

# Chemical, Physical Properties and Preferences Level of Snack Bars from Gembili Flour, Purple Yam Flour and Red Beans

Siti Tamaroh <sup>1\*</sup> and Yuli Perwita Sari <sup>2</sup>

<sup>1,2</sup> Faculty of Agroindustry, Universitas Mercu Buana Yogyakarta, Indonesia

**Abstract.** Snack bars are emergency food provided to meet nutritional needs in certain circumstances. The raw materials used to make it are typically wheat flour and soybeans. In this research, snack bars were made from local tubers, purple yam flour, gembili flour as an energy source, and red beans as a source of protein. This research aims to develop a popular snack bar that can potentially serve as a source of antioxidants. In this research, snack bars were made from purple yam flour: gembili flour (30:70; 40:60; 50:50) and red bean granule (10; 20; 30). The resulting snack bars were tested for color, texture, antioxidants, anthocyanins, and total phenols. The data obtained were tested statistically using a Completely Randomized Design (CRD). If significant differences were found, Duncan's New Multiple Range Test (DNMRT) was used at a 95% confidence level. The results of the study showed that the snack bar made with purple yam flour: flour gembili (50:50) and red bean granule flour 30 were most preferred by the panelists with the criteria of water content 10.94%, ash content 8.53%, fat content 22.09%, texture 2,570 gF, anthocyanin content 27.94 mg/100g db, total phenols 300.36 EGA mg/100 g db, color L = 59.53, a=6.7 and b=9.93.

## 1 Introduction

Currently, the need for ready-to-eat food availability is very necessary. This is related to the activities of most people who have a lot of busyness. One type of food that is easy and ready to consume is the snack bar type. Snack bars are rectangular foods that contain the nutrients needed by humans. Snack bars are foods that can be consumed ready to eat or as emergency food with complete nutrition [1]. Emergency food is food that has a high energy and nutrient density to be consumed immediately in urgent situations. Snack bars were initially developed as emergency food sources of energy because they contain sufficient calories and complete nutrition, namely carbohydrates, fat, protein, fiber, vitamins, and minerals [2].

The raw materials for making snack bars are currently mostly wheat flour and soybeans, which are ingredients that must be imported due to their limited availability. Indonesia's wheat flour imports are consistently increasing. According to data from the Central Statistics

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\*Corresponding Authors: [tamaroh@mercubuana-yogya.ac.id](mailto:tamaroh@mercubuana-yogya.ac.id)

Agency (BPS), Indonesia's wheat imports will reach 9.45 million tons in 2024. Australia is the largest supplier, with 2.15 million tons, followed by Canada (2.02 million tons), and Argentina (1.80 million tons). Reducing the need for wheat flour needs to be attempted by maximizing the use of local sources.

According to the National Food Agency (NFA), the national soybean requirement for 2024 is 2.8 million tons per year. The largest proportion of this requirement will be used to meet food needs. This soybean requirement is met through imports from several countries, such as the United States, Brazil, Argentina, China, and India. Most of the natural food sources in Indonesia have not been fully utilized. An example is the source of carbohydrate from yam tuber. Yam tuber production can reach 60-70 tons/ha/ year and can be harvested 2-3 times annually. The chemical components contained in yam tubers (*Dioscorea esculenta* L) are as follows : 1.5 g protein, 22.4 g carbohydrates, 0.1 g fat, 14 mg calcium, 1 mg iron in 100 g of material and 95 calories of energy. The largest component of yam bean tubers is carbohydrates 27-30%, which consists of amylose 14.2% and amylopectin 85.8%.

Another type of local carbohydrate source that contains carbohydrate components and natural antioxidants is purple yam. Purple yam (*Dioscorea alata* L) contains natural anthocyanin dyes, which are natural pigments. Anthocyanins are usually found in plants, especially parts of plants or fruits that are red, purple, blue, or yellow [3]. Anthocyanins are included in the flavonoid compound group. In fresh Chinese purple yam, there is a total phenolic content of 478 mg/100g dry matter. Anthocyanins found in purple yam are biologically useful, including as natural antioxidants, anticancer, and antihypertension [4]. Purple yam tubers contain 75-84% db carbohydrates, and small amounts of protein, fat, vitamins, and minerals [5].

Many types of beans have been cultivated in Indonesia, for example, red beans (*Phaseolus vulgaris* L). The nutritional components found in red beans include 23.1% protein and 59.5% carbohydrates. Other components found in red beans are the minerals calcium, phosphorus, and iron, in addition to vitamins (vitamins A and B1), as well as bioactive ingredients, including flavonoids and phytosterols [6]. The anthocyanin content in 100 g of red beans is 1.2 mg/100g of cyanidin and 2.4 mg/100g of pelargonidin. Based on the above, this study will produce snack bars using local tubers (purple yam and gembili) and red bean, which have the potential to be a source of complete nutrition and serve as a natural antioxidant, and are preference by panelists.

## **2. Materials And Methods**

### **2.1 Materials**

The materials used were purple yam tubers, gembili and red beans obtained from Godean market, Sleman, Yogyakarta. Other materials included eggs, skim milk, margarine, sugar, and CMC, obtained from Mirota supermarket in Yogyakarta. The materials used for chemical analysis were DPPH, ethanol, H<sub>2</sub>SO<sub>4</sub>, NaOH, Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>, aquades, boric acid, PP indicator, HCl, catalyst (Na<sub>2</sub>SO<sub>4</sub>: HgO (20: 1), KCl, CH<sub>3</sub>COONa, benzene, Methanol, HCl, Potassium Chloride Buffer pH 1, Sodium Acetate Buffer pH 4.5 and alcohol.

### **2.2. Purple Yam Flour Preparation [7]**

Purple yam tubers, peeled and sliced to a thickness of 3 cm<sup>3</sup>, then steamed for 8 minutes. After that, it was sliced with a thickness of 2-3 mm and dried in a cabinet drier at a

temperature of 55 °C for 8 hours. The dried purple yam slices were reduced in size and sieved through an 80-mesh sieve, yielding purple yam flour.

### 2.3. Gembili tuber flour Preparation

The gembili tubers are washed clean and then peeled. The gembili is sliced with a thickness of  $\pm 1-2$  cm. The gembili is steamed for 10 minutes at a temperature of 90 °C. Then, it is soaked in a 15% salt solution overnight. Washed with running water and soaked again in a solution of rice straw ash (1 kg of gembili, 10 g of rice straw ash, 1 L of water) overnight. Then wash with running water until clean. After that, it is dried in a cabinet dryer at a temperature of 60 °C for  $\pm 7$  hours. The dried gembili is blended and sieved using an 80-mesh sieve.

### 2.4. RED BEAN GRANULES PREPARATION [8], WHICH IS MODIFIED.

Red beans are sorted by soaking them in water, bad beans will float. After obtaining quality red beans, they are soaked for 8 hours. After soaking, they are washed, steamed for 10 minutes, and roasted for 20 minutes. The resulting red beans are reduced in size to form coarse particles.

### 2.5. The formulation for making snack bars

Formulation for making snack bars is presented in Table 1. The reason for choosing the flour ratios used in this study for making snack bars is that the more purple yam flour used, the greater its potential as an anthocyanin source. The more red bean flour added, the greater the protein content of the snack bar.

**Table 1.** Snack Bar Making Formulation

Komponen	A	B	C	D	E	F	G	H	I
Purple yam flour (g)	30	30	30	40	40	40	50	50	50
Gembili flour(g)	70	70	70	60	60	60	50	50	50
Red bean granules (g)	10	20	30	10	20	30	10	20	30
Egg (g)	50	50	50	50	50	50	50	50	50
Margarine (g)	30	30	30	30	30	30	30	30	30
Salt (g)	1	1	1	1	1	1	1	1	1
Skim milk (g)	20	20	20	20	20	20	20	20	20
fine granulated sugar (g)	50	50	50	50	50	50	50	50	50
CMC (g)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

### 2.6. Statistical Analysis.

The experimental design used was a Completely Randomized Design (CRD) with the addition of purple yam flour : gembili flour (30:70; 40:60 and 50:50) and red bean granules (10;20 and 30). All data analyses were carried out in duplicate. Data were expressed as mean  $\pm$  SD. The data obtained were tested statistically by the SPSS method and if significantly different, then continued with the “Duncan new multiple range test” (DMRT) at the 5% degree of confidence.

### 3. Results and Discussion

#### 3.1. Color of the snack bar

The results of the snack bar color test in this study can be seen in Table 1. It shows that the color L is influenced by the treatment of yam flour: gembili flour and red bean granule ( $P < 0.05$ ). The color L gets darker because the ratio of yam flour: gembili flour is greater. This is because purple yam flour has a purple color that comes from the anthocyanin component. The darker the color, the greater the anthocyanin component and phenolic compounds. This study aligns with research conducted by Tamaroh and Sudrajad (2021) [9], which shows that the addition of purple yam flour to white bread, in a larger proportion, produces a darker color. This study is also in line with research conducted by Azni et al. (2018) [10] on making cookies substituted with purple sweet potatoes, which showed a lower L value, indicating that the cookies' color is becoming darker due to the presence of phenolic compounds.

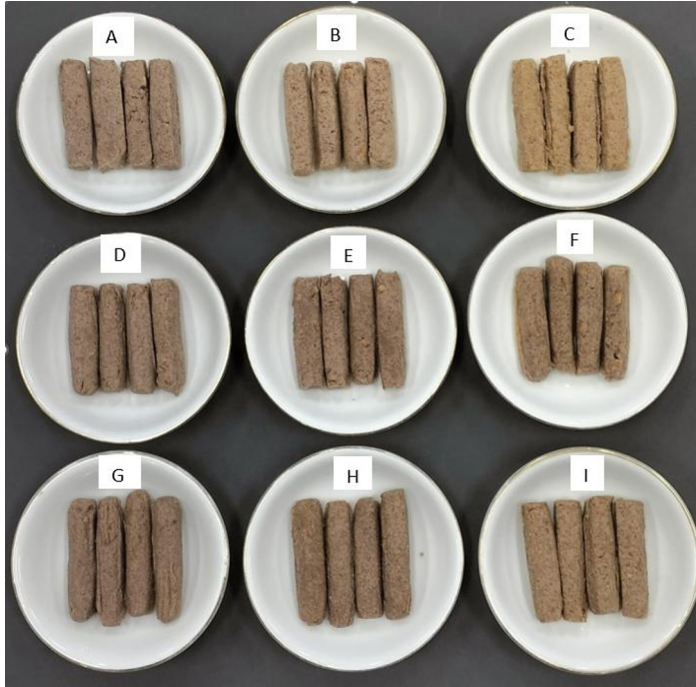
The color value a indicates the chromatic value of red color. This study showed that the treatment of red bean granule did not affect the color a ( $P > 0.05$ ). The treatment of yam flour: gembili flour, affected the color a ( $P < 0.05$ ). The greater the color value a, the redder the color, and the smaller the value a, the greener the color. This study showed that the more purple yam flour was added, the redder the color became. The red color is thought to come from the purple color of the purple yam flour.

The results of the b color statistical test showed that the treatment of purple yam flour: gembili flour did not affect the b color ( $P > 0.05$ ), but the treatment of red bean flour affected the b color ( $P < 0.05$ ). The larger the b color value, the bluer the color, and the smaller the b value, the more towards yellow the color. The addition of red bean granule is increasing, indicating a bluer color in the snack bar. The dark color of the snack bar, with the addition of red beans, may be attributed to the high protein content in red beans. During the processing of the red beans into a snack bar, non-enzymatic browning occurs, resulting in a brown color. The addition of red bean granule to roasted flakes leads to non-enzymatic browning, resulting in a dark color. The image of the snack bar resulting from the research can be seen in Figure 1.

**Table 2.** Snack bar color test results

Purple yam flour : Gembili flour(%)	Red bean granule (%)	Color		
		Lightness (L*)	Redness (a*)	Yellowness (b*)
30:70	10	59.37 ± 0.40 <sup>d</sup>	6.40 ± 0.02 <sup>a</sup>	6.91 ± 0.13 <sup>a</sup>
	20	62.50 ± 0.20 <sup>f</sup>	6.20 ± 0.08 <sup>a</sup>	9.18 ± 0.04 <sup>e</sup>
	30	60.44 ± 0.22 <sup>e</sup>	6.38 ± 0.01 <sup>a</sup>	9.22 ± 0.16 <sup>e</sup>
40:60	10	59.10 ± 0.21 <sup>d</sup>	6.51 ± 0.13 <sup>b</sup>	7.88 ± 0.14 <sup>b</sup>
	20	57.15 ± 0.01 <sup>b</sup>	6.78 ± 0.03 <sup>b</sup>	8.84 ± 0.02 <sup>d</sup>
	30	58.32 ± 0.26 <sup>c</sup>	6.59 ± 0.07 <sup>b</sup>	8.86 ± 0.04 <sup>d</sup>
50:50	10	58.28 ± 0.28 <sup>c</sup>	6.61 ± 0.02 <sup>ab</sup>	8.34 ± 0.10 <sup>c</sup>
	20	56.56 ± 0.00 <sup>a</sup>	6.20 ± 0.03 <sup>ab</sup>	8.64 ± 0.06 <sup>d</sup>
	30	59.53 ± 0.31 <sup>d</sup>	6.70 ± 0.03 <sup>ab</sup>	9.93 ± 0.16 <sup>f</sup>

Note: Numbers followed by different letter notations indicate significant differences at the 95% confidence level ( $P < 0.05$ ).



**Figure 1.** Snack bar research results

**Description:**

A = snack bar made from raw materials Purple yam flour : Gembili flour : Red Bean flour = 30 : 70 : 10 (g)

B = snack bar made from raw materials Purple yam flour : Gembili flour : Red Bean flour = 30 : 70 : 20 (g)

C = snack bar made from raw materials Purple yam flour : Gembili flour : Red Bean flour = 30 : 70 : 30 (g)

D = snack bar made from raw materials Purple yam flour : Gembili flour : Red Bean flour = 40 : 60 : 10 (g)

E = snack bar made from raw materials Purple yam flour : Gembili flour : Red Bean flour = 40 : 60 : 20 (g)

F = snack bar made from raw materials Purple yam flour : Gembili flour : Red Bean flour = 40 : 60 : 30 (g)

G = snack bar made from raw materials Purple yam flour : Gembili flour : Red Bean flour = 50 : 50 : 10 (g)

H = snack bar made from raw materials Purple yam flour : Gembili flour : Red Bean flour = 50 : 50 : 20 (g)

I = snack bar made from raw materials Purple yam flour : Gembili flour : Red Bean flour = 50 : 50 : 30 (g)

### 3.2. Texture of the snack bar

The results of the snack bar texture test in this study are presented in Table 2, indicating that the treatments of purple yam flour, gembili flour, and red bean granules significantly affected the texture of the snack bar ( $P < 0.01$ ). The greater the ratio of purple yam flour: gembili flour, the harder the texture of the snack bar, likewise the greater the addition of red bean flour, the harder the resulting snack bar.

The texture of a product made from flour with a high carbohydrate content is determined by the starch content of the raw material. Starch consists of amylose and amylopectin. Amylose in purple yam flour is 24.31 to 26.99% while the amylopectin content is 69 – 70 %. The starch content of gembili flour consists of 29.92% amylose and 70.8% amylopectin. Red bean granule content ranging between 45.32 and 51.11% amylose [11]. In red bean granules, there is starch with an amylose content of 28.30-35.43% [12]. Starch with a high amylose content will produce a hard texture because amylose is a polymer that has a straight chain, and does not form a double helix. The straight shape of the polymer chain causes amylose to easily release water, resulting in a hard product [13].

**Table 3.** Texture of snack bars (gF) made from purple yam flour: gembili flour, and red bean granule.

Purple yam flour : Gembili flour(%)	Red bean granule (%)		
	10	20	30
30:70	2,039.75 ± 20.51 <sup>d</sup>	2,262.00 ± 125.51 <sup>f</sup>	2,343.38 ± 17.14 <sup>a</sup>
40:60	1,248.25 ± 20.85 <sup>a</sup>	1,489.63 ± 0.17 <sup>b</sup>	1,628.50 ± 26.16 <sup>c</sup>
50:50	2,117.63 ± 16.44 <sup>de</sup>	2,192.25 ± 1.76 <sup>ef</sup>	2,570.00 ± 2.47 <sup>s</sup>

Note: Numbers followed by different letter notations indicate significant differences at the 95% confidence level ( $P < 0.05$ ).

The texture of the snack bar in this study showed that the addition of more red beans resulted in a harder texture. This can be explained by the fact that the more red bean granules added, the higher the amylose content will be, and this will increase the hardness of the snack bar.

### 3.3. Antioxidant activity of snack bar

The results of the antioxidant activity test of snack bars in this study can be seen in Table 3, showing a significant difference in the treatment of purple yam flour: gembili flour, and red bean granule. The greater addition of purple yam flour: gembili flour and red bean granule showed an increase in antioxidant activity. According to Leo et al. (2008)[14], phenolic and anthocyanin compounds are closely related to the ability of ingredients as a source of antioxidants.

**Table 4.** Antioxidant activity % (RSA) of snack bars made from purple yam flour: gembili flour and red bean granule.

Purple yam flour : Gembili flour(%)	Red bean granule (%)	Antioxidant activity % (RSA)
30:70	10	24.92 ± 3.05 <sup>a</sup>
	20	27.19± 2.54 <sup>a</sup>
	30	37.27± 3.23b <sup>c</sup>
40:60	10	35.51± 2.95b <sup>c</sup>
	20	33.78± 2.91 <sup>ab</sup>
	30	42.10± 3.32 <sup>cd</sup>
50:50	10	47.97± 3.51 <sup>dc</sup>
	20	46.67± 3.05 <sup>dc</sup>
	30	49.80± 1.39 <sup>e</sup>

Note: Numbers followed by different letter notations indicate significant differences at the 95% confidence level ( $P < 0.05$ ).

Purple yam flour contains anthocyanins of 87.89 mg/100 g [7] which are natural antioxidants. Likewise, red beans contain anthocyanins of 7.21 mg/100 mg [15]. Snack bar with purple yam flour treatment: gembili flour and 30% red bean granule, has an antioxidant activity of 49.80% (RSA). Research conducted by Tamaroh and Sudrajat (2021) [9], showed that in making white bread substituted with 20 - 30% purple yam flour, it has an antioxidant activity of 48.53% (RSA). According to Tamaroh and Sudrajat (2021) [9], their research showed that anthocyanin and total phenol levels correlated with antioxidant activity (% RSA). The phenol and anthocyanin compounds have a positive correlation with antioxidant activity.

### 3.4. Total phenol content of snack bar

The results of the total phenol test of the snack bar in this study can be seen in Table 4., showing that the treatment of purple yam flour: gembili flour and red bean granule affected the total phenol content of the snack bar produced. In the treatment of purple yam flour: gembili flour (50:50), the total phenol content was higher than the treatment of purple yam flour: gembili flour (30:70 and 40:60). The total phenol content of the snack bar with the treatment of purple yam flour: gembili flour (50:50) and red bean granule (10, 20 and 30) was not significantly different, namely 300.39 mg EAG/100 g bk.

In purple yam, there are phenol compounds of 478 mg/100 g bk [14]. In red beans, there are phenol components of 489 mg EAG/100 g bk [15]. The high phenol content in the snack bar results of this study is supported by the high phenol content in purple yam and red beans. Phenolic components are antioxidants that will capture free radicals. The antioxidant activity of phenolic compounds is attributed to their ability to donate hydrogen atoms to free radicals, thereby rendering them stable.

**Table 5.** Phenol content (mg EAG/100 g) of snack bars made from purple yam flour: gembili flour and red bean granule.

Purple yam flour : Gembili flour(%)	Red bean granule (%)		
	10	20	30
30:70	200.22 ± 0.54 <sup>a</sup>	200.71 ± 0.21 <sup>a</sup>	200.73 ± 0.21 <sup>a</sup>
40:60	200.14 ± 0.21 <sup>a</sup>	200.80 ± 0.21 <sup>a</sup>	300.10 ± 0.01 <sup>b</sup>
50:50	300.03 ± 0.45 <sup>b</sup>	300.77 ± 0.01 <sup>b</sup>	300.36 ± 0.38 <sup>b</sup>

Note: Numbers followed by different letter notations indicate significant differences at the 95% confidence level ( $P < 0.05$ ).

### 3.5. Snack bar anthocyanin levels

The results of the snack bar anthocyanin test in this study can be seen in Table 5, which shows that the more purple yam added, the higher the anthocyanin levels. The greater the addition of red bean granule, the higher the anthocyanin levels. Purple yam flour contains 87.89 mg/100 g of anthocyanin [14] which is a natural antioxidant. Likewise, red beans contain 7.21 mg/100 mg of anthocyanin [29]. The anthocyanin levels in purple yam flour and red beans will determine the anthocyanin levels in the snack bar.

**Table 6.** Anthocyanin content (mg/100 g bk) of snack bars made from purple yam flour: gembili flour and red bean granule.

Purple yam flour : Gembili flour(%)	Red bean granule (%)		
	10	20	30
30:70	3.60 ± 0.02 <sup>a</sup>	9.91 ± 1.27 <sup>c</sup>	18.93 ± 1.27 <sup>f</sup>
40:60	7.21 ± 0.04 <sup>b</sup>	12.62 ± 0.03 <sup>d</sup>	18.93 ± 1.28 <sup>f</sup>
50:50	16.22 ± 0.01 <sup>c</sup>	22.53 ± 1.27 <sup>g</sup>	27.94 ± 1.27 <sup>h</sup>

Note: Numbers followed by different letter notations indicate significant differences at the 95% confidence level ( $P < 0.05$ ).

### 3.6. Snack Bar Preference Test Results

The preference level test conducted on snack bars made from purple yam flour: gembili flour and red bean granule substitutions aims to determine the level of panelists' preference for the resulting product. The assessment was conducted using a numeric scale of 1-5, where 1 = "very dislike," 2 = "dislike," 3 = "somewhat like," 4 = "like," and 5 = "very like." The preference level test used the hedonic method with 21 panelists. The quality parameters used for the preference test of this snack bar include color, aroma, taste, texture, and overall. Based on the results of the statistical preference test, they are presented in Table 7.

**Table 7.** Results of statistical tests on preferences for purple yam flour snack bars: gembili flour and red bean granule.

Purple yam flour : Gembili flour(%)	Red bean granule (%)	color	aroma	taste	texture	overall
30:70	10	2.95 <sup>a</sup>	3.33 <sup>ab</sup>	3.19 <sup>a</sup>	3.00 <sup>a</sup>	3.19 <sup>a</sup>
40:60	10	3.38 <sup>ab</sup>	3.33 <sup>ab</sup>	3.19 <sup>a</sup>	3.43 <sup>a</sup>	3.24 <sup>a</sup>
50:50	10	3.38 <sup>ab</sup>	3.29 <sup>ab</sup>	3.05 <sup>a</sup>	3.10 <sup>a</sup>	3.48 <sup>ab</sup>

30:70	20	2.95 <sup>a</sup>	3.05 <sup>ab</sup>	2.81 <sup>a</sup>	3.10 <sup>a</sup>	3.00 <sup>a</sup>
40:60	20	3.52 <sup>ab</sup>	2.86 <sup>a</sup>	3.4 <sup>ab</sup>	3.43 <sup>a</sup>	3.48 <sup>ab</sup>
50:50	20	3.43 <sup>ab</sup>	3.48 <sup>ab</sup>	3.05 <sup>a</sup>	3.48 <sup>a</sup>	3.52 <sup>ab</sup>
30:70	30	3.24 <sup>a</sup>	3.19 <sup>ab</sup>	3.43 <sup>ab</sup>	3.00 <sup>a</sup>	3.29 <sup>ab</sup>
40:60	30	3.57 <sup>ab</sup>	3.38 <sup>ab</sup>	3.29 <sup>a</sup>	3.14 <sup>a</sup>	3.38 <sup>ab</sup>
50:50	30	4.00 <sup>b</sup>	3.57 <sup>b</sup>	3.90 <sup>b</sup>	3.19 <sup>a</sup>	3.86 <sup>b</sup>

Note: Numbers followed by different letter notations indicate significant differences at the 95% confidence level ( $P < 0.05$ ).

Color is the main quality attribute of food products, because color gives the first impression of the product to consumers. Color also functions as an indicator of the status and condition of food ingredients such as the level of maturity, damage, and processing guidelines. The color preference value of snack bars in this study did not differ. The average color preference test value was 3.38 = preference. The most preferred color of snack bars in this study was the treatment of purple yam flour: gembili flour (50:50) and red bean granule 30, namely a value of 4 = preference.

Aroma testing is crucial because aroma has a significant influence on consumer acceptance of a food product. Based on Table 11. the results of the statistical test of the level of preference in snack bars for aroma parameters with an average value of 3.28 = preferred. The most preferred value of the aroma preference test is the treatment of purple yam flour: gembili flour (50:50) and red bean granule 30, namely a value of 3.9 = preference.

Taste is influenced by several factors including chemical compounds, temperature, concentration, and interactions with other taste components. Based on Table 11. The results of the statistical test on the level of preference for snack bars, comparing the taste parameters of purple yam flour snack bars (gembili flour and red bean granule), showed no significant difference. The average preference value for the taste of snack bars was 3.26, and the largest value was in the snack bar treatment of purple yam flour: gembili flour (50:50) and red bean granule 30, namely a value of 3.57 = preference.

Texture is the main factor that influences the level of consumer acceptance of a product. Based on the level of preference for the purple yam flour snack bar: gembili flour and red bean granule, the average is 3.21 = preference. The results of statistical tests show that the texture of the snack bar in this study was not significantly different ( $P > 0.05$ ).

The overall assessment is a combined assessment of all sensory attributes including color, aroma, taste, and texture. Based on the level of preference for the purple yam flour snack bar: gembili flour and red bean granule, the average value is 3.38 = preference. The results of the statistical test on the overall preference test parameters showed a significant difference ( $P < 0.05$ ), namely in the purple yam flour snack bar: gembili flour (50:50) and red bean granule 10 and in the purple yam flour snack bar: gembili flour (50:50) and red bean flour 30. The purple yam flour snack bar: gembili flour (50:50) and red bean granule 30 were preferred with a value of 3.86 = preferred.

From the results of the study, it can be concluded that the snack bar that has high antioxidant activity and is preferred is the treatment of raw materials of purple yam flour: gembili flour (50:50) and 30% red bean flour, with a water content of 10.94%, ash content of 8.53%, fat content of 22.09%, texture of 2,570 gF, anthocyanin content of 27.94 mg/100g bk, total phenols of 300.36 EGA mg/100 g bk, color L = 59.53, a = 6.7 and b = 9.93.

## 4 Conclusion

The comparison treatment of purple yam flour: gembili flour and red bean granule significantly affected the color, texture, antioxidant activity, and total phenol content of the

snack bar produced. The results showed that the snack bar made with purple yam flour: gembili flour (50:50%) and 30% red bean granule was most preferred by the panelists with the criteria of water content of 10.94%, ash content of 8.53%, fat content of 22.09%, texture of 2,570 gF, anthocyanin content of 27.94 mg/100g bk, total phenol of 300.36 EGA mg/100 g bk, color L = 59.53, a = 6.7 and b = 9.93.

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## References

1. S.E. Ananta, A.D.A. Ramadhan, A. Rahmayani, W.I. Afkarina, A. Agustina, F.F. Manurung, I.F. Rosidah, A.Q. Haqq and M.A. Ichwanto, Pemanfaatan Ubi Ungu Kaya Antosianin dan Kurma sebagai Pemanis Alami Sebagai Snack Bar Bernutrisi. *Scientica. Jurnal Ilmiah Sain dan Teknologi*. **3**, 1, 750-754 (2024).
2. C.W.P.P. Siahaan, E.J.N. Nurali, and J.E.A. Kandou, Karakteristik Sensoris Snack Bars dari Tepung Komposit Pisang Goroho (*Musa acuminata* L), Kedelai (*Glycine max*) dan Kenari (*Canarium indicum* L). *Jurnal Teknologi Pertanian*. **13**, 2, 80-86 (2022).
3. M.J. Lee, J.S. Park, D.S. Choi and M.Y. Jung, Characterization and Quantitation of Anthocyanins in Purple-Fleshed Sweet Potatoes Cultivated in Korea by HPLC-DAD and HPLC-ESI-QTOF-MS/MS. *Journal of Agricultural and Food Chemistry*. **6**, 3148-3158 (2013). doi: 10.1021/jf3055455.
4. T. Oki, M. Masuda, M. Kobayash, Y. Nishiba, S. Furuta, I. Suda and T. Sato, Polymeric Procyanidins as Radical-Scavenging Components in Red-Hulled Rice. *Journal of Agricultural and Food Chemistry*. **50**, 26, 7524–7529 (2002). doi:10.1021/jf025-841z.
5. S.T. Chow, B.H. Chiang, Y.C. Chung, P.C. Chen and C.K. Hsu, Effects of storage temperatures on the antioxidative activity and composition of yam. *Food Chem*. **98**, 618-623 (2006). DOI: 10.1016/j.foodchem.2005.06.039.
6. E. Lanza, T.J. Hartman, P.S. Albert, R. Shields, M. Slattery, B. Caan, E. Paskett, F. Iber, J.W. Kikendall, P. Lance, C. Daston, A. Schatzkin, High Dry Bean Intake and Reduced Risk of Advanced Colorectal Adenoma Recurrence among Participants in The Polyp Prevention Trial. *Journal of Nutrition*. **136**, 1896-1903 (2006). doi: 10.1093/jn/136.7.1896.
7. S. Tamaroh, S. Raharjo, A. Murdiati and S. Anggrahini, Perubahan Antosianin dan Aktivitas Antioksidan Tepung Uwi Ungu Selama Penyimpanan, *Jurnal Aplikasi Teknologi Pangan*. **7**, 1, 31-36 (2018). <https://doi.org/10.17728/jatp.2224>
8. E.Moniharapon, S.J. Nendissa, and D. Laiyan, Characterization of Chemical Properties of ‘Lawa Merah’ Bean (*Phaseolus vulgaris* L.) Flour with Several Preliminary Treatments. *AGRITEKNO. Jurnal Teknologi Pertanian*. **6**, 1, 21-26 (2017). 10.30598/jagritekno.2017.6.1.21 ISSN: 2302-9218
9. S. Tamaroh, and A. Sudrajat, Antioxidative characteristics and sensory acceptability of bread substituted with purple yam (*Dioscorea alata* L.). *International Journal of Food Science*. **9** (2021).
10. A. Azni, A.M. Padzil, and I.I. Muhamad, Effect of Incorporating Purple-Fleshed Sweet Potato in Biscuit on Antioxidant Content, Antioxidant Capacity and Colour Characteristics. *Malaysian Journal of Analytical Sciences*. **22**, 4, 667–675 (2018). <https://doi.org/10.17576/mjas-2018-2204-13>

11. S. Punia, S.B. Dhull, K.S. Sandhu, M. Kaur, and S.S. Purewal, Kidney bean (*Phaseolus vulgaris*) starch: A review. *Legume Science*.**2**, e52 (2020). <https://doi.org/10.1002/leg3.52>
12. Y. Wang, X. Yao, H. Shen, R. Zhao, Z. Li, X. Shen, F. Wang, K. Chen, Y. Zhou, and B. Li, Nutritional Composition, Efficacy, and Processing of *Vigna angularis* (Adzuki Bean) for the Human Diet: An Overview. *Molecules*. **27**, 6079 (2022). <https://doi.org/10.3390/>
13. P.Y. Chiang, and A.I. Yeh, Effect of Soaking on Wet-milling of Rice. *Journal of Cereal Science*. **35**, 1, 85-94 (2002). doi:10.1006/jcers.2001.0419
14. L. Leo, A. Leone, C. Longo, D.A. Lombardi, F. Raimo and G. Zacheo, Antioxidant Compounds and Antioxidant Activity in “Early Potatoes”. *Journal of Agricultural and Food Chemistry*. **56**, 4154–4163 (2008). DOI:10.1021/jf073322w
15. M.R.E. Sari, W. Wisaniyasa, and S. Wiadnyani, Studi Kadar Gizi, Serat dan Antosianin Tepung Kacang Merah dan Tepung Kecambah Kacang Merah (*Phaseolus vulgaris* L.). *Jurnal Itepa*. **9**, 3, 282-290 (2020). DOI:10.24843/itepa.2020.v09.i03.p04