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Analysis Of Total Dissolved Solids, Color And Specific Volume Of Biscuits With Banana Flour (*Musa Acuminata* Colla) Substitution And Purple Sweet Potato Puree (*Ipomoea Batatas* L.) Addition

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ABSTRACT
This study aims to study the effect of substitution of lady finger banana flour (Musa acuminata colla) and the addition of purple sweet potato (Ipomoea batatas L.) on the total soluble solids, color and specific volume of biscuits. This study was conducted experimentally using a completely randomized factorial design. The first factor was the ratio of wheat flour to lady finger banana flour (100:0%; 75:25%; 50:50% and 25:75%). The second factor was the addition of purple sweet potato puree (0%, 25%, 50% and 75%). The parameters analyzed consisted of: total soluble solids, color: brightness (L), reddish (a) and yellowish (b) and specific volume. The results showed that the ratio of wheat flour to lady finger banana flour had a very significant effect on the total soluble solids of biscuits 12.750 - 16.083 oBrix, brightness (L) 31.730 - 49.146; redness (a) 11.911 – 22.836; yellowness (b) 2.586 – 26.891. The addition of purple sweet potato puree gave a very significant effect on the total soluble solids of biscuits 13.417 – 15.125 oBrix, brightness (L) 35.447 – 46.319; redness (a) 17.794 – 20.257; yellowness (b) 7.377 – 15.559. The interaction between the ratio of wheat flour to banana flour and the addition of purple sweet potato puree gave a very significant effect on the parameters of brightness (L), redness (a) and yellowness (b).

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INTRODUCTION

Biscuits are one of the popular food products among all groups. Biscuits are made from wheat flour and are made through a molding and baking process. Biscuits prioritize crispy texture and low water content, generally less than 5% (Utami, 1992). Biscuits are generally made from wheat flour. Dependence on imported wheat needs to be given special attention to increase the development of alternative foods as a substitute or substitute for wheat and to be able to utilize local resources (Yasinta et al., 2017). The high consumption of wheat has led to an increase in wheat imports in Indonesia. Indonesia is the third largest wheat importing country in the world. This condition has given rise to the idea of finding alternative substitutes for wheat in the manufacture of food products made from wheat. Wheat is

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widely used in the manufacture of noodles and bakery products such as bread, cakes and biscuits (Pratama & Nendra, 2017). One of the food ingredients that can be used as an alternative to wheat flour is banana flour (Yasinta et al., 2017). Banana flour can also be used as a substitute for wheat flour in various processed products (Nurhayati & Andayani, 2014). The use of banana flour in the food industry is very varied, including being used as a substitute for wheat flour in baby food and cookies. This is done because banana flour contains good nutrition and is easily digested by the digestive organs. The wide use of banana flour makes banana flour one of the local products that has the potential to be developed (Rosalina et al., 2018).

Lady finger banana is one of Indonesia's mainstay tropical fruits that has export potential, is fast-growing and available throughout the season. The taste of bananas is very popular with various levels of society, and is very good as a source of vitamin C and pro vitamin A (Utomo et al., 2018). Bananas are an agricultural commodity that is easily damaged. The shelf life of bananas is also very limited, so it is necessary to use appropriate technology to process bananas into food products that can increase added value and extend their shelf life (Nurhayati & Andayani, 2014). The perishable nature of bananas can be overcome by further processing them in the form of semi-finished products, namely processing them into banana flour, so that they have a fairly long shelf life (Oktaviana et al., 2017). One of the food ingredients that can be used as a substitute for wheat flour in making biscuits is banana flour. Banana production is very abundant in Indonesia, but its processing is still limited. Another reason is because bananas contain various vitamins such as vitamin A, vitamin B, vitamin C. Bananas also contain minerals such as phosphorus, calcium, and iron. Bananas contain starch as much as 61.3-76.5 g/100 g dry weight and fiber content as much as 6.3-15.5 g/100 g dry weight (Aziah et al., 2012). High dietary fiber intake has beneficial effects on human health, so that flour made from bananas has the potential to be used as an alternative functional food. Previous studies have reported that banana flour substitution has the potential to provide additional energy intake because the basic ingredient of banana flour contains high carbohydrates (Merawati et al., 2012). Banana flour contains high carbohydrates and has a long shelf life so it can be used as an alternative to rice flour and wheat flour (Prabawati et al., 2008). The disadvantage of Kepok banana flour is that the brown color of the flour can affect the color of the product (Kaleka, 2013). Biscuits with increasing banana flour substitution tend to be less preferred by panelists because their color becomes increasingly brownish (Oktaviana et al., 2017).

Sweet potato (Ipomea batatas) is an agricultural product that has bright prospects in the future, because it can be used as a food ingredient that can be projected as a material for food industry products (Richana, 2012). Purple sweet potato is a variety of sweet potato that is widely found in Indonesia (Sukardi et al., 2001). Purple sweet potatoes have many advantages because they have a variety of nutritional content. The nutritional content of purple sweet potatoes of the antin-3 variety is 150.7 mg of anthocyanin, 1.1% fiber, 18.2% starch, 0.4% reducing sugar, 0.6% protein, 0.70 mg of iron and 20.1 mg of vitamin C (Dirjen Pangan, 2016). The purple color of sweet potatoes is caused by the presence of

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anthocyanin pigments which are spread from the skin to the flesh of the tuber (Sarwono, 2005). Anthocyanins are beneficial for body health because they can function as antioxidants, antihypertensives, lower blood sugar, increase insulin secretion, and prevent insulin resistance (Apriyantono, 2002; Matondang et al., 2017). Currently, many functional foods are being developed, namely foods that not only act as a source of energy, but also have added value for health, such as foods that contain antioxidant compounds (Li et al., 2019). One example of a compound that has antioxidant activity is anthocyanin. Anthocyanin is a natural coloring agent that can also act as an antioxidant that is beneficial for body health. One of the roles of antioxidants is to capture free radicals in the body so that it slows down aging, prevents cancer, and other degenerative diseases (Kano et al., 2005; Li et al., 2019; Lim et al., 2013; Suda et al., 2003; Sutirta-Yasa et al., 2011). This study aims to study the effect of substitution of banana flour (Musa acuminata colla) and the addition of purple sweet potato (Ipomoea batatas L.) on total dissolved solids, color and specific volume of biscuits.

METHOD

Place and time of research

The research was conducted in July – August 2023 at the Food Analysis and Processing Laboratory, Agricultural Product Technology, Faculty of Agriculture, HKBP Nommensen University, Medan.

Tools

The tools used in the study consisted of: analytical scales, mixers, basins, spatulas, baking pans, ovens, knives, petri dishes, sieves, spoons, blenders, and trays. While the tools used for laboratory analysis were analytical scales Sartorius BSA224S-CW, hand refractometer Atago Master 53-M, colormeter TES-135 rinse bottles, mortars, 90 ml Pyrex® Iwaki Glass containers, filter cloths, glass droppers, stirrers and stationery

Material

The materials used in the research consisted of: (1) the raw materials for making biscuits were green unripe bananas and purple sweet potatoes obtained from Kampung Durian Market, Medan City, wheat flour, sugar, eggs, margarine, powdered milk, baking powder and salt; (2) the materials used in the analysis were distilled water, Sodium metabisulfite (Na2S2O5) obtained from a cake ingredients shop.

Experimental design

The study was conducted in a laboratory experimental manner using a completely randomized factorial design. The treatment factors were the ratio of composition (%) of wheat flour to lady finger banana flour (T) consisting of 4 levels (T0 = 100:0; T1 = 75:25; T2 = 50:50; T3 = 25:75) and the percentage of addition (concentration) of purple sweet potato puree from the total ratio of wheat flour and lady finger banana flour (P) consisting of 4 levels (P0 = 0%; P1 = 25%; P2 = 50%; and P3 = 75%). The number of replications was 2 (two) replications. With a total number of experimental units of 16 x 2 = 32 experimental

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units. Data were analyzed by analysis of variance using SPSS software version 26. Significantly different treatments were tested using the Duncan test at p = 0.05.

Implementation of research

Production of lady finger banana flour

The production of banana flour was carried out by following the research of Ambarwati, 2020. The bananas were peeled with a knife to separate the skin from the flesh. The banana flesh was then sliced crosswise using a slicer to form thin sheets of banana fruit. To inhibit the browning process in bananas, the banana slices were soaked for 10 minutes in a solution of Sodium metabisulfite at a rate of 2 grams/liter of water. The soaked banana slices were then dried using an oven at a temperature of 120 oC for 60 minutes. The drying results were then called dried bananas (banana gaplek). The banana gaplek was then mashed using a blender, then sieved using a 60 mesh sieve to obtain banana flour according to the SNI 01-3841-1995 standard concerning banana flour quality standards.

Production of purple sweet potato puree

Production of purple sweet potato puree refers to research Br Tarigan et al., 2019 and Selvakumaran et al., 2019. Purple sweet potatoes are washed with water and then peeled. The flesh is then cut into cubes with a size of ± 2 cm. The pieces of purple sweet potato flesh are then steamed for 20 minutes, then mashed using a blender until a fruit puree is formed.

Pembuatan Biskuit

Biscuits are made by following the recipe of Soewitomo, 2009 and the research of Arise et al., 2021 dan Wanti et al., 2019. Prepared and weighed ingredients consisting of 250 gr flour; 100 gr margarine; 0.5 gr salt; 2 eggs; 125 gr powdered sugar; 25 gr powdered milk; 0.5 gr baking powder. Mixing ingredients is divided into 2 stages. First stage mixing: egg yolks, margarine, salt, powdered sugar, powdered milk and baking powder are mixed using a high-speed mixer until a cream is formed. Second stage mixing, wheat flour, banana flour and purple sweet potato puree according to treatment are added to the results of the first stage mixing and stirred again until biscuit dough is formed. Biscuit molding is done by weighing 6 gr of dough, then rounded by hand and placed on a baking sheet. Baking the dough is done using an oven at a temperature of 140 oC for 20 minutes to produce biscuits.

Procedure and Data Analysis

a. Total dissolved solids

Total dissolved solids (TPT) content was measured by grinding biscuits with a mortar to extract the juice. One piece of biscuit was put into the mortar, then 5 ml of water was added and then ground until it became biscuit porridge. The biscuit porridge was then filtered using a filter cloth and then dripped onto the lens of the Atago Master 53-M hand refractometer, then the refractometer in the telescope to see the results. Refractometer measurements were carried out at room temperature ranging from 28-30 0C. The measurement results were recorded in °Brix units (Widodo *et al*., 2019).

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b. Biscuit color

The color of the biscuits was measured using a colormeter. Measurements were made in the CIELab color space to obtain the measurement results of the L*, a* and b* values. The color measurement results used were the average value of the measurement results of two different points. (Akbar et al., 2017).

c. Specific weight

Measurement of the specific volume of biscuits in this study was carried out by weighing and measuring the volume of the modified biscuits (Yananta, 2003). Biscuit volume measurement using the displacement test method is done by putting sesame seeds into a container with a known volume until full, then weighing the weight of the grains that fill the volume of the container. Then the container is refilled with half of the sesame. Then the biscuits are put into the container, and the container is filled with the remaining sesame. Sesame seeds that are not put into the container are weighed as spilled sesame seeds, and the volume of the biscuits and the specific volume of the biscuits are calculated using the following formula:

$$Biscuit\ volume = \frac{W}{W_T} \times container\ volume\ (ml)$$

Information:
W = Weight of spilled sesame (g)
W_T = Total weight of sesame (g)
Next, the specific volume of biscuit cake with the formula:

$$Spesific\ volume\ (ml/g) = \frac{Biscuit\ volume}{Weight\ of\ biscuit}$$

Results and Discussion

The results of the statistical analysis of the research data are presented in Table 1 below:

Table 1. Effect of the ratio of wheat flour to banana flour and the addition of purple sweet potato puree on the parameters of Brix, color (L*a*b) and specific volume of biscuits.

Treatment		Parameter				
Comparison of Wheat Flour and Banana Flour (%)	Purple Sweet Potato Pure Concentrate (%)	Total Dissolved Solids (°Brix)	Color			Specific Volume (ml/g)
			Brightness (L)	Redness (a)	Yellowish (b)	
100:0	0	12,17 ± 2,12$^{abc}_{a}$	72,92 ± 1,78$^{db}_{f}$	7,77 ± 2,34$^{ab}_{a}$	36,32 ± 1,39$^{ca}_{f}$	0,59 ± 0,07$^{aa}_{a}$
100:0	25	14,00 ± 0,47$^{ac}_{a}$	42,43 ± 2,82$^{da}_{e}$	13,12 ± 0,01$^{aab}_{b}$	24,57 ± 0,22$^{cb}_{e}$	0,66 ± 0,08$^{aa}_{a}$
100:0	50	12,17 ± 0,71$^{aa}_{a}$	41,06 ± 4,96$^{da}_{de}$	12,98 ± 2,08$^{aa}_{b}$	23,52 ± 2,01$^{cb}_{e}$	0,66 ± 0,04$^{aa}_{a}$
100:0	75	12,67 ±	40,18 ±	13,78 ±	23,16 ±	0,74 ±

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Treatment		Parameter				
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			Brightness (L)	Redness (a)	Yellowish (b)	
75:25	0	1,41$^{aab}_{a}$ 13,67 ± 0,00$^{abc}_{a}$	3,01$^{da}_{cde}$ 42,16 ± 1,19$^{cb}_{e}$	1,56$^{aab}_{b}$ 24,16 ± 0,26$^{bb}_{de}$	2,09$^{cb}_{e}$ 1,39 ± 0,20$^{ba}_{ab}$	0,06$^{aa}_{a}$ 0,63 ± 0,26$^{aa}_{a}$
75:25	25	15,00 ± 0,94$^{ac}_{a}$	35,20 ± 3,15$^{ca}_{abc}$	20,08 ± 0,06$^{bab}_{c}$	12,09 ± 2,40$^{bb}_{de}$	0,68 ± 0,02$^{aa}_{a}$
75:25	50	12,33 ± 0,47$^{aa}_{a}$	36,00 ± 1,61$^{ca}_{bcd}$	16,41 ± 0,60$^{ba}_{b}$	15,58 ± 2,86$^{bb}_{def}$	0,57 ± 0,04$^{aa}_{a}$
75:25	75	13,00 ± 0,47$^{aab}_{a}$	40,79 ± 0,78$^{ca}_{de}$	16,32 ± 0,11$^{bab}_{b}$	19,31 ± 0,05$^{bb}_{de}$	0,63 ± 0,09$^{aa}_{a}$
50:50	0	17,00 ± 0,47$^{cbc}_{a}$	36,03 ± 1,08$^{bb}_{bcd}$	24,40 ± 0,93$^{cb}_{e}$	-3,18 ± 0,32$^{ba}_{a}$	0,60 ± 0,05$^{aa}_{a}$
50:50	25	16,00 ± 0,47$^{cc}_{a}$	34,87 ± 1,24$^{ba}_{abc}$	21,28 ± 2,04$^{cab}_{cde}$	10,69 ± 6,29$^{bb}_{bcde}$	0,62 ± 0,03$^{aa}_{a}$
50:50	50	15,83 ± 0,24$^{ca}_{a}$	34,67 ± 2,74$^{ba}_{ab}$	20,44 ± 3,41$^{ca}_{cd}$	18,92 ± 9,72$^{bb}_{de}$	0,61 ± 0,00$^{aa}_{a}$
50:50	75	15,50 ± 0,24$^{cab}_{a}$	33,64 ± 3,23$^{ba}_{ab}$	21,43 ± 2,55$^{cab}_{cde}$	8,60 ± 5,42$^{bb}_{bcd}$	0,67 ± 0,00$^{aa}_{a}$
25:75	0	15,67 ± 0,47$^{bbc}_{a}$	34,17 ± 0,02$^{ab}_{ab}$	24,71 ± 0,34$^{cb}_{e}$	-5,02 ± 0,54$^{aa}_{a}$	0,80 ± 0,04$^{aa}_{a}$
25:75	25	15,50 ± 0,24$^{bc}_{a}$	31,17 ± 0,08$^{aa}_{ab}$	22,59 ± 1,62$^{cab}_{cde}$	1,65 ± 1,51$^{ab}_{abc}$	0,61 ± 0,00$^{aa}_{a}$
25:75	50	13,33 ± 0,00$^{ba}_{a}$	30,06 ± 2,07$^{aa}_{a}$	21,36 ± 1,83$^{ca}_{cde}$	2,55 ± 0,73$^{ab}_{abc}$	0,70 ± 0,06$^{aa}_{a}$
25:75	75	14,50 ± 0,24$^{bab}_{a}$	31,53 ± 0,14$^{aa}_{ab}$	22,69 ± 1,01$^{cab}_{cde}$	11,17 ± 8,71$^{ab}_{cde}$	0,69 ± 0,01$^{aa}_{a}$

Information:
1. Different superscript letter notations in the same column indicate significant differences at the 5% level.
2. The same subscript letter notation in the same column indicates there is no treatment interaction effect at the 5% level.

Total dissolved solids

The comparison of wheat flour with lady finger banana flour and the addition of purple sweet potato puree gave a very significant effect (sig<0.01) on the total soluble solids of biscuits. The interaction between the comparison of wheat flour with lady finger banana

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flour and the addition of purple sweet potato puree did not have a significant effect on the total soluble solids loss of biscuits as seen in Table 1.

From Table 2, it can be seen that the total soluble solids of biscuits tend to increase along with the increase in the percentage of banana flour in the biscuit dough. This is in line with research of Yasinta et al., (2017) where the average total dissolved solids in biscuits tend to increase with the addition of banana flour as a substitute for wheat flour in the biscuit dough.

Table 2. Effect of the ratio of wheat flour to banana flour on the total soluble solids of biscuits.

Comparison of Wheat Flour to Banana Flour (%)	Average Total Dissolved Solids (°Brix)
100:0	12,750 ± 1,294[a]
75:25	13,500 ± 1,141[a]
50:50	16,083 ± 0,661[c]
25:75	14,750 ± 2,149[b]

Note: Different letter notations in the same column indicate significant differences at the 5% level and ± indicates standard deviation.

The average total dissolved solids in biscuits tended to decrease with the addition of purple sweet potato puree in the biscuit dough as seen in Table 3. This is caused by the anthocyanin compounds contained in purple sweet potatoes having hydrophilic properties or binding water, thus causing the water content of the biscuits to increase and causing the total amount of dissolved solids to decrease (Maharani et al., 2023).

Table 3. Effect of adding purple sweet potato puree on total soluble solids of biscuits.

Concentration of Pure Purple Sweet Potato (%)	Average Total Dissolved Solids (°Brix)
0	14,625 ± 2,149[bc]
25	15,125 ± 0,907[c]
50	13,417 ± 1,601[a]
75	13,917 ± 1,354[ab]

Note: Different letter notations in the same column indicate significant differences at the 5% level and ± indicates standard deviation.

Color

Brightness (L)

The comparison of wheat flour with lady finger banana flour and the addition of purple sweet potato puree gave a very significant effect (sig<0.01) on the brightness value (L) of the biscuit color. The interaction between the comparison of wheat flour with lady finger banana flour and the addition of purple sweet potato puree gave a very significant effect (sig<0.01) on the brightness value (L) of the biscuit color. as seen in Table 1. Table 4 shows that the average brightness (L) value of the biscuit color decreases as the ratio of banana flour in the biscuit dough increases.

Jurnal Scientia
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https://infor.seaninstitute.org/index.php/pendidikan

Table 4. Effect of the ratio of wheat flour to banana flour on the brightness value (L) of biscuit color.

Comparison of Wheat Flour to Banana Flour (%)	Average Brightness Value (L)
100:0	49,146 ± 14,916[d]
75:25	38,537 ± 3,507[c]
50:50	34,801 ± 1,942[b]
25:75	31,730 ± 1,793[a]

Note: Different letter notations in the same column indicate significant differences at the 5% level and ± indicates standard deviation.

Based on Table 5, it can be seen that the average brightness value (L) of the biscuit color tends to decrease as the addition of purple sweet potato puree in the biscuit dough increases.

Table 5. Effect of adding purple sweet potato puree on the brightness (L) value of biscuit color.

Concentration of Puree Purple Sweet Potato (%)	Average Brightness Value (L)
0	46,319 ± 16,746[b]
25	35,917 ± 4,668[a]
50	35,447 ± 4,809[a]
75	36,531 ± 4,625[a]

Note: Different letter notations in the same column indicate significant differences at the 5% level and ± indicates standard deviation.

The interaction between the ratio of wheat flour to lady finger banana flour and the addition of purple sweet potato puree gave a very significant effect (sig<0.01) on the brightness value (L) of the color of the biscuits as in Table 1. The relationship between the ratio of wheat flour to lady finger banana flour and the addition of purple sweet potato puree caused the brightness value (L) of the color of the biscuits to tend to decrease as in Figure 1. The highest average brightness value (L) of the color of the biscuits was 72.92 ± 1.78 in the control biscuits with the treatment of a ratio of wheat flour to lady finger banana flour of 100:0 and the addition of 0% purple sweet potato puree. While the lowest average brightness value (L) of the color of the biscuits was 30.06 ± 2.07 in the biscuits with the treatment of a ratio of wheat flour to lady finger banana flour of 25:75 and the addition of 50% purple sweet potato puree.

Jurnal Scientia
Volume 13, Number 03, 2024, DOI 10.58471/ scientia.v13i03
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

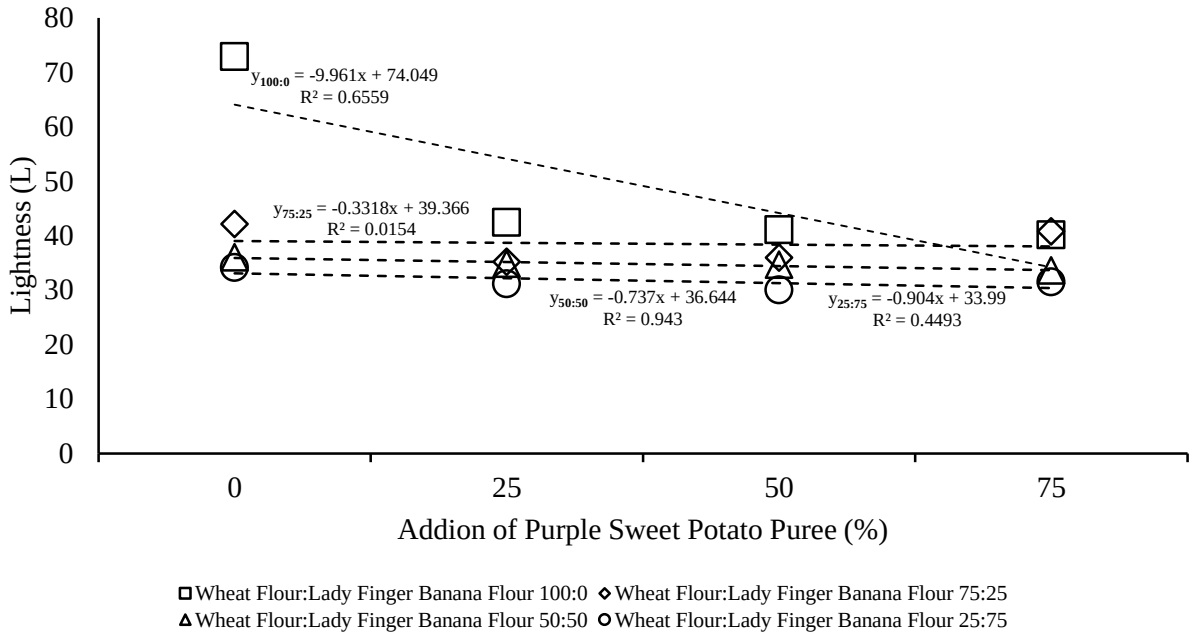

Figure 1. Relationship between the interaction effect of the ratio of wheat flour to banana flour and the addition of purple sweet potato puree on the brightness value (L) of biscuit color.

Redness (a)

The comparison of wheat flour with lady finger banana flour and the addition of purple sweet potato puree gave a very significant effect (sig<0.01) on the redness value (a) of the biscuit color. The interaction between the comparison of wheat flour with lady finger banana flour and the addition of purple sweet potato puree gave a very significant effect (sig<0.01) on the redness value (a) of the biscuit color. as seen in Table 1.

Table 6 shows that the average redness value (a) of the biscuit color increases as the ratio of banana flour in the biscuit dough increases.

Table 6. Effect of the ratio of wheat flour to banana flour on the redness value (a) of biscuit color.

Comparison of Wheat Flour to Banana Flour (%)	Average Redness Value (a)
100:0	11,911 ± 2,896[a]
75:25	19,239 ± 3,449[b]
50:50	21,886 ± 2,423[c]
25:75	22,836 ± 1,633[c]

Note: Different letter notations in the same column indicate significant differences at the 5% level and ± indicates standard deviation.

Based on Table 7, it can be seen that the average redness value (a) of the biscuit color tends to decrease as the addition of purple sweet potato puree in the biscuit dough increases.

Jurnal Scientia
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Table 7. Effect of adding purple sweet potato puree on the reddish (a) color of biscuits.

Concentration of Puree Purple Sweet Potato (%)	Average Redness Value (a)
0	20,257 ± 7,771[b]
25	19,266 ± 4,034[ab]
50	17,794 ± 3,951[a]
75	18,554 ± 4,075[ab]

Note: Different letter notations in the same column indicate significant differences at the 5% level and ± indicates standard deviation.

The interaction between the ratio of wheat flour to banana flour and the addition of purple sweet potato puree gave a very significant effect (sig<0.01) on the redness value (a) of the biscuit color as in Table 1. The relationship between the ratio of wheat flour to banana flour with a ratio of 75:25, 50:50 and 25:75 and the addition of purple sweet potato puree caused the redness value (a) of the biscuit color to tend to decrease, but tended to increase in the control biscuit without banana flour substitution (100:0) as seen in Figure 2. The highest average redness value (a) of the biscuit color was 24.71 ± 0.34 in biscuits with a ratio of wheat flour to banana flour of 25:75 and the addition of 0% purple sweet potato puree. While the lowest average redness value (a) of the biscuit color was 7.77 ± 2.34 in the control biscuit with a ratio of wheat flour to banana flour of 100:0 and the addition of 0% purple sweet potato puree.

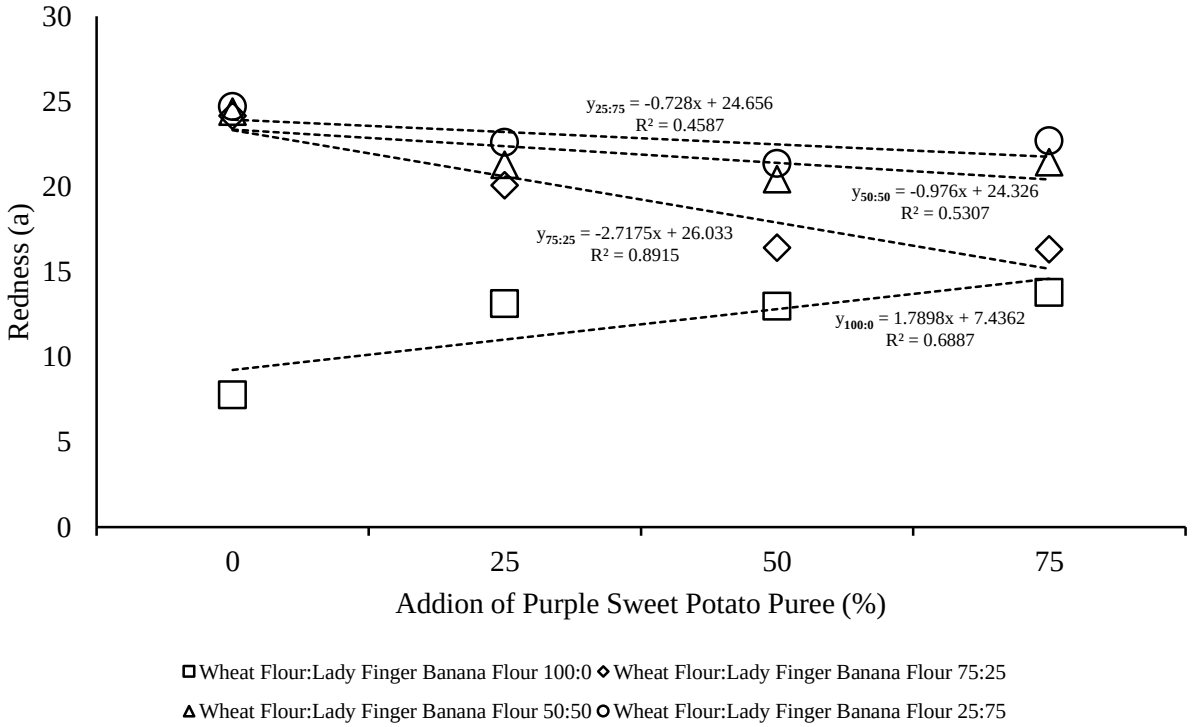

Figure 2. Relationship between the interaction effect of the ratio of wheat flour to banana flour and the addition of purple sweet potato puree on the redness value (a) of the biscuit color.

Jurnal Scientia
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Yellowish (b)

The comparison of wheat flour with lady finger banana flour and the addition of purple sweet potato puree gave a very significant effect (sig<0.01) on the yellowness value (b) of the biscuit color. The interaction between the comparison of wheat flour with lady finger banana flour and the addition of purple sweet potato puree gave a very significant effect (sig<0.01) on the yellowness value (b) of the biscuit color. as seen in Table 1.

Table 8 shows that the average yellowness value (b) of the biscuit color decreases as the ratio of banana flour in the biscuit dough increases.

Table 8. Effect of the ratio of wheat flour to banana flour on the yellowness value (b) of biscuit color.

Comparison of Wheat Flour to Banana Flour (%)	Average Yellowish Value (b)
100:0	26,891 ± 5,970^{c}
75:25	12,091 ± 7,285^{b}
50:50	8,760 ± 9,729^{b}
25:75	2,586 ± 7,009^{a}

Note: Different letter notations in the same column indicate significant differences at the 5% level and ± indicates standard deviation.

Based on Table 9, it can be seen that the average yellowness value (b) of the biscuit color increases with the addition of purple sweet potato puree in the biscuit dough.

Table 9. Effect of adding purple sweet potato puree on the yellowness (b) of biscuit color.

Concentration of Puree Purple Sweet Potato (%)	Average Yellowish Value (b)
0	7,377 ± 18,045^{a}
25	12,250 ± 9,111^{b}
50	15,144 ± 9,209^{b}
75	15,559 ± 7,450^{b}

Note: Different letter notations in the same column indicate significant differences at the 5% level and ± indicates standard deviation.

The interaction between the ratio of wheat flour to banana flour and the addition of purple sweet potato puree gave a very significant effect (sig<0.01) on the yellowness value (b) of the biscuit color as in Table 1. The relationship between the ratio of wheat flour to banana flour with a ratio of 75:25, 50:50 and 25:75 and the addition of purple sweet potato puree caused the yellowness value (b) of the biscuit color to tend to increase, but tended to decrease in the control biscuit without banana flour substitution (100:0) as seen in Figure 3. The highest average yellowness value (b) of the biscuit color was 36.32 ± 1.39 in the control biscuit with the treatment of a ratio of wheat flour to banana flour of 100:0 and the addition of 0% purple sweet potato puree. While the lowest average yellowness value (b) of the biscuit color was -5.02 ± 0.54 in the biscuit with the treatment of a ratio of wheat flour to banana flour of 25:75 and the addition of 0% purple sweet potato puree.

Jurnal Scientia
Volume 13, Number 03, 2024, DOI 10.58471/ scientia.v13i03
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

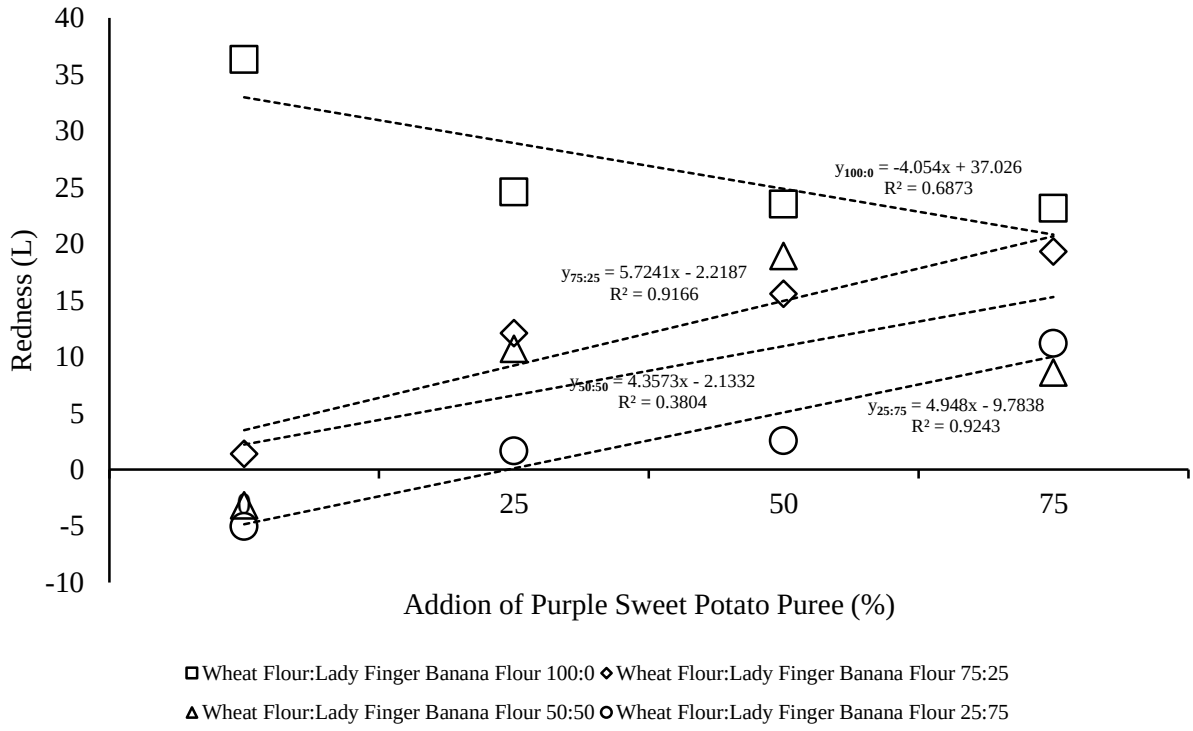

Figure 3. Relationship between the interaction effect of the ratio of wheat flour to banana flour and the addition of purple sweet potato puree on the yellowness value (b) of biscuit color.

Specific Volume

The comparison of wheat flour with lady finger banana flour and the addition of purple sweet potato puree did not have a significant effect (sig>0.05) on the specific volume of biscuits. The interaction between the comparison of wheat flour with lady finger banana flour and the addition of purple sweet potato puree did not have a significant effect (sig>0.05) on the specific volume of biscuits. as seen in Table 1.

Table 10 shows that the average specific volume of biscuits tends to decrease as the ratio of banana flour in the biscuit dough increases.

Table 10. Effect of the ratio of wheat flour to banana flour on the specific volume of biscuits.

Comparison of Wheat Flour to Banana Flour (%)	Average of Specific Volume (ml/g)
100:0	0,661 ± 0,076[a]
75:25	0,627 ± 0,115[a]
50:50	0,624 ± 0,038[a]
25:75	0,699 ± 0,079[a]

Note: Different letter notations in the same column indicate significant differences at the 5% level and ± indicates standard deviation.

Based on Table 11, it can be seen that the average specific volume of biscuits tends to decrease along with the increasing addition of purple sweet potato puree in the biscuit dough.

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ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

Table 11. Effect of adding purple sweet potato puree on the specific volume of biscuits.

Concentration of Puree Purple Sweet Potato (%)	Average of Specific Volume (ml/g)
0	0,652 ± 0,140[a]
25	0,640 ± 0,046[a]
50	0,634 ± 0,059[a]
75	0,685 ± 0,061[a]

Note: Different letter notations in the same column indicate significant differences at the 5% level and ± indicates standard deviation.

CONCLUSION

The comparison of wheat flour with banana flour has a very significant effect on the total soluble solids of biscuits 12.750 - 16.083 oBrix, brightness (L) 31.730 - 49.146; redness (a) 11.911 - 22.836; yellowness (b) 2.586 - 26.891. However, it does not have a significant effect on the specific volume of biscuits. The addition of purple sweet potato puree has a very significant effect on the total soluble solids of biscuits 13.417 - 15.125 oBrix, brightness (L) 35.447 - 46.319; redness (a) 17.794 - 20.257; yellowness (b) 7.377 - 15.559. However, it does not have a significant effect on the specific volume of biscuits. The interaction between the ratio of wheat flour to banana flour and the addition of purple sweet potato puree gave a very significant effect on the brightness (L), redness (a) and yellowness (b) parameters. However, it did not give a significant effect on the total dissolved solids and specific volume parameters.

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REFERENCE

Akbar, Y. M., Masithoh, Dr. R. E., & Khuriyati, N. (2017). Aplikasi Analisis Multivariat Berdasarkan Warna untuk Memprediksi Brix dan pH pada Pisang. *Agritech*, *37*(1), 109. https://doi.org/10.22146/agritech.17022

Ambarwati, R. (2020). Pengembangan makanan tambahan berbasis F100 dengan substitusi tepung labu kuning dan tepung pisang. *Journal of Nutrition College*, *9*(2), 121–128. https://doi.org/10.14710/jnc.v9i2.27033

Apriyantono, A. (2002). Pengaruh pengolahan terhadap nilai gizi dan keamanan pangan. In *Karumo Women dan Education. Jakarta*. Karumo Women dan Education.

Arise, A. K., Akeem, S. A., Olagunju, O. F., Opaleke, O. D., & Adeyemi, D. T. (2021). Development and quality evaluation of wheat cookies enriched with bambara groundnut protein isolate alone or in combination with ripe banana mash. *Applied Food Research*, *1*(1). https://doi.org/10.1016/j.afres.2021.100003

Aziah, N., Ho, L. H., Shazliana, N., & Bhat, R. (2012). Quality evaluation of steamed wheat bread substituted with green banana flour. *International Food Research Journal*, *19*(3), 869–876.

Br Tarigan, W., Hamzah, F., & Rahmayuni. (2019). Karakteristik bika ambon tapioka dengan puree ubi jalar ungu. *Sagu*, *18*(1), 39–47.

Dirjen Pangan, D. J. T. P. (2016). Petunjuk Teknis Teknologi Tanam Jajar Legowo. In *Kementerian Pertanian*. Kementerian Pertanian.

Kaleka, N. (2013). Pisang-pisang komersial. In *Solo. Arcita*. Arcita.

Kano, M., Takayanagi, T., Harada, K., Makino, K., & Ishikawa, F. (2005). Antioxidative activity of anthocyanins from purple sweet potato, Ipomoera batatas Cultivar Ayamurasaki. *Bioscience, Biotechnology, and Biochemistry*, *69*(5), 979–988. https://doi.org/10.1271/BBB.69.979

Li, A., Xiao, R., He, S., An, X., He, Y., Wang, C., Yin, S., Wang, B., Shi, X., & He, J. (2019). Research advances of purple sweet potato anthocyanins: extraction, identification, stability, bioactivity, application, and biotransformation. *Molecules*, *24*(21). https://doi.org/10.3390/MOLECULES24213816

Lim, S., Xu, J., Kim, J., Chen, T. Y., Su, X., Standard, J., Carey, E., Griffin, J., Herndon, B., Katz, B., Tomich, J., & Wang, W. (2013). Role of anthocyanin-enriched purple-fleshed sweet potato P40 in colorectal cancer prevention. *Molecular Nutrition & Food Research*, *57*(11), 1908. https://doi.org/10.1002/MNFR.201300040

Maharani, M., Pratiwi, I., & Soeka, Y. S. (2023). Komposisi Nutrisi, Kandungan Senyawa Bioaktif dan Uji Hedonik Kue Tepung Ubi Ungu (Ipomoea batatas cultivar Ayamurasaki) Fermentasi [Nutrient Composition, Content of Bioactive Compounds and Hedonic Test of Purple Sweet Potato Flour Cake (Ipomoea batatas cultivar Ayamurasaki) Fermentation]. *Jurnal Biologi Indonesia*, *19*(1), 43–56. https://doi.org/10.47349/jbi/19012023/43

Matondang, A. R., Vica, C., Tarigan, R., Sihombing, M. A., Defie, R., Siringoringo, E. T., & Utomo, A. W. (2017). Ubi jalar ungu goreng atau kukus dosis bertingkat terhadap gula darah tikus wistar. *Jurnal Kedokteran Diponegoro (Diponegoro Medical Journal)*, *6*(2), 487–494. https://doi.org/10.14710/DMJ.V6I2.18565

Merawati, D., Wibowotomo, B., Sulaeman, A., & Setiawan, B. (2012). Uji organoleptik biskuit dan flake campuran tepung pisang dengan kurma sebagai suplemen bagi olahragawan. *Jurnal TIBBS (Teknologi Industri Boga Dan Busana)*, *3*(1), 7–13. https://www.academia.edu/33681604/UJI_ORGANOLEPTIK_BISKUIT_DAN_FLAKE_CAMPURAN_TEPUNG_PISANG_DENGAN_KURMA_SEBAGAI_SUPLEMEN_BAGI_OLAHRAGAWAN

Nurhayati, C., & Andayani, O. (2014). Teknologi mutu tepung pisang dengan sistem spray drying untuk biskuit. *Jurnal Dinamika Penelitian Industri*, *25*(1), 31–41.

Oktaviana, A. S., Hersoelistyorini, W., & Nurhidajah. (2017). Kadar protein, daya kembang, dan organoleptik cookies dengan substitusi tepung mocaf dan tepung pisang kepok. *Jurnal Pangan Dan Gizi*, *7*(2), 72–81.

Prabawati, S., Suyanti, S., & Setyabudi, D. A. (2008). Teknologi Pascapanen dan Pengolahan Buah Pisang. *Balai Besar Penelitian Dan Pengembangan Pascapanen Pertanian. Dalam Seminar Badan Litbang Pertanian. Departemen Pertanian, Bogor*.

Pratama, M. A., & Nendra, H. (2017). Sifat fisik, kimia dan organoleptik cookies dengan penambahan tepung pisang kepok putih. *Seminar Nasional Dan Gelar Produk*, 584–591.

Richana, N. (2012). Ubi kayu dan ubi jalar. *Nuansa. Bandung*, *124*.

Rosalina, Y., Susanti, L., Silsia, D., & Setiawan, R. (2018). Karakteristik tepung pisang dari bahan baku pisang lokal Bengkulu. *Industria: Jurnal Teknologi Dan Manajemen Agroindustri*, *7*(3), 153–160. https://doi.org/10.21776/ub.industria.2018.007.03.3

Sarwono, B. (2005). Ubi jalar: Cara Budidaya yang Tepat, Efisien, dan Ekonomis. In *Penebar Swadaya. J* (Seri Agribisnis). Penebar Swadaya.

Selvakumaran, L., Shukri, R., Ramli, N. S., Pak Dek, M. S., & Wan Ibadullah, W. Z. (2019). Orange sweet potato (Ipomoea batatas) puree improved physicochemical properties and sensory acceptance of brownies. *Journal of the Saudi Society of Agricultural Sciences*, *18*(3). https://doi.org/10.1016/j.jssas.2017.09.006

Soewitomo, S. (2009). *1000 Resep Masakan & Kue Sisca Soewitomo yang Paling Dicari*. PT. Gramedia Pustaka Utama.

Suda, I., Oki, T., Masuda, M., Kobayashi, M., Nishiba, Y., & Furuta, S. (2003). Physiological functionality of purple-fleshed sweet potatoes containing anthocyanins and their utilization in foods. *Japan Agricultural Research Quarterly: JARQ*, *37*(3), 167–173. https://doi.org/10.6090/JARQ.37.167

Sukardi, S., P., M. H., & Hidayat, N. (2001). Optimasi Penurunan Kandungan Oligosakarida pada Pembuatan Tepung Ubijalar dengan Cara Fermentasi. *Jurnal Teknologi Pertanian*, *2*(1). https://jtp.ub.ac.id/index.php/jtp/article/view/108

Sutirta-Yasa, I. W. P., Jawi, I. M., Ngurah, I. B., & Subawa, A. A. N. (2011). Umbi ubi jalar ungu Bali (Ipomoea batatas) di transaminase serum, malondialdehide hepar dan alkohol kronis. *INDONESIAN JOURNAL OF CLINICAL PATHOLOGY AND MEDICAL LABORATORY*, *17*(3), 151–154. https://doi.org/10.24293/IJCPML.V17I3.1170

Utami, I. S. (1992). Pengolahan Roti Pusat Antar Universitas Pangan dan Gizi. *Universitas Gajah Mada, Yogyakarta*.

Utomo, B., Marsiti, C. I. R., & Damiati. (2018). Uji kualitas tepung pisang mas (Musa Acuminata). *Jurnal Bosaparis: Pendidikan Kesejahteraan Keluarga*, *9*(3), 189–199. https://doi.org/https://doi.org/10.23887/jjpkk.v9i3.22146

Wanti, T., Herawati, N., & Fitriani, S. (2019). Pemanfaatan pure ubi jalar kuning dan ampas kelapa kering dalam pembuatan kukis. *Sagu*, *18*(2).

Yananta, A. P. (2003). Perbaikan Proses Produksi Tepung Umbi Minor. *IPB University Scientific Repository*.

Yasinta, U. N. A., Dwiloka, B., & Nurwantoro. (2017). Pengaruh substitusi tepung terigu dengan tepung pisang terhadap sifat fisikokimia dan organoleptik cookies. *Jurnal Aplikasi Teknologi Pangan*, *6*(3), 119–123. https://doi.org/10.17728/jatp.200