Vol 9 No. 1 (2024) 49- 61 ISSN (Online) : 2502-0943

Jurnal Katalisator

CHEMICAL AND ORGANOLEPTIC CHARACTERISTICS OF DONUTS FROM SEVERAL TYPES OF SWEET POTATO FLOUR

Inawaty Sidabalok[1)], Rera Aga Salihat[*1)], Muhammad Farid[1)], Eddwina Aidila Fitria[1)]

[1)]Agricultural Product Technology Study Department, Agriculture Faculty, Ekasakti University, Padang

*E-mail: reraagasalihat@unespadang.ac.id

Detail Artikel

Diterima : 23 Februari 2024
Direvisi : 14 April 2024
Diterbitkan : 29 April 2024

Kata Kunci

antioxidant
sweet potato
proximate
donut
organoleptic

Penulis Korespondensi

Name : Rera Aga Salihat
Affiliation : Agriculture Faculty, Ekasakti University, Padang
E-mail : reraagasalihat@unespadang.ac.id

ABSTRACT

Donuts are a snack made from wheat flour and are popular among various groups. However, wheat flour contains gluten, which can cause the immune system of a person with celiac disease to react to gluten and attack the small intestine lining. Therefore, wheat flour needs to be substituted with alternative ingredients, one of which is sweet potato flour. This research aims to determine the effect of different types of sweet potato flour in making donuts on their chemical and organoleptic characteristics. The research design used was a Completely Randomized Design (CRD) with five treatments and three replications. Observation data were analyzed using ANOVA and Duncan's New Multiple Range Test (DNMRT) at α = 1%. The treatment in this study was the addition of variations of sweet potato flour (A = 50% white sweet potato, B = 50% purple sweet potato, C = 50% yellow sweet potato, D = 50% orange sweet potato, E = 50% cilembu sweet potato). Further test results showed that the addition of various variations of sweet potato flour had very significantly different effects on moisture, ash, fat, protein, carbohydrate content, and antioxidant activity. Based on organoleptic tests, the best treatment was treatment E (cilembu sweet potato flour) with an average value of 5.93 (very like), where the resulting donuts had the following chemical characteristics: moisture content (24.18%), ash content (2.10%), fat content (10.87%), protein content (14.96%), carbohydrate content (56.74%) and antioxidant activity (64.75%). Donuts with cilembu sweet potatoes have the most fragrant aroma, golden brown color, slightly sweet taste, and soft texture.

http://doi.org/10.22216/jk.v5i2.5717
Published by LLDIKTI Wilayah X

Jurnal Katalisator Vol 9 No. 1 (2024) 49-61

INTRODUCTION

Donuts are round-shaped bread with the characteristic that they have a hole in the middle and are prepared by frying or baking (Amelia *et al*., 2020). Donuts are a snack that is popular among various circles of society. Donuts are made from wheat flour, granulated sugar, eggs, and butter (Huq et al., 2021). The main ingredient for making donuts is wheat flour. The nutritional content of wheat flour includes protein 7.5-15%, ash 0.30-1%, fat 1-1.5%, and carbohydrates in the form of starch 68-76% (Zhang, 2020). Wheat flour has a unique content compared to other flour types, namely gluten (Xu & Kuang, 2024).

Wheat flour is flour obtained from the process of milling wheat grains. Wheat flour contains gluten which causes the dough to become elastic and not easily destroyed during the processing process (Shewry, 2019). However, consuming gluten can cause the immune system of a person with celiac disease to react to gluten and attack the lining of the small intestine (Akesowan et al., 2022). This reaction can interfere with the absorption of nutrients from food and cause symptoms such as diarrhea, bloating, fatigue and weight loss (Namir et al., 2021). One alternative ingredient that can replace wheat flour is sweet potato flour.

Sweet potato (*Ipomoea batatas* L.) is a tuber plant that can grow and develop quickly in Indonesia. Sweet potatoes are the fourth most significant source of carbohydrates after rice, corn, and cassava. Sweet potatoes can increase food availability and diversity in society. As a source of nutrition, sweet potatoes contain energy, β-carotene, vitamin C, niacin, riboflavin, thiamin, and various minerals (Q. Li et al., 2023). The uniqueness of sweet potatoes is that the color of their flesh varies, showing their bioactive components and taste. The tubers' purple, yellow, orange, and orange flesh indicates the presence of β-carotene, which functions as an antioxidant in the human body. Sweet potatoes are often processed into flour to be used as raw material for various food products.

Sweet potato flour is a processed sweet potato product that can be used as a raw material in the food industry. Sweet potato flour can make bread, cakes, biscuits, and other food products, including donuts (Wahyuningsih, 2023).

Research on making donuts by substituting white, yellow, and purple sweet potatoes has been carried out (Ernayanti, 2021). However, in this research, wheat flour was still used as the primary raw material and had yet to be entirely replaced by sweet potato flour. Apart from that, the sweet potatoes used are in pasta form. Therefore, research on the effect of variations in sweet potato flour in making donuts on their chemical and organoleptic characteristics has never been carried out before.

MATERIALS AND METHODS

Materials and tools

The main ingredients used in this research were white sweet potatoes, yellow sweet potatoes, orange sweet potatoes, cilembu sweet potatoes, and purple sweet potatoes obtained from Pasar Raya Padang, West Sumatra. Additional ingredients for making donuts include instant yeast, granulated sugar, chicken eggs, margarine, powdered milk, salt, cooking oil, and water.

http://doi.org/10.22216/jk.v5i2.5717

Published by LLDIKTI Wilayah X

Jurnal Katalisator Vol 9 No. 1 (2024) 49-61

Chemicals used in parameter testing include distilled water (Brataco), n-hexane (SmartLab), sulfuric acid (SmartLab), sodium hydroxide (Merck), hydrochloric acid (Merck), selenium mixture (Merck), boric acid (Merck), phenolphthalein (Merck) and DPPH (Sigma Aldrich).

Tools used in making products include digital scales, knives, basins, pans, trays, grinders, donut molds, and gas stoves.

The testing instruments used are a UV-vis spectrophotometer (Thermoscientific Genesys 150), Kjeldahl testing device (Pyrex), soxhlet extraction device (Pyrex), laboratory oven (Memmert UN 110), furnace (Carbolite AAF 1100), and other tools.

Research procedure

Making sweet potato flour begins by washing fresh sweet potatoes, peeling them, and then slicing them to a thickness of 1 mm. Sweet potato slices were soaked in 0.1% sodium bisulfite for 10 minutes. After that, the sweet potatoes were dried in a food dehydrator for 12 hours at 60 oC. The dried sweet potatoes are ground and sieved with a 60-mesh size (Iriyanti, 2012).

Making sweet potato donuts begins by weighing all the ingredients with the following weights: 50 g wheat flour, 50 g sweet potato flour (based on treatment), 1.5 g instant yeast, 60 ml water, 15 g granulated sugar, 6 g margarine, 5 g milk powder, 10 g egg yolk and 1 g salt. Then, stir the mixture until smooth and knead the dough until smooth. The dough is then fermented for 30 minutes, molded, and fermented again for 60 minutes. The dough that has risen is then fried using heated oil until cooked, characterized by a brownish color (Swandani et al., 2017). The product is ready for use in chemical and organoleptic parameter testing.

Research methods

The research design used was a one-level Completely Randomized Design (CRD) with five treatments and three replications. The observation data were analyzed using analysis of variance (ANOVA) with the F test and Duncan's New Multiple Ranger Test (DNMRT) at a significance level of 1%.

The treatments in this research were various types of sweet potato flour in making donuts, namely:

A = white sweet potato flour 50%
B = purple sweet potato flour 50%
C = yellow sweet potato flour 50%
D = orange sweet potato flour 50%
E = cilembu sweet potato flour 50%

Proximate Assessment

The proximate analysis included moisture content using the air oven method, ash content using the direct method, fat content using the Soxhlet extraction method, and protein content using the Microkjeldahl method (Andarwulan et al., 2011).

http://doi.org/10.22216/jk.v5i2.5717

Published by LLDIKTI Wilayah X

Jurnal Katalisator Vol 9 No. 1 (2024) 49-61

Determination of Antioxidant Activity

1,1-diphenyl-2-picryl hydrazyl (DPPH) radical was used to determine the antioxidant activity of the samples (Koleva et al., 2002). Samples from all treatments were placed in equal volumes into DPPH dissolved in methanol (100 µM). After 15 minutes at room temperature, absorbance was measured at 517 nm.

Organoleptic Assessment

Organoleptic testing is a method to determine the panelists' response to the donut products produced. Organoleptic tests are carried out with four parameters: color, aroma, texture, and taste because the level of consumer preference for a product is influenced by taste, aroma, texture, and color (Restuning, 2012). Several panelists carried out organoleptic tests to determine the level of consumer acceptance of the steamed brownie product produced with a panelist assessment score of 1 = dislike extremely, 2 = dislike moderately, 3 = dislike slightly, 4 = neither like nor dislike, 5 = like slightly, 6 = like moderately and 7 = like extremely.

RESULTS AND DISCUSSION

Moisture content

Moisture content is an important parameter that determines the texture quality of the donuts produced (Budaraga et al., 2023b; L. Li et al., 2022). The diversity analysis results showed that different types of sweet potato flour had very significantly different effects ($P<0.01$) on the moisture content of donuts. The average moisture content of donuts is presented in Table1.

Table 1. Average moisture content of donuts

Treatment	Moisture (%)
A	16.48 a ± 2.60
B	29.09 e ± 1.41
C	19.49 b ± 1.27
D	27.62 d ± 1.77
E	24.18 c ± 0.13
DC = 2.42%	

Table 1 shows that the moisture content of donuts ranges from 16.48-29.09%. The highest moisture content was found in treatment B (purple sweet potato flour) at 29.09%, while the lowest moisture content was obtained in treatment A (white sweet potato flour) at 16.48%. Based on further DNMRT tests at the 1% level, each treatment showed a very

http://doi.org/10.22216/jk.v5i2.5717
Published by LLDIKTI Wilayah X

Jurnal Katalisator Vol 9 No. 1 (2024) 49-61

significant difference in the moisture content of the donuts. The higher the starch content of a material, the higher its ability to absorb water so that the moisture content will be higher (Hastuti, 2014).

The data in Table 1 corresponds to the moisture content of each main ingredient used, where the moisture content of white sweet potato (68.78%), purple sweet potato (70.46%), yellow sweet potato (64.15%), orange sweet potato (68.78%) and cilembu sweet potato (65.00%) (Mahmudatussa'adah, 2014; Yuliansar et al., 2020). The frying process causes a decrease in moisture content in donut products before testing the moisture content. The frying process causes the water molecules bound in the material matrix to escape.

Ash content

Ash content is an indicator in determining the purity and cleanliness of a food product (Salihat et al., 2023). The diversity analysis results showed that different types of sweet potato flour had very significantly different effects ($P<0.01$) on the ash content of donuts. The average ash content of donuts is presented in Table 2.

Table 2. Average ash content of donuts

Treatment	Ash (%)
A	1.30 c ± 0.14
B	1.04 b ± 1.36
C	0.13 a ± 0.80
D	1.70 d ± 0.17
E	2.10 e ± 0.31
DC = 5.60 %	

Table 2 shows that the sweet potato donuts' ash content ranges from 0.13-1.70%. The highest ash content was found in treatment E (cilembu sweet potato flour) at 2.10%, while the lowest ash content was found in treatment C (yellow sweet potato flour) at 0.13%. Based on further DMRT tests at the 1% level, each treatment showed a very significant difference in the ash content of sweet potato donuts. This shows differences in the mineral content of each type of sweet potato. The mineral content in the essential ingredients causes the high ash content in donuts. This statement is in accordance with the opinion (Aulia & Putri, 2015), that the more mineral content in sweet potatoes, the higher the ash content.

Ash content of white sweet potato (0.93%), purple sweet potato (0.84%), yellow sweet potato (0.71%), orange sweet potato (0.99%), and cilembu sweet potato (1.45%) (Mahmudatussa'adah, 2014; Yuliansar et al., 2020). According to research (Ambarsari et al., 2009), differences in ash content can be caused by differences in the sweet potato varieties used.

http://doi.org/10.22216/jk.v5i2.5717
Published by LLDIKTI Wilayah X

Jurnal Katalisator Vol 9 No. 1 (2024) 49-61

Fat content

The diversity analysis results showed that adding various variations of sweet potato flour had a very significantly different effect (P<0.01) on the fat content of donuts. The average fat content of donuts is presented in Table 3.

Table 3. Average fat content of donuts

Treatment	Fat (%)
A	17.75 d ± 1.38
B	23.43 e ± 0.70
C	9.67 a ± 2.17
D	15.74 c ± 1.02
E	10.87 b ± 1.76
DC = 2.80 %	

Table 3 shows that the sweet potato donuts' fat content ranges from 9.67-23.43%. The highest fat content was in treatment B (purple sweet potato flour) at 23.43%, while the lowest fat content was in treatment C (yellow sweet potato flour) at 9.67%. Based on further DMRT tests at the 1% level, each treatment showed a very significant difference in the fat content of sweet potato donuts.

There are fat content of white sweet potato (0.77%), purple sweet potato (0.94%), yellow sweet potato (0.59%), orange sweet potato (0.68%), and cilembu sweet potato (0.63%) (Mahmudatussa'adah, 2014; Yuliansar et al., 2020). What influences the fat content of sweet potatoes is that each type of sweet potato has different contents for each type. The high fat content in donut products is also caused by the fat content in the raw materials, namely margarine and eggs, as additional ingredients (Salihat & Putra, 2021b).

Protein content

Protein is an essential nutrient for the body because this macromolecule functions as a building and regulating substance (Budaraga et al., 2023a). The diversity analysis results showed that different types of sweet potato flour had very significantly different effects (P<0.01) on the protein content of donuts. The average protein content of donuts is presented in Table 4.

http://doi.org/10.22216/jk.v5i2.5717
Published by LLDIKTI Wilayah X

Jurnal Katalisator Vol 9 No. 1 (2024) 49-61

Table 4. Average protein content of donuts

Perlakuan	Kadar Protein (%)
A	12.11 b ± 1.93
B	10.72 b ± 2.19
C	7.08 a ± 1.26
D	8.10 a ± 2.04
E	14.96 c ± 2.53
DC = 6.10 %	

Table 4 shows that the sweet potato donuts' protein content ranges from 7.08-14.49%. The highest protein content was found in treatment E (cilembu sweet potato flour) at 14.96%, while the lowest protein content was found in treatment C (yellow sweet potato flour) at 7.08%. Based on further DMRT tests at the 1% level, each treatment showed a very significant difference in the protein content of sweet potato donuts.

There are protein content of white sweet potato (0.89%), purple sweet potato (0.77%), yellow sweet potato (0.45%), orange sweet potato (0.49%), and cilembu sweet potato (2.81%) (Mahmudatussa'adah, 2014; Yuliansar et al., 2020). The levels of the main ingredients for making donuts are comparable to those of donut products produced, as in Table 4. Protein is an essential substance for the body because this substance, besides functioning as fuel in the body, also functions as a building and regulating substance.

Carbohydrate content

The diversity analysis results showed that different types of sweet potato flour had very significantly different effects ($P<0.01$) on the carbohydrate content of donuts. The average carbohydrate content of donuts is presented in Table 5.

Table 5. Average carbohydrate content of donuts

Treatment	Carbohydrate (%)
A	46.20 a ± 1.78
B	44.04 a ± 2.07
C	53.57 b ± 2.44
D	45.78 a ± 1.23
E	56.74 c ± 1.80
DC = 1.70 %	

http://doi.org/10.22216/jk.v5i2.5717
Published by LLDIKTI Wilayah X

Jurnal Katalisator Vol 9 No. 1 (2024) 49-61

Table 5 shows that the carbohydrate content of the sweet potato donuts produced ranges from 44.04-56.74%. The highest carbohydrate content was in treatment E (cilembu sweet potato flour) at 56.74%, while the lowest carbohydrate content was in treatment B (purple sweet potato flour) at 44.04%. Based on further DMRT tests at the 1% level, each treatment showed very significant differences in the carbohydrate content of sweet potato donuts.

Sweet potatoes have a relatively high source of carbohydrates, where the carbohydrate content is white sweet potatoes (28.79%), purple sweet potatoes (12.64%), yellow sweet potatoes (34.10%), orange sweet potatoes (24.47%), and cilembu sweet potato (55.11%) (Mahmudatussa'adah, 2014; Yuliansar et al., 2020). This value is in line with the data shown in Table 5. The more sweet potato flour added, the higher the carbohydrate content of the donut (Anugrah et al., 2020).

Antioxidant activity

The results of the diversity analysis showed that the addition of various variations of sweet potato flour had a very significantly different effect ($P<0.01$) on the antioxidant activity of donuts. The average antioxidant activity of donuts is presented in Table 6.

Table 6. Average antioxidant activity of donuts

Treatment	Antioxidant Activity (%)
A	14.90 a ± 0.40
B	74.64 e ± 1.21
C	56.45 b ± 1.09
D	59.48 c ± 0.84
E	64.75 d ± 1.68
DC = 1.80 %	

Table 6 shows that the antioxidant activity of sweet potato donuts ranges from 14.90-74.64%. The highest antioxidant activity was found in treatment B (purple sweet potato flour) at 74.64%, while the lowest antioxidant activity was found in treatment A (white sweet potato flour) at 14.90%. Based on further DMRT tests at the 1% level, each treatment showed a very significant difference in the antioxidant activity of sweet potato donuts. This shows that there are differences between each type of sweet potato.

These are the antioxidant activity of white sweet potato (8.38%), purple sweet potato (79.41%), yellow sweet potato (7.14%), orange sweet potato (8.38%), and cilembu sweet potato (59.74 %) (Arief, 2012; Fitriani et al., 2019; Retnati et al., 2009). The high level of antioxidants in purple sweet potatoes is caused by anthocyanin compounds, which are also purple pigments (Budaraga & Salihat, 2020). Antioxidant activity generally decreases after processing (Salim et al., 2017).

http://doi.org/10.22216/jk.v5i2.5717
Published by LLDIKTI Wilayah X

Jurnal Katalisator Vol 9 No. 1 (2024) 49-61

Antioxidants are compounds that can delay, slow down, and prevent the oxidation process caused by free radicals (Salihat & Putra, 2021a). Antioxidants work by capturing free radicals so that they do not have the opportunity to attach to and damage DNA (Kumalaningsih, 2006). The human body does not have excess antioxidant reserves, so if excessive radical exposure occurs, the body needs antioxidants. Therefore, the donuts produced in this research can be used as a source of antioxidant compounds needed by the body to ward off free radicals that cause cancer.

Organoleptic Test

Organoleptic testing is one of the factors that determines the quality and consumer acceptance of a product. The organoleptic test is carried out through sensory assessment, namely by tasting the taste and observing the donut's color, aroma, and texture. This assessment is done by making donuts according to the treatment formulation and testing them with 25 untrained panelists.

Table 7. Recapitulation of organoleptic tests for sweet potato donuts

Treatment	Assesments				
	Aroma	Color	Flavor	Texture	Average
A	4.10	5.02	4.42	5.63	4.79
B	5.38	3.24	5.01	4.28	4.47
C	5.21	5.29	6.04	5.15	5.42
D	5.26	5.18	5.95	4.58	5.24
E	6.35	6.26	6.59	4.52	5.93

The evaluation was identified using a 7-point hedonic scale (1=dislike extremely, 2=dislike moderately, 3=dislike slightly, 4=neither like nor dislike, 5=like slightly, 6=like moderately and 7=like extremely)

Aroma

The aroma of food determines the deliciousness of the food. Assessing the aroma of food must be distinct from the function of the sense of smell. The aroma received by the nose and brain is generally a mixture of four primary aromas: fragrant, sour, rancid, and burnt. Table 7 shows that the panelists' highest assessment of the aroma of sweet potato donuts was in treatment E (cilembu sweet potato flour), namely 6.35 (like moderately). Donuts made with cilembu sweet potato flour have the most fragrant and soft aroma. Cilembu sweet potatoes have a high dissolved sugar content. When fried in the oven or baked at a specific temperature and time, they produce a soft, honey-like aroma (Choir & Akbar, 2023)

The lowest rating for sweet potato donuts was in treatment A (white sweet potato flour), namely 4.10 (neither like nor dislike). The addition of white sweet potato flour has no effect

http://doi.org/10.22216/jk.v5i2.5717

Published by LLDIKTI Wilayah X

Jurnal Katalisator Vol 9 No. 1 (2024) 49-61

on the aroma of the donuts produced because white sweet potato has no aroma or is neutral. This statement is supported by the results of research by Amelia et al. (2020), who stated that the substitution of up to 40% wheat flour with sweet potato flour did not affect the panelists' preferences for the aroma of the donuts produced.

Color

The color of the brownies is brownish-black. The color is influenced by the ingredients used, namely flour, chocolate, and liquid (Omira, 2013). Color assessment is carried out by directly observing the product from the point of view of each panelist. Determining the quality of a food ingredient depends on several factors, but before other factors are observed, the color factor appears first to determine the quality of the food ingredient.

Table 7 shows that the panelists' highest assessment of the color of sweet potato donuts was in treatment E (cilembu sweet potato flour), namely 6.26 (like moderately). From the results of research that has been carried out, the color produced by cilembu sweet potato donuts is golden brown due to the caramelization process that occurs. Sugar caramelization breaks down sugar when heated above its melting point, so the food product changes color to brown (Sitepu, 2019). The lowest rating for sweet potato donuts was in treatment B (purple sweet potato flour), namely 3.24 (dislike slightly). Purple sweet potato flour is used to make donuts, which produces a blackish-purple color, making the donuts less attractive.

Flavor

Taste is the parameter that most influences consumer acceptance of a food product. Taste involves each panelist's sense of tongue. Taste can be influenced by several factors, namely chemical compounds, temperature, concentration, and interaction of one flavor component with other flavor components.

Table 7 shows that the panelists' highest assessment of the taste of sweet potato donuts was in treatment E (cilembu sweet potato flour), namely 6.59 (like extremely). The results of research on adding cilembu sweet potato flour to making donuts show that the resulting taste tends to be sweeter than donuts produced with other sweet potato flour. The lowest rating for sweet potato donuts was in treatment A, 4.42 (neither like nor dislike). The use of white sweet potato flour causes the resulting donuts to taste more bitter. The thing that influences the sweet taste of each sweet potato is the high fructose content (Mahmudatussa'adah et al., 2014).

Texture

Texture is a pressure sensation that can be felt with the mouth (when bitten, chewed, and swallowed) or touched with the fingers. Texture test results consist of various things: wetness, dryness, hardness, smoothness, roughness, and oiliness. Table 7 shows that the panelists' highest assessment of the texture of sweet potato donuts was in treatment A (white sweet potato flour), namely 5.63 (like moderately). The lowest rating for sweet potato donuts was in treatment B (purple sweet potato flour), namely 4.28 (neither like nor dislike). The texture resulting from adding purple sweet potato flour to making donuts has a rougher and more broken texture, while white sweet potato donuts have a softer texture and do not break.

http://doi.org/10.22216/jk.v5i2.5717

Published by LLDIKTI Wilayah X

Jurnal Katalisator Vol 9 No. 1 (2024) 49-61

CONCLUSIONS

Variations in the use of sweet potato flour have significantly different effects on water content, ash content, fat content, protein content, carbohydrate content, and antioxidant activity. Based on the results of organoleptic tests, the best treatment was treatment E (cilembu sweet potato flour) with an average value of 5.93 (like moderately), where the resulting donuts had moisture content (24.18%), ash content (2.10%), fat content (10.87%), protein content (14.96%), carbohydrate content (56.74%) and antioxidant activity (64.75%). Donuts with cilembu sweet potatoes have the most fragrant aroma, golden brown color, slightly sweet taste, and soft texture.

REFERENCES

Akesowan, A., Chareonkul, A., & Tantakasem, S. (2022). Quality Evaluation of Gluten-Free Rice Donut Incorporated With Eggplant Flour and Xanthan Gum. *Indonesian Food Science and Technology Journal*, *5*(2), 39–43. https://doi.org/10.22437/ifstj.v5i2.14379

Ambarsari, I., Sarjana, & Choliq, A. (2009). Rekomendasi dalam Penetapan Standar Mutu Tepung Ubi Jalar. *Jurnal Teknologi Dan Manajemen Agro Industri*, *11*(3), 212–219.

Amelia, R., Julianti, E., & Nurminah, M. (2020). Pengaruh Perbandingan Tepung Terigu dengan Tepung Ubi Jalar Ungu dan Penambahan Xanthan Gum Terhadap Mutu Donat. *Jurnal Keteknikan Pertanian Tropis Dan Biosistem*, *8*(3), 263–274. https://doi.org/10.21776/ub.jkptb.2020.008.03.08

Andarwulan, N., Kusnandar, F., & Herawati, D. (2011). *Analisis Pangan*. Dian Rakyat.

Anugrah, R. M., & Suryani, E. (2020). Kandungan Gizi Donat dengan Penambahan Ubi Ungu (Ipomoea Batatas L.) Sebagai Makanan Jajanan Berbasis Pangan Lokal Bagi Anak Sekolah. *Jurnal Gizi*, *9*(1), 150. https://doi.org/10.26714/jg.9.1.2020.150-158

Arief, M. D. (2012). *Pemanfaatan Tepung Ubi Jalar (Ipomoea batatas (L). Lam) Cv. Cilembu Sebagai Bahan Substitusi Tepung Terigu dalam Pembuatan Biskuit*. Universitas Atma Jaya Yoyakarta.

Aulia, R. E., & Putri, W. D. R. (2015). Karakterisasi Sifat Fisikokimia Tepung Ubi Jalar Oranye Hasil Modifikasi Kimia dengan STTP. *Jurnal Pangan Dan Agroindustri*, *3*(2), 476–482.

Budaraga, I. K., & Salihat, R. A. (2020). Antioxidant activity of 'broken skin' purple rice, 'skinned' purple rice, and purple rice stem organically cultivated in Indonesia. *International Journal on Advanced Science, Engineering and Information Technology*, *10*(5), 2132–2137. https://doi.org/10.18517/ijaseit.10.5.9634

Budaraga, I. K., Salihat, R. A., & Fitria, E. A. (2023a). Acidification effects of starfruit (Averrhoa Bilimbi L.) on soy milk-based cottage cheese : A physicochemical and organoleptic assessment. *Potravinarstvo Slovak Journal of Food Sciences*, *17*, 986–996.

Budaraga, I. K., Salihat, R. A., & Fitria, E. A. (2023b). The study of the utilization of wuluh starfruit (Averrhoa bilimbi L.) in cottage cheese from goat milk prepared with acidification method based on physicochemical properties and organoleptic evaluation. *Bulgarian Journal of Agricultural Science*, *29*(5), 873–881.

Choir, A. Z. A., & Akbar, A. A. (2023). Analisis kandungan glukosa dan daya terima gula cair berbahan dasar Ubi Cilembu (Ipomoea batatas L.). *Jurnal SAGO Gizi Dan Kesehatan*, *5*(1), 133. https://doi.org/10.30867/gikes.v5i1.1295

Ernayanti, S. (2021). *Pengaruh Substitusi Ubi Jalar Putih, Kuning dan Ungu Terhadap*

Jurnal Katalisator Vol 9 No. 1 (2024) 49-61

Karakteristik Fisikokimia dan Organoleptik Donat Isi. 156–171.

Fitriani, L., Yurnalis, & Hermalena, L. (2019). Pembuatan Cookies Menggunakan Tepung Ubi Jalar Ungu Dan Tepung Ubi Jalar Putih Making Cookies Using Sweet Flour Flour and White Sweet Flour. *Unes Journal Mahasiswa Pertanian*, *3*(1), 49–57. http://faperta.ekasakti.org

Hastuti. (2014). Kajian sifat fungsional dan sensoris cake ubi jalar kuning (ipomoea batatas l.) dengan berbagai variasi perlakuan. *Jurnal Teknosains Pangan*, *3*(1), 145147.

Huq, S., Das, P. C., Islam, M. A., Jubayer, M. F., Ranganathan, T. V., & Mazumder, M. A. R. (2021). Nutritional, textural, and sensory quality of oil fried donut enriched with extracted dietary fiber and okara flour. *Journal of Food Processing and Preservation*, *45*(3). https://doi.org/10.1111/jfpp.15310

Koleva, I. I., Van Beek, T. A., Linssen, J. P. H., De Groot, A., & Evstatieva, L. N. (2002). Screening of plant extracts for antioxidant activity: A comparative study on three testing methods. *Phytochemical Analysis*, *13*(1), 8–17. https://doi.org/10.1002/pca.611

Kumalaningsih, S. (2006). *Antioksidan Alami Penangkal Radikal Bebas, Sumber Manfaat, Cara Penyediaan dan Pengolahan*. Trubus Agrisarana.

Li, L., Chen, H., Lü, X., Gong, J., & Xiao, G. (2022). Effects of papain concentration, coagulation temperature, and coagulation time on the properties of model soft cheese during ripening. *Lwt*, *161*(March), 113404. https://doi.org/10.1016/j.lwt.2022.113404

Li, Q., Cai, P., Xiao, H., & Pan, Y. (2023). pH-responsive color indicator films based on chitosan and purple yam extract for in-situ monitoring food freshness. *Food Bioscience*, *56*, 103373. https://doi.org/10.1016/j.fbio.2023.103373

Mahmudatussa'adah, A. (2014). Komposisi Kimia Ubi Jalar (Ipomoea batatas L) Cilembu pada Berbagai Waktu Simpan sebagai Bahan Baku Gula Cair. *Pangan*, *23*(1), 53–64.

Mahmudatussa'adah, A., Fardiaz, D., Andarwulan, N., & Kusnandar, F. (2014). Karakteristik Warna dan Aktivitas Antioksidan Antosianin Ubi Jalar Ungu. *Jurnal Teknologi Dan Industri Pangan*, *25*(2), 176–184. https://doi.org/10.6066/jtip.2014.25.2.176

Namir, M., Rabie, M. A., & Rabie, N. A. (2021). Physicochemical, pasting, and sensory characteristics of antioxidant dietary fiber gluten-free donut made from cantaloupe by-products. *Journal of Food Measurement and Characterization*, *15*(6), 5445–5459. https://doi.org/10.1007/s11694-021-01106-2

Omira. (2013). *Cara Memilih Bahan-Bahan Kue Yang Baik*. https://travel.kompas.com/read/2009/08/31/10461534/tips.memilih.bahan.kue

Restuning, L. T. (2012). Water Holding Capacity, pH and the Organoleptic Characteristics of Chicken Nugget that was Substituted by Boiled Eggs. *Indonesian Jurnal of Food Technology*, *1*(1), 69–78.

Retnati, Adriani, & Fauza, G. (2009). The influence of addition of various sweet potatoes (Ipomea batatas) extract to total count of cells and antioxidant activity in yogurt. *Biofarmasi Journal of Natural Product Biochemistry*, *7*(2), 68–76. https://doi.org/10.13057/biofar/f070202

Salihat, R. A., Budaraga, I. K., Syukri, D., Yanti, N. R., & Fitria, E. A. (2023). The Effect of Addition of Wuluh Starfruit (Averrhoa bilimbi L.) Juice as a Coagulant in Cottage Cheese from Cow ' s Milk. *Annals of Agri-Bio Research*, *28*(2), 328–336.

Salihat, R. A., & Putra, D. P. (2021a). Pengaruh Substitusi Tepung Terigu Dengan Tepung Beras Ungu Terhadap Mutu Dan Aktivitas Antioksidan Brownies Kukus. *Jurnal Teknologi Pangan*, *15*(2). https://doi.org/10.33005/jtp.v15i2.2942

Salihat, R. A., & Putra, D. P. (2021b). Pengujian Mutu Dan Aktivitas Antioksidan Brownies Panggang Dari Substitusi Tepung Terigu Dengan Tepung Beras Ungu. *Jurnal Sains Dan*

Teknologi Pangan, *6*(2). https://doi.org/10.33772/jstp.v6i2.17287

Salim, M., Dharma, A., Mardiah, E., & Oktoriza, G. (2017). Pengaruh Kandungan Antosianin dan Antioksidan Pada Proses Pengolahan Ubi Jalar Ungu. *Jurnal Zarah*, *5*(2), 7–12. https://doi.org/10.31629/zarah.v5i2.209

Shewry, P. (2019). What Is Gluten—Why Is It Special? *Frontiers in Nutrition*, *6*(101). https://doi.org/10.3389/fnut.2019.00101

Sitepu, K. M. (2019). Penentuan Konsentrasi Ragi pada Pembuatan Roti. *Jurnal Penelitian Dan Pengembangan Agrokompleks*, *2*(1), 71–77.

Wahyuningsih, R. W. (2023). Pengaruh Substitusi Tepung Terigu dengan Tepung Ubi Jalar Terhadap Sifat Organoleptik dan Sifat Kimia Nastar Nabikajau. *Jurnal Ilmu Gizi Indonesia (JIGZI)*, *4*(1), 26–32. https://doi.org/10.57084/jigzi.v4i1.1027

Xu, K., & Kuang, J. (2024). Effects of thermal treatment on the physicochemical and structural properties of wheat gluten proteins: insights from gluten, glutenin, and gliadin fractions. *International Journal of Food Science & Technology*. https://doi.org/10.1111/ijfs.16953

Yuliansar, Ridwan, & Hermawati. (2020). Karakterisasi pati ubi jalar putih, orange, dan ungu. *Saintis*, *1*(2), 1–13.

Zhang, A. (2020). Effect of wheat flour with different quality in the process of making flour products. *International Journal of Metrology and Quality Engineering*, *11*, 6. https://doi.org/10.1051/ijmqe/2020005

Published by LLDIKTI Wilayah X