (as the main object ingredient of this research), wheat flour, coconut milk, granulated sugar, eggs, vanilla, baking soda and oil for frying.

Table 1.
Formula for Ketapang Seed Cookie

No	Ingredients (gram)	Formula Ketapang Seed Cookie	
		P1	P2
1	Porang Flour	1000	800
2	Wheat Flour	0	200
3	White Sugar	250	250
4	Whole Eggs	200	200
5	Margarine	50	50
6	Coconut Milk	260	260
7	Vanlili	3	3
8	Baking Soda	8	8
Total		1.771	1.771

Additional information:

The treatment studied was replacing wheat flour with porang flour with the following composition:

1. Product formula 1 using code P1 : 100% porang flour to replace wheat flour
2. Product formula 2 using code P2 : 20% wheat flour and 80% porang flour

The porang flour Ketapang Seed cookie were assessed through a hedonic test with

organoleptic analysis covering aspects of color, texture, aroma, and overall taste. This test was given to 30 consumer panelists using a research instrument in the form of a questionnaire. Panelists were given product code samples P1 and P2, then asked to make sensory observations and express their opinions by filling out the provided questionnaire. Panelists were given product with code of samples are P1 and P2, then asked to make sensory observations and express their opinions by filling out the provided questionnaire. The preference level test includes a choice of attitudes that strongly dislike, dislike, quite like, like and really like, which has an assessment based on ratings (Larmond, 1973). The attitude scale in this study has a range of 1 to 4, where the value categories tested are as follows: Very Likes: scale 4; Likes: scale 3; Dislikes: scale 2; Dislike very much: scale 1.

The implementation procedure in the research on making Ketapang Seeds cookie with substitution of wheat flour with porang flour is as follows:

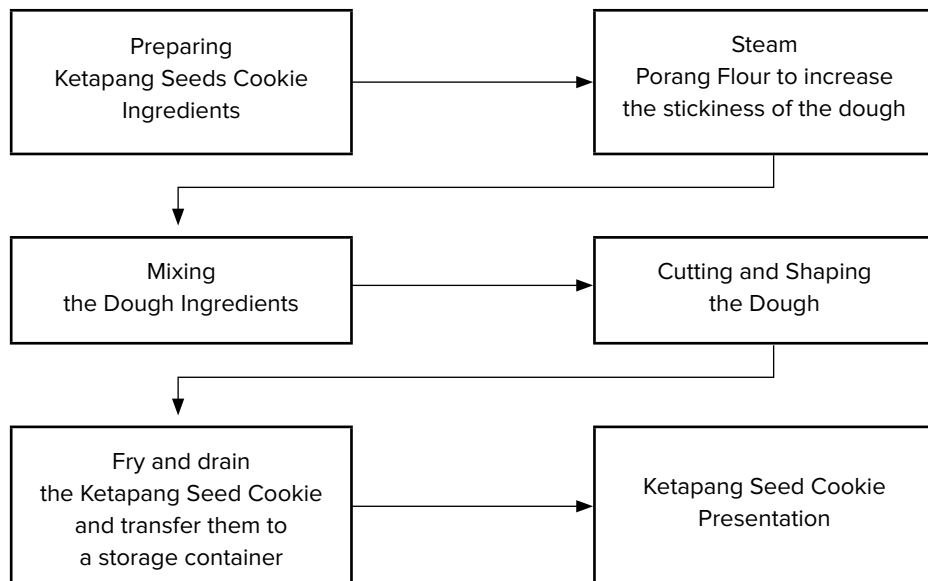


Figure 1. Research Procedures for Making Porang Ketapang Seed Cookie, 2023

RESULTS AND DISCUSSION

Statistical description of the calculation of the organoleptic test questionnaire on formula P1 (100% substitution of porang flour) Ketapang Seeds cookie using SPSS is as follows:

the P1 formulation is good, that is, the average panelist likes the P1 product and the resulting value is above the median value, which is 3.00. The highest score was given by the panelists for the crunchy and easy-to-digest texture

Table 2. Descriptive analysis of results calculation of the questionnaire on Formula P1 Ketapang Seed Cookies

Statistics											
Color		Aroma		Texture		Taste					
N	Valid	30	N	Valid	30	N	Valid	30	N	Valid	30
	Missing	0		Missing	0	N	Missing	0	N	Missing	0
Mean	3.20		Mean	3.23		Mean	3.20		Mean	3.20	
Median	3.00		Median	3.00		Median	3.00		Median	3.00	
Mode	3		Mode	3		Mode	3		Mode	3	
Std. Deviation	.407		Std. Deviation	.430		Std. Deviation	.407		Std. Deviation	.407	
Minimum	3		Minimum	3		Minimum	3		Minimum	3	
Maximum	4		Maximum	4		Maximum	4		Maximum	4	

Source: SPSS 26 data processing for this research (2023)

Based on Table 2 above, it can be seen that the range of average values in the P1 formulation treatment of the Ketapang Seed Cookie when viewed from the four aspects studied namely color, aroma, texture and taste produced values between 3.20 to 3.23 where this shows that the panelist's preference for

of the Biji Ketapang cookie made from 100% substitution of porang wheat flour.

The statistical description of the calculation of the organoleptic test questionnaire in the P2 formula treatment (80% substitution of porang flour for wheat flour) Ketapang Seed Cookie is as follows:

Table 3. Descriptive analysis of results calculation of the questionnaire on Formula P2 Ketapang Seed Cookies

Statistics											
Color		Aroma		Texture		Taste					
N	Valid	30	N	Valid	30	N	Valid	30	N	Valid	30
	Missing	0		Missing	0	N	Missing	0	N	Missing	0
Mean	2,90		Mean	2,80		Mean	2,87		Mean	2,87	
Median	3,00		Median	3,00		Median	3,00		Median	3,00	
Mode	3		Mode	3		Mode	3		Mode	3	
Std. Deviation	0,305		Std. Deviation	0,407		Std. Deviation	0,346		Std. Deviation	0,346	
Minimum	2		Minimum	2		Minimum	2		Minimum	2	
Maximum	3		Maximum	3		Maximum	3		Maximum	3	

Source: SPSS 26 data processing for this research (2023)

Table 3 shows that the range of average values in the P2 formulation treatment of the Ketapang Seed Cookie when viewed from the four aspects studied namely color, aroma, texture and taste produced values between 2.80 to 2.90 which indicated that the panelist's preference for this P2 formulation was quite good, that is, the average panelist likes P2 products but the resulting value is below the research median value of 3.00. The highest score was given by the panelists for the color of the Ketapang Cookie, which was lighter yellow and golden in color. This can happen because the brown color of porang flour makes it a little difficult to determine the right maturity so that the lighter color is considered more attractive by the panelists.

To find out the difference between the two formulas, an organoleptic test was carried out through the SPSS analysis tool with the Kruskal-Wallis test which is one of the non-parametric statistical tests to find out whether there is a significant difference between the independent variable groups and the dependent variable where the independent variable in this study are color, aroma, texture and taste, and the dependent variable is the research sample. If in the results there is a difference between the treatment formulas P1 and P2 then the analysis is continued with

the Mann Whitney test which is a test to find out whether there is a real difference between the averages of two populations with the same distribution, through two independent samples taken from both populations.

The following figure shows the average value of the organoleptic test for the research sample:

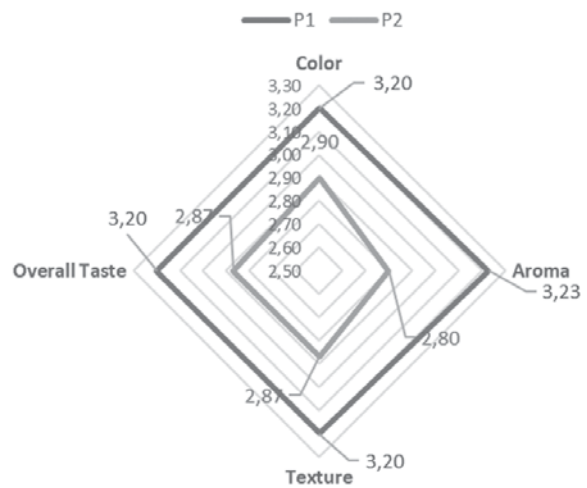


Figure 2. The average value of the organoleptic test for research samples

The results of the research on the organoleptic test criteria for color, aroma, texture and taste of ketapang seed cookie formula P1 (100% porang flour) and formula P2 (80% porang flour) can be seen in the following table:

Table 4. Organoleptic Analysis of Ketapang Seed Cookie with Porang Flour Substitution

Parameter	Average Value Organoleptic Test of the Samples		Significance value	
	P1	P2	Kruskal Wallis	Mann-Whitney
Color	3,20 ± 0,407 ^b	2,40 ± 0,305 ^b	0,003	0,007
Aroma	3,23 ± 0,430 ^b	2,80 ± 0,407 ^b	0,000	0,001
Texture	3,20 ± 0,407 ^b	2,87 ± 0,346 ^b	0,022	0,001
Overall Taste	3,20 ± 0,407 ^b	2,87 ± 0,346 ^b	0,002	0,002

Source: SPSS 26 data processing for this research (2023)

Description:

1 = really don't like it; 2 = dislike; 3 = likes;

4 = really like

a, b are letter notations that define where the notation a is given if there is no significant difference in the Kruskal Wallis and Mann Whitney test levels and the notation b is given if there is a significant difference in the Kruskal Wallis and Mann Whitney test levels.

The explanation from table 4 is as follows:

a. Color

The results of the Kruskal Wallis test on the color aspect showed a value of $P < 0.05$ or $0.003 < 0.05$, which means that H_0 was rejected and H_1 was accepted. There was a significant difference in the level of preference of the panelists between the treatment formula P1 and formula P2, Ketapang seed cookie with substitution of porang flour. Given this difference, the analysis was continued with the Mann-Whitney test where the results showed that the panelist's preference for the color of the two formula treatments in the Ketapang seed cookie was significantly different, namely $P < 0.05$ or $0.007 < 0.05$. According to Fellows (2000) in (D. K. Sari et al., 2021), color is the fastest and easiest response to give a good impression. Furthermore, Winarno (2004) in (D. K. Sari et al., 2021) stated that visually, color greatly determines whether a food is accepted or not by the public or consumers. Food that tastes good, is nutritious and has a good texture will not necessarily be liked by consumers if the food has an unsightly color or deviates from the color it should be.

b. Aroma

Aroma is one of the parameters in testing sensory properties (organoleptic)

using the sense of smell. Aroma is acceptable if the resulting material has a specific aroma (Kusmawati, et al, 2000) in (Lamusu, 2018). The results of the Kruskal Wallis test on the aroma aspect showed a value of $P < 0.05$ or $0.000 < 0.05$, which means that H_0 was rejected and H_1 was accepted. There was a significant difference in the level of preference of the panelists between the treatment formula P1 and formula P2, Ketapang seed cookie with substitution of porang flour. Given this difference, the analysis was continued with the Mann-Whitney test where the results showed that the level of preference of the panelists for the aroma of the two formula treatments in the Ketapang Seed Cookie was significantly different, namely $P < 0.05$ or $0.001 < 0.05$.

c. Texture

According to (De Man, 1997) in (Lamusu, 2018), texture is a sensation that is associated with touch or touch. Sometimes texture is also considered as important as smell, taste and aroma because it affects the image of food. Texture is most important in soft and crunchy foods. The characteristics most often ignored are hardness, cohesiveness, and water content. The Kruskal Wallis test on the texture aspect showed a value of $P < 0.05$ or $0.022 < 0.05$, which means that H_0 was rejected and H_1 was accepted. There was a significant difference in the level of preference of the panelists between the treatment formula P1 and formula P2, Ketapang seed cookie with substitution of porang flour. Given this difference, the analysis was continued with the Mann-Whitney test where the results showed that the panelist's preference level for the texture of the two formula treatments in the Ketapang Seed Cookie was significantly

different, namely $P < 0.05$ or $0.001 < 0.05$.

d. Flavor

The taste in the ketapang seed cookie is a combination of taste and aroma created to suit the taste of the panelists. Taste is the perception of the sense of taste which includes salty, sweet, sour and bitter tastes caused by materials dissolved in the mouth (Gracia. C et al.,) in (Mahirdini & Afifah, 2016). The results of the Kruskal Wallis test on the taste aspect showed a value of $P < 0.05$ or $0.002 < 0.05$, which means that H_0 was rejected and H_1 was accepted. There was a real and significant difference in the level of preference of the panelists between the treatment formula P1 and formula P2, Ketapang Seed Cookie with flour substitution. porang. Given this difference, the analysis was continued with the Mann-Whitney test where the results showed that the panelists' preference level for the taste of the two formula treatments in the Ketapang Seed Cookie was significantly different, namely $P < 0.05$ or $0.002 < 0.05$.

MANAGERIAL IMPLICATION

The results of the study showing that porang flour can replace wheat flour in the manufacture of pastries, especially ketapang seed cookie, indicate that the market potential can open up good business opportunities, but the relatively expensive price of porang flour is a concern in determining market segmentation and target markets in selling food. This is why it should be labeled as healthy food to give more value from the consumer's perspective.

It is recommended for further research to be careful in the process of frying the dough, it must be dipped in cold oil first and then set the cooking fire to a low level. The brown color of porang flour makes it difficult to determine the proper doneness, if during the process of

frying the cookie it shows a lighter brown color than the dough, it indicates that the cookie are cooked. The texture of the ketapang seed cake, which is quite soft, makes the cookie break easily, so let the cookie cool before serving so that the cookie harden and are slightly crunchy. Research on food substitution using porang flour will be better if the experiment is carried out testing more than 2 samples, in addition to testing the samples with the help of expert panelists for a more valuable and reliable assessment.

CONCLUSION

The level of acceptance tested by the parameters of color, aroma, texture, and taste to the consumer panelists for the substitution of wheat flour with porang flour in making Ketapang Cookie, got the best results in the P1 formula treatment, namely 100% substitution of porang flour to replace wheat flour. The Kruskal Wallis test shows that there are significant differences in the criteria for color, aroma, texture and taste in the two formulas of the Ketapang Seed cookie. Based on these results, a follow-up test can be carried out by using the Mann Whitney test where the results show that there is a real and significant difference in the criteria color, aroma, texture and taste of the two formulas studied.

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