JISIP (Jurnal Ilmu Sosial dan Pendidikan)
Vol. 10 No. 4 November 2026
e-ISSN : 2656-6753, p-ISSN: 2598-9944
DOI: *10.36312/jisip.v10i4.11275/http://ejournal.mandalanursa.org/index.php/JISIP/index*

The Effect of Sorghum Flour (*Sorghum bicolor L.*) Substitution in the Production of Ketapang Seed Cookies on Physical and Sensory Quality

Syarifah Mardhiyah[1], Alsuhendra[2], Annis Kandriasari[3]
[123]Pendidikan Tata Boga, Fakultas Teknik, Universitas Negeri Jakarta

Article Info
Article history:
Received: 25 July 2026
Publish: 1 November 2026

Keywords:
Kue Biji Ketapang;
Tepung Sorgum;
Kualitas Fisik;
Mutu Sensori.

Abstract
This study aims to analyze the effect of sorghum flour (Sorghum bicolor L.) substitution in the production of ketapang seed cookies on their physical and sensory quality. The study was conducted at the Pastry and Bakery Laboratory, Department of Culinary Arts Education, Jakarta State University, from November 2024 to July 2026. An experimental method was used. The research samples consisted of ketapang seed cakes with sorghum flour substitutions of 20%, 30%, and 40%. The physical quality test, specifically the oil absorption test, was performed three times for each sample. The results of the analysis using ANOVA showed no significant effect on oil absorption. The sample with 40% sorghum flour substitution had the highest oil absorption, while the sample with 20% sorghum flour substitution had the lowest oil absorption. The sensory quality test involved 45 moderately trained panelists, with evaluation aspects including color, sorghum aroma, coconut aroma, cinnamon aroma, sorghum flavor, sweetness, savory flavor, and texture (crispness). The results of the hypothesis testing using the Kruskal-Wallis test showed no significant effect on color, sorghum aroma, coconut aroma, cinnamon aroma, sweetness, savory taste, and texture (crispness). However, there was a significant effect on sorghum flavor, so the analysis was continued with Tukey's test. The conclusion of this study is that the sample with a 20% sorghum flour substitution is the best formulation recommended for the development of traditional snacks and the optimization of local food utilization.

This is an open access article under the Lisensi Creative Commons Atribusi-BerbagiSerupa 4.0 Internasional

Corresponding Author:
Syarifah Mardhiyah
Universitas Negeri Jakarta
Email Coresspondent: ssyarifahhm@gmail.com

1. INTRODUCTION

Traditional Indonesian pastries are part of Indonesia's cultural heritage that has endured to this day. Traditional pastries are divided into two types based on their moisture content: moist pastries and dry pastries. The main ingredients for both moist and dry pastries are various types of flour, including wheat flour, rice flour, glutinous rice flour, and sago flour [1]. Dry pastries are prepared by baking or frying to reduce their moisture content, allowing them to last longer. The prevalence of traditional pastries in Indonesia has declined since the rise of modern pastries. This trend is widespread among Indonesians, particularly in urban areas.

Ketapang seed cookies is a traditional dessert from Betawi. Originally, ketapang seed cake was a snack that was always served to the Betawi community during religious holidays, such as Eid al-Fitr and Eid al-Adha. This cookie is shaped like a ketapang seed, which comes from the ketapang tree. Ketapang seed cookies are made from wheat flour, with the addition of sugar, eggs, margarine, vanilla, toasted coconut, and coconut milk. To make them, mix all the ingredients into a dough, roll it into a long log, and cut it diagonally

to resemble ketapang seeds; the cookies are then deep-fried. The resulting flavor is sweet and savory [2].

Wheat flour remains the primary ingredient in most baked goods produced in Indonesia. This is due to the public's limited knowledge of local food ingredients that can serve as substitutes for wheat flour, which is derived from wheat grains [1]. As a result, wheat imports have been on the rise. To reduce wheat imports used to produce wheat flour, it is necessary to identify alternative food ingredients with similar characteristics that can serve as substitutes for wheat flour. One such alternative is substituting wheat flour with sorghum flour derived from the sorghum plant (Sorghum bicolor).

The wide variety of sorghum flour-based products indicates that sorghum flour has the potential to be used as a raw material in various processed food products. By using sorghum flour as a substitute, it is hoped that the utilization of local food ingredients can be optimized and that the effect of sorghum flour substitution on the production of ketapang seed cookies can be analyzed.

2. RESEARCH METHODS

This study employed an experimental design to determine the effect of sorghum flour substitution in the production of ketapang seed cookies on physical quality (oil absorption) and sensory quality (color, aroma, taste, and texture). Sampling was conducted using random sampling by a panel of 45 moderately trained evaluators. The panelists evaluated the sensory quality, including color, sorghum aroma, coconut aroma, cinnamon aroma, sorghum flavor, sweetness, savory taste, and texture (crispness) of the ketapang seed cookies made with sorghum flour substitution. Before the sensory test was conducted with the panelists, a validation test was first carried out with expert panelists consisting of five faculty members from the Culinary Arts Education Program, Faculty of Engineering, Jakarta State University.

The production of white sorghum flour requires several processes, including soaking, drying, milling, and sifting. The white sorghum was soaked and then sun-dried for 8 hours. Next, the white sorghum is ground using a grinder to reduce the particle size. It is then sifted using a 200-mesh sieve. The white sorghum used by the author was derived from 100% hulled white sorghum, which was then processed into white sorghum flour.

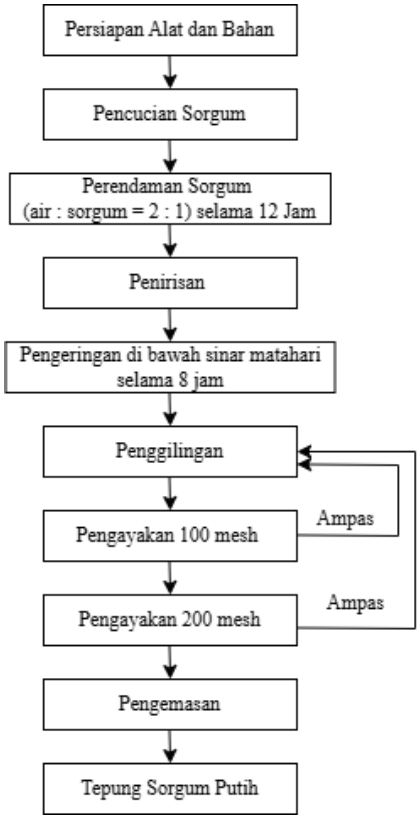


Figure 1 Flow Diagram for Making Sorghum Flour

The recipe for ketapang seed cookies in this study is based on a study by Teddy Hidayat (2023). The process of making ketapang seed cookies involves selecting ingredients, preparing equipment, weighing the ingredients (wheat flour, sorghum flour, margarine, eggs, toasted coconut, coconut milk, sugar, and salt), beating and mixing the ingredients, rolling out the dough, cutting the dough, and frying.

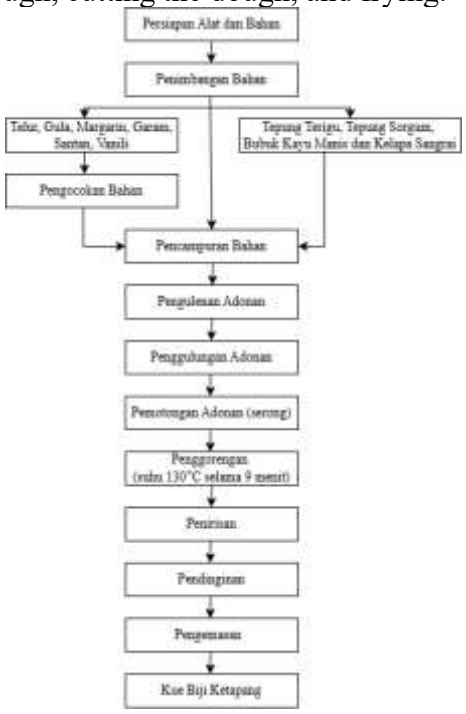


Figure 2 Flow Diagram for Making Ketapang Seed Cookies

Table 1 Standard Recipe for Ketapang Seed Cookies

Material	Amount

	Gram	%
All-purpose flour	250	100
Shredded coconut	35	14
Sugar	80	32
Margarine	60	24
Eggs	40	16
Instant coconut milk	20	8
Salt	1	0,4
Vanilla powder	1	0,4

Table 2 Ketapang Seed Cookies Recipe Using Sorghum Flour as a Substitute

Material	Amount					
	Gram	20%	Gram	30%	Gram	40%
All-purpose flour	200	80	175	70	150	60
Sorghum flour	50	20	75	30	100	40
Shredded coconut	35	14	35	14	35	14
Sugar	80	32	80	32	80	32
Margarine	60	24	60	24	60	24
Eggs	40	16	40	16	40	16
Instant coconut milk	20	8	20	8	20	8
Salt	1	0,4	1	0,4	1	0,4
Vanilla powder	1	0,4	1	0,4	1	0,4

3. RESULTS AND DISCUSSION

3.1.Research Results

Physical Quality

ANOVA Test of Oil Absorption Using Oil Volume

SK	Db	JK	KT	Fhitung	Ftabel
Perlakuan (p)	2	0,38	0,19	3,83	5,14
Galat (g)	6	0,30	0,05		
Total	8	0,68	0,24		

Based on the measurement of oil absorption relative to oil volume, Fcount < Ftable was obtained, meaning that H_0 is accepted and H_1 is rejected. This indicates that the substitution of sorghum flour in ketapang seed cookies does not have a significant effect on oil absorption relative to oil volume.

Sensory Quality

1. Color

The highest average score was obtained for the 40% substitution sample at 4.67, followed by the 30% substitution sample with an average score of 4.6, and the 20% substitution sample with the lowest average score of 4.5. Based on the average scores, the ketapang seed cookies with 40% sorghum flour substitution had a color that more closely matched the characteristics of the control product. Based on the results of the Kruskal-Wallis test, sorghum flour substitution did not affect the color of the ketapang seed cookies. This is indicated by the calculated x^2count of 0.91, which is less than the critical x^2 table of 5.99.

Testing Criteria	x^2count	x^2table
Color	0,91	5,99

2. The Aroma of Sorghum

The highest average score was obtained for the 20% substitution sample at 4.3, followed by the 30% substitution sample with an average score of 4.1, and the 40% substitution sample with the lowest average score of 3.7. Based on the average scores, the ketapang seed cookies with 20% sorghum flour substitution had an aroma more consistent with the characteristics of the control product. Based on the average scores, the ketapang seed cake with 40% sorghum flour substitution had a color that was more consistent with the characteristics of the control product. Based on the results of the Kruskal-Wallis test, sorghum flour substitution did not affect the sorghum aroma of the ketapang seed cookies. This is indicated by the calculated x^2count of 5.53 < x^2table of 5.99.

Testing Criteria	x^2count	x^2table
The Aroma of Sorghum	5,53	5,99

3. The Aroma of Coconut

The highest average score was obtained for the 40% substitution sample at 4.2, followed by the 30% substitution sample with an average score of 4.1, and the 20% substitution sample with the lowest average score of 3.9. Based on the average scores, the ketapang seed cookies with 40% sorghum flour substitution had a coconut aroma that was more consistent with the characteristics of the control product. Based on the results of the Kruskal-Wallis test, sorghum flour substitution did not affect the coconut aroma of the ketapang seed cookies. This is indicated by the calculated x^2 count of 0.4, which is less than the critical x^2 table of 5.99.

Testing Criteria	x^2 count	x^2 table
The Aroma of Coconut	0,4	5,99

4. The Flavor of Sorghum

The highest average score was obtained for the 20% substitution sample at 4.5, followed by the 30% substitution sample with an average score of 4, and the 40% substitution sample with the lowest average score of 3.7. Based on the average scores, the ketapang seed cookies with 20% sorghum flour substitution had a sorghum flavor that was more consistent with the characteristics of the control product. Based on the results of the Kruskal-Wallis test, sorghum flour substitution affected the sorghum flavor of the ketapang seed cookies. This is indicated by the calculated x^2 count of 9.18 > the critical x^2 table of 5.99. Therefore, the analysis continued with Tuckey's test.

Testing Criteria	x^2 count	x^2 table
The Flavor of Sorghum	9,18	5,99

Difference for Each Treatment	Comparison of Result	Conclusion
|A-B| = |4,5 - 4| = 0,5	0,5 > 0.2	Significantly different
|A-C| = |4,5 - 3,7| = 0,8	0,8 > 0,2	Significantly different
|B-C| = |4 - 3,7| = 0,3	0,3 > 0,2	Significantly different

Information :
A : Ketapang seed cookies with 20% sorghum flour
B : Ketapang seed cookies with 30% sorghum flour

C : Ketapang seed cookies with 40% sorghum flour

5. The Flavor of Sweet

The highest average score was obtained for the 40% substitution sample at 4.2, followed by the 20% and 30% substitution samples with an average of 3.8. Based on the average scores, the ketapang seed cookies with 40% sorghum flour substitution had a sweetness that was more consistent with the characteristics of the control product. Based on the results of the Kruskal-Wallis test, sorghum flour substitution did not affect the sweetness of the ketapang seed cookies. This is indicated by the calculated x^2 count of 4.47 < the critical x^2 tabke of 5.99.

Testing Criteria	x^2 count	x^2 table
The Flavor of Sweet	4,47	5,99

6. The Flavor of Savory

The highest average score was obtained for the 30% substitution sample at 4.3, followed by the 20% substitution sample with an average score of 4, and the 20% substitution sample with the lowest average score of 3.9. Based on the average scores, the ketapang seed cookies with 30% sorghum flour substitution had a savory taste that was more consistent with the characteristics of the control product. Based on the results of the Kruskal-Wallis test, sorghum flour substitution did not affect the savory flavor of the ketapang seed cookies. This is indicated by the calculated x^2 count of 2.56 < the critical x^2 table of 5.99.

Testing Criteria	x^2 count	x^2 table
The Flavor of Savory	2,56	5,99

7. Texture (crispness)

The highest average score was obtained for the 40% substitution sample at 4.6, followed by the 20% and 30% substitution samples with an average score of 4.5. Based on these average scores, the ketapang seed cookies with 40% sorghum flour substitution had a crispness that more closely matched the characteristics of the control product. Based on the results of the Kruskal-Wallis test, sorghum flour substitution did not affect the savory flavor of the ketapang seed cookies. This is indicated by the calculated x^2 count of 1.22 < the critical x^2 table of 5.99.

Testing Criteria	x^2 count	x^2 table
Texture (crispness)	1,22	5,99

3.2.Discussion

Physical Quality

The results of the ANOVA test on the three samples with three replicates indicate that there is no significant effect on the oil absorption of ketapang seed cookies. This is demonstrated by the calculated F-count of 3.38, which is smaller than the F-table of 5.14; therefore, H_0 is accepted and $H_1$is rejected. The highest mean value for oil absorption was observed in the 40% treatment. It can be concluded that the higher the percentage of sorghum flour used, the greater the amount of oil absorbed by the product. During the frying process, water in the food product evaporates and is replaced by oil; thus, the lower the moisture content in the food, the greater the likelihood of oil absorption [3]. However, in this study, the use of sorghum flour did not show a significant change in the physical quality test for oil absorption.

Sensory Quality

Based on the results of the sensory quality test of the three products, the color observed was brown. The results of the hypothesis test indicated that there was no significant difference in the color of the ketapang seed cakes among the samples. The lack of a significant difference in color may be due to the fact that the frying temperature and time were controlled for each sample.

Aroma is the perception received by the nose when evaluating a food [4]. Based on the results of the sensory quality test regarding the aroma of sorghum, all three substitution percentages fell into the category of "weak sorghum aroma." The results of the hypothesis test indicated that there was no significant difference in sorghum aroma among the samples. The highest average score in the sensory quality test for the sorghum aroma aspect was found in the 20% treatment.

Taste is perceived through stimulation of the taste buds. Taste is a crucial factor that consumers will always remember. Generally, there are only five basic tastes: sweet, bitter, sour, salty, and umami [5]. One of the desired taste profiles in the production of these ketapang seed cakes with sorghum flour substitution is that they do not taste like sorghum, are sweet, and have a savory flavor. Based on the results of the hypothesis test, it was shown that all three samples tended to have a weak sorghum flavor. The highest average score was obtained by the 20% substitution sample at 4.5. The higher the percentage of white sorghum flour used, the stronger the resulting sorghum flavor. The desired flavor in this aspect is one that is very weak.

Hypothesis testing of sensory quality regarding texture (crispness) showed that ketapang seed cookies made with sorghum flour substitution had no effect on sensory quality in terms of texture (crispness). The product with the highest average score was the 40% substitution. The higher the proportion of sorghum flour used, the coarser and more brittle the resulting texture [6]. This is due to the presence of amylose in sorghum flour, a polysaccharide compound that acts as a texture enhancer [7].

4. CONCLUSION

Based on the results of sensory quality tests conducted with 45 panelists and a Kruskal-Wallis test analysis, the substitution of sorghum flour in ketapang seed cookies did not have a significant effect on most sensory aspects, except for the sorghum flavor. Each substitution level had advantages in specific aspects: the 20% level excelled in sorghum aroma, cinnamon aroma, and sorghum flavor; the 30% level in savory flavor; and the 40% level in color, coconut aroma, sweetness, and texture. Considering the results of the sensory tests and physical quality, the 40% sorghum flour substitution formulation was selected as the best because it had characteristics closest to the control product, such as a brown color, strong aroma, very crisp texture, and appropriate oil absorption; therefore, it is recommended as an alternative for the development of ketapang seed cookies while supporting the optimization of local food utilization.

5. ACKNOWLEDGMENTS

We would like to thank the Culinary Arts Program, Faculty of Engineering, Jakarta State University, for facilitating this research.

6. BIBLIOGRAPHY

[1] I. Amelia, "Analisa Tingkat Kesukaan Kue Kering Biji Ketapang Dengan Bahan Tepung Sorgum Putih Sebagai Substitusi Tepung Terigu," 2022, *STP AMPTA Yogyakarta*.

[2] T. Hidayat, "Pengaruh Suhu Pemanggangan Terhadap Kualitas Fisik dan Daya Terima Kue Biji Ketapang Panggang," Skripsi, Universitas Negeri Jakarta, Nov. 2023.

[3] F. Paramata, P. Ningsih, M. Limonu, "Karakteristik Fisikokimia Kerupuk Kerang Darah

(Anadara granosa) yang Diformulasi Tepungan Daun Kelor (Moringa oleifera)". *Jambura Journal of Food Technology (JJFT)*, 5(2), 161–173, 2023.
[4] D. Setyaningsih, *Analisis Sensori untuk Industri Pangan dan Agro*. *IPB Press,* 2010
[5] M. K. Sharif, *et al, Sensory Evaluation And Consumer Acceptability.* Handbook of food science and technology, 361 386.
[6] A. Gunawan, F. S. Pranata, Y. R. Swasti, "Kualitas *Muffin* Dengan Kombinasi Tepung Sorgum Dan Tepung Kacang Merah," *Jurnal Teknologi Hasil Pertanian,* 14(1), 11-19, 2021.
[7] Paryoto, R. N. Rahmadani, S. T. Saputra, "Uji Kualitas Organoleptik Substitusi Tepung Sorgum Dalam Pembuatan *Butter Cake,*" *Jurnal Culinaria,* 1(1), 1-14, 2019.
[8] N. F. Aryani, *et al, Budidaya Tanaman Sorgum (Sorghum bicolor (L.) Moench).* Eprints UNM.
[9] Y. Boga, *Kue-Kue Indonesia,* Gramedia Pustaka Utama.
[10] N. A. Fairuz dan M. Dahlia, "Pengaruh Substitusi Tepung Sorgum Putih Dalam Pembuatan Vanilla Cupcake Terhadap Kualitas Fisik Dan Daya Terima Konsumen, *Jurnal Ilmu Ilmu Agribisnis: Journal Of Agribusiness Science*, *12*(1), 83–89. 2024
[11] M. Gardjito, A. Djuwardi, E. Harmayani, *Pangan Nusantara: Karakteristik Dan Prospek Untuk Percepatan Diversifikasi Pangan,* Prenada Media.
[12] A. R. Krisnadi, " Gastronomi Makanan Betawi Sebagai Salah Satu Identitas Budaya Daerah," 2018
[13] T. S. Kusuma, *et al, Pengawasan Mutu Makanan,* Universitas Brawijaya Press.
[14] E.S. Murtini dan N.F. Sabilla, *Sorgum dan Pemanfaatannya dalam Industri Pangan,* FTP-UB Press.
[15] S.Slameto, "Daya Hasil Sorgum Dengan Sistem Tanam Zigzag Pada Lahan Kering Masam Di Wilayah Kabupaten Lampung Selatan, Provinsi Lampung," *Prosiding Seminar Nasional Hasil Penelitian Agribisnis*, *6*(1), 332–338, 2022