Content lists available at PublikasiPolije

International Journal of Technology, Food and Agriculture (TEFA)

journal homepage : https://publikasi.polije.ac.id/index.php/tefa

Article

The Impact of Purple Sweet Potato Flour Substitution on the Physical and Organoleptic Characteristics of Non-flaky Crackers

Silvia Oktavia Nur Yudiastuti [1*], Wiwin Purnama [2], Abdul Halim [3]

[1] Food Engineering, Politeknik Negeri Jember; silvia.oktavia@polije.ac.id
[2] Food Engineering, Politeknik Negeri Jember; wiwinprnm78@gmail.com
[2] Chemical Engineering, Institut Sains dan Teknologi Al-Kamal; halim.abe@gmail.com

* Correspondence: silvia.oktavia@polije.ac.id

Abstract: Non-flaky crackers are snacks like biscuits but go through a fermentation process and are not layered. This research aimed to determine the effect of purple sweet potato flour substitution on non-flaky crackers' physical and organoleptic characteristics. This research used a Completely Randomized Design (CRD) method consisting of six treatments and three replications. The treatments are C0 (100% wheat flour), C1 (10% purple sweet potato flour, 90% wheat flour), C2 (30% purple sweet potato flour, 70% wheat flour), C3 (50% purple sweet potato flour, 50% wheat flour). wheat), C4 (70% purple sweet potato flour, 30% wheat flour), C5 (90% purple sweet potato flour, 10% wheat flour). Data analysis used the Microsoft Excel 2010 program, the ANOVA (Analysis of Variance) method, then continued with data processing using IBM SPSS Statistics 25 and continued with Duncan's Multiple Range Test. The research showed that substituting purple sweet potato flour had significantly affected the characteristics and hedonic colour, texture, physical characteristics, and characteristics of cracker products. The best treatment was the C4 iteration of 70% purple sweet potato flour and 30% wheat flour.

Keywords: sweet potato purple flour; non-flaky crackers; physical and organoleptic.

Citation: S. O. N. Yudiastuti, W. Purnama, and A. Halim, "The Impact of Purple Sweet Potato Flour Substitution on the Physical and Organoleptic Characteristics of Non-flaky Crackers", *TEFA*, vol. 2, no. 2, pp. 62–71, Apr. 2025.

Received: 11-07-2024
Accepted: 10-04-2025
Published: 21-04-2025

1. Introduction

Indonesia is a country that has a variety of local foods that have the potential to be developed, one of which is sweet potatoes. According to data from the Indonesian Central Bureau of Statistics, sweet potato production in 2015 reached around 160.3 quintals/hectare, while in 2017, East Java province produced sweet potatoes that reached 257,414 tons. One type of sweet potato produced is the purple sweet potato. Purple sweet potatoes contain anthocyanin compounds as a natural source of antioxidants[1]. Purple sweet potatoes can be processed into chips, cookies, and traditional preparations. Apart from that, purple sweet potatoes can be processed into flour. Purple sweet potato flour has a water content of 10.92 ± 0.09% (DB), protein 6.44 ± 0.27% (DB), fat 0.61 ± 0.06% (DB), ash 2.58 ± 0.01% (DB), carbohydrates 90.37 ± 0.00%, starch 74.57 ± 0.32% (DB), amylose 24.79 ± 0.94% (DB), amylopectin 49.78 ± 0.00% (bk), reducing sugar 3.15 ± 0.3% (DB), and crude fibre ± 0.35% (DB)[2]. The use of purple sweet potato as a local food source for crackers can positively impact the food industry's progress in Indonesia for both MSMEs and large open sectors. MSMEs can profit by producing purple sweet potato flour, which can increase labor absorption. Large open industries can reduce import costs, thereby growing company profits. So, using purple sweet potato as a local food can provide economic growth.

Crackers consist of two types, namely flaky crackers and non-flaky crackers. The difference is that flaky crackers have a characteristic layered structure, while non-flaky crackers are becoming flaky. They go through a lamination or coating stage using a coating material (dust filling) made from fat, such as a corvette. At the same time, non-flaky crackers do not require a coating material, so the cross-sectional area is not layered or bookmarked. This can speed up the manufacturing process without the additional costs of cracker products that have a non-layered structure[3]. Flaky crackers go through a lamination or coating stage using a coating material (dust filling) made from fat such as vegetable oil. In contrast, non-flaky crackers do not require a coating material, so the cross-sectional area is not layered or bookmarked. This can speed up the manufacturing process without additional costs.

Making non-flaky crackers requires flour with low protein content, such as purple sweet potato, because it does not require high dough development like bread. Non-flaky crackers are made from stiff dough, so they match the characteristics of purple sweet potatoes, which tend to have a hard texture. The presence of anthocyanins in purple sweet potatoes can be used as a natural colouring and antioxidant. Purple sweet potato has a protein fraction that cannot trap gas, so it is suitable for use as a raw material for non-flaky crackers [4]. Based on the considerations above, researchers are interested in researching the effect of purple sweet potato flour substitution on non-flaky cracker products' physical and organoleptic characteristics.

2. Materials and Methods

The Materials used to make non-flaky crackers are purple sweet potato flour, wheat flour, margarine, water, instant yeast, salt, powdered Sugar, milk powder, egg yolk, cornstarch, and baking powder [5].

The variables used in the study were the comparison of purple sweet potato flour and wheat flour regarding consumer acceptance of the resulting product. The research used an experimental study with a non-factorial, Completely Randomized Design (CRD) method with six treatments and four repetitions. The treatments are C0 (100% wheat flour), C1 (10% purple sweet potato flour, 90% wheat flour), C2 (30% purple sweet potato flour, 70% wheat flour), and C3 (50% purple sweet potato flour, 50% wheat flour). wheat), C4 (70% purple sweet potato flour, 30% wheat flour), C5 (90% purple sweet potato flour, 10% wheat flour). This treatment was modified based on research by [6][19]. The 10% concentration range for adding purple sweet potato flour is intended as an initial reference point based on previous studies that showed its effectiveness in producing a balanced texture and taste[5].

The research stages include making non-flaky crackers, organoleptic tests, and physical tests. The process for making non-flaky crackers is weighing the ingredients, mixing the wet and dry ingredients, fermenting for 1 hour at room temperature, moulding the dough to a thickness of 0.1 cm, and baking at 150°C for 10 minutes. After the product manufacturing process, organoleptic testing is continued using 25 somewhat trained panelists to test the hedonic and sensory quality of the product. The number of panelists follows the hedonic test requirements to meet the population. The parameters tested in the organoleptic test include colour, taste, aroma, and texture on a scale of 1-5. The physical test used for colour testing using ImageJ is a laptop, a mini photo studio, and a cellphone. The tools used for physical analysis are texture analyzers. The next stage is data analysis using the ANOVA method and further testing using DMRT (Duncan's Multiple Range Test). The Duncan test will determine the best-selected formulation from the treatment. The formulation of the non-flaky crackers is presented in Table 1.

Table 1. Dough Formulation

Material	Weight (grams)
Flour (50%)	50
Margarine (20%)	20
Water (15%)	15
Refined Sugar (5%)	5
Salt (1%)	1
Yeast (1%)	1
Powdered Milk (5%)	5
Baking Powder (1%)	1
Cornstarch (2%)	2
Total (100%)	100

Modification Recipe [7][18]

3. Results and Discussion

This research produces non-flaky cracker products using purple sweet potato flour as the raw material. This product's formulation selection is based on physical and organoleptic characteristics.

3.1. Organoleptic

Organoleptic characteristics are the characteristics of a food ingredient that are obtained based on the results of organoleptic tests using human senses. The purpose of organoleptic testing is to determine the level of panelists' preference for the product's color, taste, texture, and aroma. Organoleptic testing consists of two types, namely hedonic testing and hedonic quality testing. Hedonic testing or liking testing is a test that asks panelists to provide a response using the five senses to the product from the aspect of liking or disliking the product being tested. Hedonic testing can be carried out on untrained panelists or consumers. In contrast, semi-trained or trained panelists must carry out hedonic quality testing because it requires the ability to evaluate product characteristics. Therefore, the purpose of hedonic testing and hedonic quality is to determine the level of preference and organoleptic characteristics of non-flaky crackers products.

3.1.1. Hedonic Color

Table 2. Hedonic Color

Treatment	Average
C0	3.80 ± 0.86c
C1	2.64 ± 0.76a
C2	3.24 ± 0.66b
C3	3.52 ± 0.92bc
C4	3.52 ± 0.82bc
C5	3.64 ± 0.76bc

The colour of non-flaky crackers is one of the first appearances the human senses see[8]. If a food product has a good taste, nutritional value and good texture but has an unattractive colour, it is likely that the product will be less popular[9]. Table 2 above shows that the substitution of purple sweet potato flour significantly affects the hedonic colour of non-flaky crackers with a significance value ($P<0.05$). This shows that the more purple sweet potato flour is added, the higher the hedonic value of the colour, which means the panelists like it more. However, the highest value was in treatment C0 (100%

wheat flour), namely 3.8 (like), and the lowest value was in treatment C1 (10% purple sweet potato flour and 90% wheat flour), with an average value of 2.64 (not Like).

3.1.2 Hedonic Taste

Table 3. Hedonic Taste

Treatment	Average
C0	2.52 ± 1.20a
C1	2.64 ± 0.90ab
C2	3.20 ± 0.76bc
C3	3.20 ± 0.96bc
C4	3.40 ± 1.15c
C5	3.40 ± 1.0c

Taste is an important element that can determine a product's acceptance level [10]. This can determine the panelists' decision to accept or reject a food product. Table 3 shows that the substitution of purple sweet potato flour has a significant effect ($P<0.05$) on the hedonic taste of non-flaky crackers. The more purple sweet potato flour added, the more panelists will like it from the hedonic taste aspect. The highest value was in treatment C4 and C5, with the same value of 3.4 (somewhat like), while the lowest value in treatment C0 was 2.52 (dislike). Differences in each panelist's preferences cause the taste's hedonic value.

3.1.3 Hedonic Aroma

Table 4. Hedonic Aroma

Treatment	Average
C0	2.92 ± 1.15a
C1	3.12 ± 0.72a
C2	3.4 ± 0.81bc
C3	3.64 ± 0.63c
C4	3.80 ± 0.71c
C5	3.84 ± 0.94c

Aroma is the smell that is smelled by the olfactory nerves in the nasal cavity and is obtained from chemical stimulation [11]. Aroma is a subjective sensation of the human sense of smell that determines the level of acceptability of a product [12]. Table 4 above shows the effect of purple sweet potato flour substitution on the aroma hedonic characteristics, with a significance value ($P<0.05$). Adding more purple sweet potato flour can increase the hedonic value of the aroma, meaning the panellists like it. The highest value was found in treatment C5 (90% purple sweet potato flour, 10% wheat flour), with an average value of 3.84. Therefore, the panellists liked the addition of purple sweet potato flour to non-flaky cracker products in terms of the hedonic aroma aspect.

3.1.4 Hedonic Texture

Table 5. Hedonic Texture

Treatment	Average
C0	2.52 ±1.04a
C1	3.28 ± 1.10b
C2	3.84 ± 0.80c
C3	3.72 ± 0.84bc
C4	3.48 ± 0.92bc
C5	3.24 ± 0.92b

The texture of a food product can be identified using the sense of touch or touch. Texture is an aspect that is considered equivalent to aroma and taste in food imagery[10]. Apart

from aroma and colour, food texture is a component that determines the taste of food. This is caused by the sensitivity of the taste being influenced by the consistency of the food. The hedonic texture ANOVA test results in Table 5 above show a significant difference with a significance value ($P<0.05$). This means that the substitution of purple sweet potato flour substantially affects the hedonic characteristics of the texture. The best value was obtained by the C2 treatment with a concentration of purple sweet potato flour of 30%, and the average value of the panelists was 3.84. This shows that panelists like the addition of purple sweet potato flour to non-flaky cracker products in the hedonic texture aspect.

3.1.5 Hedonic Quality of Color

Table 6. Hedonic Quality of Color

Treatment	Average
C0	1.08 ± 0.28a
C1	1.24 ± 0.435a
C2	2.08 ± 0.75b
C3	2.64 ± 1.15c
C4	3.24 ± 1.39d
C5	3.28 ± 1.24d

Table 6 shows that substituting purple sweet potato flour significantly affects non-flaky cracker products' colour hedonic quality characteristics. The more concentrated purple sweet potato flour is added, the closer the colour becomes to purple. The highest value was in the C5 treatment (90% purple sweet potato flour, 10% wheat flour), with an average value of 3.28, which means it is slightly purple.

The purple colour of purple sweet potatoes is due to the anthocyanin pigment in the tubers and skin. Therefore, purple sweet potato can be an alternative natural dye [13]. The purple colour in non-flaky cracker products substituted for purple sweet potato flour is darker. The skin and flesh of purple sweet potatoes are deep purple [14].

3.1.6 Hedonic Quality of Taste

Table 7. Hedonic Quality of Taste

Treatment	Average
C0	1.64 ± 0.907a
C1	1.96 ± 0.88a
C2	2.68 ± 0.85b
C3	3.20 ± 0.96c
C4	3.84 ± 1.25d
C5	3.92 ± 0.86d

The human senses can perceive the main flavours are sweet, bitter, sour, and salty. Additionally, taste can be influenced by smell, taste, and oral stimuli such as heat or cold [13]. Table 7 above proves that the substitution of purple sweet potato flour significantly affects the hedonic quality characteristics of the non-flaky cracker taste, as indicated by the different letter notations in the table. The higher the concentration of purple sweet potato flour added to the non-flaky cracker product, the more purple sweet potato taste it will have. The highest value was found in treatment C5 (90% purple sweet potato flour, 10% wheat flour), which had a mean value of 3.92 (purple sweet potato taste). Generally, purple sweet potatoes taste sweet, so you don't need to use a lot of Sugar [15]. Crackers taste savoury and tend to be salty, so adding salt is necessary. Apart from that, the salty

taste can come from the margarine used in making crackers, which is useful as an emulsifiers.

3.1.7 Hedonic Quality of Aroma

Table 8. Hedonic Quality of Aroma

Treatment	Average
C0	1.72 ± 0.84a
C1	2.0 ± 0.76a
C2	2.6 ± 0.86b
C3	3.0 ± 1.08bc
C4	3.4 ± 1.12c
C5	3.4 ± 0.95c

Aroma is one important aspect that can determine the level of panelist acceptance apart from the colour and taste aspects. The aroma hedonic quality test is carried out by trained panelists who use their sense of smell to assess the product [16]. The ANOVA results showed that the substitution of purple sweet potato flour significantly affected the hedonic quality characteristics of the aroma of non-flaky crackers with a significance value ($P<0.05$). The highest values were found in treatments C4 (70% purple sweet potato flour, 30% wheat flour) and C5 (90% purple sweet potato flour, 10% wheat flour) with a value of 3.4 (slightly smelling of purple sweet potato). The non-flaky aroma of crackers is caused by adding purple sweet potato flour to the product. The higher the addition of purple sweet potato flour, the higher the aroma of purple sweet potato flour will be felt. The aroma can be influenced by certain components that cause a distinctive smell, such as margarine and Sugar. The aroma arising from the Maillard reaction during the roasting process produces folate compounds [4].

3.1.8 Hedonic Quality of Texture

Table 9. Hedonic Quality of Texture

Treatment	Average
C0	2.2 ± 1.0a
C1	3.12 ± 1.23bc
C2	3.84 ± 0.89d
C3	3.64 ± 0.99cd
C4	3.44 ± 1.08cd
C5	2.84 ± 1.067b

The texture is the taste value on a surface and is one of the components determining food taste. This is caused by the sensitivity of the sense of taste being influenced by the consistency of the food [17]. The table above shows that the notation is different for each treatment. Hence, the substitution of purple sweet potato flour significantly affects the hedonic quality characteristics of the non-flaky cracker texture. This proves that more sweet potato flour added to non-flaky cracker products will produce a slightly crunchier texture. However, adding too much will make the product more complex. The best value was found in the C2 treatment (30% purple sweet potato flour, 70% wheat flour), with the highest value of 3.84 (slightly crunchy).

3.2. physical

3.2.1 Image Processing

Table 10. *Colour Test Result*

Treatment	Average value		
	L	**a**	**b**
C0	59.4 ± 2.07d	1.97 ± 0.54a	35.9 ± 2.63d
C1	43.41 ± 3.35c	4.29 ± 6.19a	22.16 ± 4.69c
C2	35.93 ± 3.94b	12.74 ± 1.99b	18.52 ± 2.45c
C3	29.21 ± 0.75a	9.23 ± 0.35b	14.22 ± 0.34b
C4	32.3 ± 4.42ab	13.05 ± 0.21b	13.15 ± 1.5ab
C5	29.11 ± 4.76a	11.13 ± 1.08b	9.53 ± 1.26a

The results of colour analysis using the ImageJ application in Table 10 show that the substitution of purple sweet potato flour significantly affects the colour characteristics of non-flaky crackers with a significance value (P<0.05). The results of the research showed that the higher the amount of purple sweet potato flour added, the darker the colour of the non-flaky crackers or the lower the brightness level.

The colour produced in non-flaky crackers from purple sweet potato flour tends to be dark brown. The decreasing brightness value could be caused by adding more purple sweet potato flour[18]. The anthocyanin pigment content causes the purple colour in non-flaky cracker products. Anthocyanins are a group of reddish pigments found in cell fluids that are water soluble [19]. This follows the data produced because the more purple sweet potato flour added, the higher the value (redness). The highest redness value (a) was found in treatment C4 (70% purple sweet potato flour, 30% wheat flour) with a value of 13.05 ± 0.21. Meanwhile, the lowest value was found in the C0 treatment (100% wheat flour), with a value of 1.97 ± 0.54.

The table above shows that the yellowness value (b) will decrease as more purple sweet potato flour is added. The highest yellowness value (b) was found in the C0 treatment (100% wheat flour) with 35.9 ± 2.63 because, in this treatment, there was no addition of wheat flour, so the product tended to be yellow. The lowest yellowness value was in the C5 treatment (90% wheat flour, 10% wheat flour), with a value of 9.53 ± 1.26. In the C5 treatment, a lot of purple sweet potato flour was added, causing the product not to be yellow. The yellowness value (b) decreases due to anthocyanin pigments. Anthocyanins will give the product a red-blue colour [19].

3.2.2 Breakage Force

Table 11. Breakage Force

Treatment	Average
C0	150 ± 57.7c
C1	100 ± 0.0b
C2	25 ± 50a
C3	0.0 ± 0.0a
C4	0.0 ± 0.0a
C5	0.0 ± 0.0a

The results of the breakage force analysis using a texture analyzer in the table above show that the substitution of purple sweet potato flour significantly affects the physical characteristics of flaky crackers, with a significance value (P<0.05). The more purple sweet potato flour added, the higher the breaking strength value. The breaking strength value

or hardness level can be influenced by the material's water, fiber, starch, and protein content.

3.2.3 Expansion Ability

Table 12. Expansion Ability

Treatment	Average
C0	$150 \pm 57{,}7^{c}$
C1	$100 \pm 0{,}0^{b}$
C2	25 ± 50^{a}
C3	$0{,}0 \pm 0{,}0^{a}$
C4	$0{,}0 \pm 0{,}0^{a}$
C5	$0{,}0 \pm 0{,}0^{a}$

According to Table 4.11 above, the substitution of purple sweet potato flour significantly affects the characteristics of non-flaky crackers with a significance value ($P<0.05$). The best value is found in treatment C0 (100% wheat flour) with a value of 175 ± 05. In treatment C0, there is no addition of purple sweet potato flour, so the dough expansion is better because the protein content of wheat flour is higher than that of purple sweet potato flour. The expansion ability will increase with the higher protein content [20].

Determination of Best Treatment

Parameter	Treatment					
	C0	**C1**	**C2**	**C3**	**C4**	**C5**
Hedonic Color	✓			✓	✓	✓
Hedonic Taste			✓	✓	✓	✓
Hedonic Aroma			✓	✓	✓	✓
Hedonic Texture			✓	✓	✓	
Hedonic Quality Color					✓	✓
Hedonic Quality Taste					✓	✓
Hedonic Quality Aroma				✓	✓	✓
Hedonic Quality Texture			✓	✓	✓	
Brightness (L)	✓					
Redness (a)			✓	✓	✓	✓
Yellowness (b)	✓					
Breakage Force	✓	✓	✓	✓		
Expansion Ability	✓					
Total	5	1	6	8	9	7

Based on the table above, it can be concluded that the selected treatment is C4 (70% purple sweet potato flour and 30% wheat flour). This chosen treatment will be chemically analyzed with the following results. Substitution of purple sweet potato flour significantly affects the hedonic characteristics and hedonic quality of color, taste, aroma, texture, and physical attributes of color, breaking power, and expansion power of non-flaky crackers products. Purple sweet potato flour's content differs from wheat flour's.

4. Conclusions

Substitution of purple sweet potato flour with concentrations of 0%, 10%, 30%, 50%, 70%, and 90% has a significant effect on the hedonic characteristics and hedonic quality of colour, taste, aroma, texture, and physical attributes of colour, breaking strength, and the expanding power of non-flaky cracker products. Based on the research results, it is better to study further the modification process of purple sweet potato flour to avoid increasing water content. Further research is needed regarding the shelf life of non-flaky

crackers substituted with purple sweet potato flour. Studying the antioxidant activity of non-flaky crackers with purple sweet potato flour is necessary.

References

[1] O. B. Oluwole *et al.*, "Effect of Baking Temperature on the Quality of Baked Sweet Potato Crisps," *Br J Appl Sci Technol*, vol. 4, pp. 3419–3429, 2014, [Online]. Available: https://api.semanticscholar.org/CorpusID:123438735

[2] A. Rahim, "Physical, Chemical, and Sensory Characteristics Of Instant Noodles Made By Purple Sweet Potato Flour (Ipomea Batatas L. Poir) At Various Cencentration.," *AGROLAND: The Agricultural Sciences Journal*, vol. 7, no. 2, pp. 133–143, 2020.

[3] K. Syafitri, A. Ali, and D. F. Ayu, "Pemanfaatan Tepung Pisang Raja sebagai Bahan Baku Pembuatan Non-Flaky Crackers," *JURNAL AGROINDUSTRI HALAL*, vol. 4, no. 2, pp. 109–116, Oct. 2018, doi: 10.30997/jah.v4i2.1181.

[4] R. R. Rahmalia, R. Yuliani, A. Nurfadyah Islami, F. Khoerunnisa, D. Yuli, and P. Sari, "The effect of composition purple sweet potato flour (Ipomoea batatas L.) and wheat on the physical, chemical and sensory properties in cookies," *Journal of Food and Agricultural Product*, vol. 4, no. 2, 2024, [Online]. Available: http://journal.univetbantara.ac.id/index.php/jfap

[5] N. Novidahlia, S. Maulida Ulfa, and T. Rohmayanti, "Formulation of Food Bar as An Emergency Food Based Orange Sweet Potato Flour (Ipomoea Batatas L.) and Red Bean Flour (Phaseolus Vulgaris L.)," *Jurnal Agroindustri Halal* , vol. 8, no. 1, pp. 128–136, Dec. 2022.

[6] Z. F. Walneg and S. A. Marliyati, "Substitusi Tepung Ubi Jalar Ungu (Ipomoea batatas L.) Sebagai Sumber Serat dan Antioksidan pada Flaky Crackers Untuk Remaja," *Jurnal Ilmu Gizi dan Dietetik*, vol. 1, no. 2, pp. 127–134, 2022, doi: 10.25182/jigd.2022.1.2.127-134.

[7] A. S. Rahayu, "Crackers Substitusi Tepung Ampas Kelapa Sebagai Makanan Selingan Sumber Serat Bagi Penderita Diabetes Melitus Tipe 2," pp. 31–41, 2023.

[8] R. M. Anugrah and E. Suryani, "Kandungan Gizi Donat dengan Penambahan Ubi Ungu (Ipomoea Batatas L.) Sebagai Makanan Jajanan Berbasis Pangan Lokal Bagi Anak Sekolah," 2020.

[9] M. Sulandra, "Effect of Adding Purple Sweet Potato (Ipomoea Batatas L.) on Organoleptic Properties and Antioxidant Activity in Yangko Cake," *Agrotech : Jurnal Ilmiah Teknologi Pertanian*, pp. 1–9, 2020, Accessed: Apr. 19, 2025. [Online]. Available: https://doi.org/10.37631/agrotech.v3i1.171

[10] S. Handayani and K. Hidayati, "Analysis of Betacarotene, Total Sugar, and Organoleptic Jam of Purple Sweet Potato (Ipomoea Batatas L. Poir) Variation with Cassava Sugar (Manihot Esculenta)," *Amerta Nutrition*, vol. 8, no. 2, pp. 253–262, Jun. 2024, Accessed: Apr. 19, 2025. [Online]. Available: 10.20473/amnt.v8i2.2024.253- 262

[11] Maharani, I. Pratiwi, and Y. S. Soeka, "Nutrient Composition, Content of Bioactive Compounds and Hedonic Test of Purple Sweet Potato Flour Cake (Ipomoea batatas cultivar Ayamurasaki) Fermentation," *J Biologi Indones*, vol. 1, no. 19, pp. 43–56, 2023, doi: 10.47349/jbi/19012023/43.

[12] V. A. Nurhidayati, A. Rizkiriani, A. Nuraeni, A. G. Prameswari, C. E. Marlina, and F. K. Naqli, "Development of Dimsum Product from Purple Sweet Potato Ipomoea batatas L.," *Jurnal Sains Terapan*, pp. 98–109, Dec. 2022, doi: 10.29244/jstsv.12.2.98-109.

[13] D. Lamusu, "Organoleptic TEct Jalangkote Ubi Jalar Purple (Ipomoea batatas L) As Food Diversification Effort," *Jurnal Pengolahan Pangan*, vol. 1, no. 3, pp. 9–15, 2017, doi: https://doi.org/10.31970/pangan.v3i1.7.

[14] L. V. Rezende *et al.*, "Study of the drying process of the purple-fleshed sweet potato (Ipomoea batatas (L.) Lam) in spouted bed," *Food Science and Technology*, vol. 44, Mar. 2024, doi: 10.5327/fst.00180.

[15] G. Jingrong *et al.*, "Image Analysis of the Sugar-reduced Muffin Formulated with Stevianna® or Inulin as a Sugar Replacer," *Grain & Oil Science and Technology*, vol. 1, no. 2, pp. 63–71, Apr. 2018, doi: 10.3724/sp.j.1447.gost.2018.18043.

[16] S. Lestari, Y. Wibisono, T. R. Pangan, J. T. Pertanian, and N. Jember, "Pengaruh Konsentrasi Tepung Sorgum dan Tepung Daun Katuk Terhadap Sifat Fisik, Kimia, dan Hedonik Cookies," 2023.

[17] M. M. Rochmah, A. D. Sofa, E. E. Oktaviya, I. Muflihati, and A. R. Affandi, "Chemical Characteristic and Organoleptic Churros Substituted with Rice Flour with Sweet Potato Flour," *Jurnal Pangan dan Gizi*, vol. 9, no. 1, pp. 2086–6429, 2019, doi: http://jurnal.unimus.ac.id/index.php/JPDG.

[18] H. Ji, H. Zhang, H. Li, and Y. Li, "Analysis on the Nutrition Composition and Antioxidant Activity of Different Types of Sweet Potato Cultivars," *Food Nutr Sci*, vol. 06, no. 01, pp. 161–167, 2015, doi: 10.4236/fns.2015.61017.

[19] N. A. Sunaryo, P. D. Ab Rashid, R. Nurmalasari, and S. Soekopitojo, "The effect of purple sweet potato flour (Ipomoea batatas L) as substitution on anthocyanins content and antioxidant capacity of snow white's ball cookies," *IOP Conf Ser Earth Environ Sci*, vol. 1302, no. 1, 2024, doi: 10.1088/1755-1315/1302/1/012078.

[20] T. M. Kiranawati, U. Rohajatien, and R. S. Jayanti, "The Effect Of Long Fermentation Of Dough On Physical And Chemical Properties Of Crackers Substitution Of Composite Flour," vol. 11, no. 2, pp. 133–142, Aug. 2021, doi: 10.31186/j.agroind.11.2.133-142.