Study of Making Steamed Brownies Premix Flour Made From Mung Beans Flour (Vigna radiata) and Pumpkin Flour (Cucurbita moschata)

Evi Rosfitasari* and Mulyati M. Tahir

1Master Program of Food Science and Technology, Department of Agricultural Technology, Faculty of Agriculture, Hasanuddin University.
2Department of Agricultural Technology, Faculty of Agriculture, Hasanuddin University, 90245 Makassar, Indonesia

Abstract. Brownies are food products that have a distinctive sweet chocolate taste with a soft texture. Brownies are generally loved by people from all walks of life, from children to adults, so they can be developed into highly nutritious products. By adding local vegetables such as mung beans and pumpkin, the aim was to use raw materials to diversify products and improve the nutritional value of products. This study aimed to determine the best formulation and nutritional profile of steamed brownie premix flour that uses mung bean flour and pumpkin flour. The research method employed five treatments followed by tests, known as sensory tests, including color, aroma, taste, and texture. The best treatments obtained will be tested for ash, water, protein fat, fiber, and carbohydrate content. The nutritional content of formulated brownies flour were A0 treatment (Protein 14.49%, Fat 18.94%, Carbohydrates 41.16%, Fiber 24.86%), A2 (Protein 15.54%, Fat 22.50%, Carbohydrates 33.11%, Fiber 28.87%), and A3 (Protein 17.99%, Fat 24.59, Carbohydrates 28.55%, Fiber 30.88%). The best formulation for a steamed brownie premix using mung bean flour and pumpkin flour, namely, A2 treatment (40% wheat flour: 30% mung bean flour: 30% pumpkin flour).

1 Introduction

Food is a primary need for humans [1]. The use of food in human life provides many benefits in maintaining food security in society.

The consumption pattern of people who have begun to get used to noodle, bread, or brownie products [2] encourages practitioners and academics to develop a food product that is made instant so that it can make it easier to be under, stored, practical in the processing process. One of the food products that is made instantly is premix flour.

Premix flour is one of the flour products consisting of various types of flour-based components mixed [3]. The selling value of premix flour products increased significantly from 2008 to 2013 [4]. The use of premix flour at this time has been developed in food products such as donuts, cookies, pancakes, and brownies.

*Corresponding author: evirosfitasari@gmail.com
Brownies are a group of cakes that have a distinctive sweet and sweet taste with a soft texture. As a cake product that is favored by all circles of society ranging from young children to adults [5] the development and innovation of raw materials is increasingly interesting to learn about, especially with Indonesia's natural resources which have the potential for the availability of diverse food ingredients [6]. Green bean and yellow pumpkin plants are a small part of local food that is known to increase the added value of processed food products [7][8].

Green beans (Vigna radiata) are a type of legume that has a fairly good nutritional content, where the protein content is about 22%, fiber is around 7.6 gr / 100 gr, and a high source of calcium and phosphorus [9]. Green beans also have a high amylose starch content [10], So that it is possible to make it into flour so that its use can be wider [7].

Yellow pumpkin (Cucurbita moschata) is a nutrient-rich food with a high content of vitamins and minerals [11]. However, it is very unfortunate because based on statistical data, the abundant production of yellow pumpkin throughout 2011-2014 amounted to 428,197-523.63 tons [12] was not balanced with its use in product diversification to complement the food needs of the community [13]. Recently, several studies related to the use of yellow pumpkin have been reported by several researchers, in the form of flour which recently is the use of yellow pumpkin as an additive in the manufacture of brownies flour [11] [8]. The research results they report encourage academics to be able to find more innovations in utilizing the use of these foodstuffs.

Based on this, researchers tried to make brownie premix flour by utilizing two ingredients at once, namely green bean flour and yellow pumpkin flour. It is hoped that the results of this study can enrich scientific information related to the use of green bean and yellow pumpkin plants in processed products that have a high nutritional content.

2 Research Method

2.1 Tools and Materials

The tools used in this study consisted of tools for processing (basins, spoons, flour sieves, analytical scales, mixers, stoves, spatulas, pans, and baking sheets size 28×8×5. Measuring cup analyzer (Pyrex, Germany), measuring flask (Pyrex, Germany), size pipette (Pyrex, Germany), handler (IKA), beaker (Pyrex, Germany), Erlenmeyer flask (Pyrex, Germany), oven (Memmert), Khjedahl (Gerhardt), UV-VIS spectrometer (Optimal), furnace, desiccator, analytical scales, heating device, soxhlet, porcelain cup, mortar, pestle, and tongs.

The main ingredients used in this study were green bean flour, yellow pumpkin flour, wheat flour, refined sugar, eggs, margarine, skim milk, chocolate bars and cocoa powder, baking powder, and vanilla. The chemicals used for analysis are chemicals used, namely equates, chlorochromate, selenium, H₂SO₄, NaOH 40%, boric acid (H₃BO₃) 2%, bromcresol green 0.1%, methyl red 0.1%, HCl, filter paper, diethyl ether, aluminum foil, and tissue.

2.2 Research Procedure

2.2.1 Making premix flour

That begins with preparing tools and ingredients. The main ingredients, namely wheat flour, mung bean flour, and yellow pumpkin flour are weighed according to the treatment. Then added additional ingredients in the form of flour such as refined sugar 24%, skim milk 2.4%, baking powder 0.2%, vanilla 0.2%, and cocoa powder 1.2%. Then mix everything until homogeneous. Then obtained brownies premix flour.
2.2.2 Making Steamed Brownies

Preparing tools and materials. The first step starts with 19% eggs being beaten using a mixer until they become fluffy dough. Input the premix flour according to the treatment and then mix until the dough thickens. After that, input the 3.6% chocolate bar that has been stimulated with 24% margarine then stirred until evenly distributed. After that, put it on a baking sheet measuring 28×8×5 cm which has been smeared with margarine, then steam for ±30 minutes with a temperature of 100°C.

2.3 Observation Parameters

2.3.1 Organoleptic Test.
Organoleptic test is a test of a product based on the preferences or feasibility of a product. The test method used is the hedonic method or favorability test including taste, aroma, color, and texture. The panelists used were 25 semi-trained panelists. The assessment uses a scale of 1 to 7: very like (7), kinda like (6), like (5), neutral (4), somewhat dislike (3), dislike (2), and strong dislike (1).

2.3.2 Moisture Content
Water content testing is carried out by first empty cups in the oven for 30 minutes with a temperature of 105°C, then cooled in a desiccator for 15 minutes, and then weighed. After that, a sample of 2 grams is put into a saucer, then dried in the oven using a temperature of 105°C for 3 hours and cooled in a desiccator for 15 minutes. Then, it is weighed and calculated how much the initial weight difference is before and after it is done. The procedure is repeated until it gains a constant weight with a difference of 0.02. After that, the moisture content is calculated using the formula:

\[
\text{% Water content} = \frac{\text{Initial Weight} - \text{Final Weight}}{\text{Final Weight}} \times 100\%
\]

2.3.3 Ash Content
A porcelain cup was prepared. Then the porcelain dish is calibrated in the oven for 30 minutes with a temperature of 105°C. After that, it is put in a desiccator for 15 minutes, then the dish is weighed and a sample of 5 grams is added. After that, the saucer is put in a furnace for 5 hours with a temperature of 600°C. After that, it is put in a desiccator for 30 minutes. Then the saucer is weighed and calculated the ash content by the formula:

\[
\text{Ash content} = \frac{\text{ash weight}}{\text{weight of sample}} \times 100\%
\]

2.3.4 Fat Content
Testing fat content can be done using the soxhlet extraction method, which is the first fat flask dried using a temperature of 105°C for 30 minutes. After that, the fat flask is cooled using a desiccator for 15 minutes and weighed. The sample of as much as 2 grams is then wrapped using filter paper which is then put into a soxhlet extraction tool installed on the condenser. Then the hexane solvent is put into the fat flask then the reduction is carried out for 5 hours until the solvent returns to the fat flask and is clear in color. The fat solvent and fat flask are extracted until the solvent evaporates then the fat flask is carried out drying using an oven at a temperature of 105°C. The fat flask is dried using a desiccator. Fat content can be calculated by the formula:
Fat Content \( = \frac{w3 - w2}{w1} \times 100\% \)

### 2.3.5 Protein Content

The sample was weighed as much as 0.51 grams and then put into the flask adding 1 gram of selenium mixture and 25 ml of concentrated H\(_2\)SO\(_4\). Destructed in a fume hood until clear. The material is allowed to cool and then poured into a 100 ml measuring flask while rinsing with aquadest. Allowed to cool then added equates until the mark tera. Who test tube consists of 10 ml of H\(_2\)BO\(_3\) 2% is added 4 drops of indicator solution in Erlenmeyer 100 ml. Pipettes of 5 ml of NaOH 30% and 100 ml of equates, distilled until the volume of the reservoir becomes approximately 50 ml. rinsed the tip of the distiller with equates then accommodated along with the contents. Titrated with a solution of HCL or H\(_2\)SO\(_4\) 0.02 N, then the protein content is calculated by the formula:

\[
\text{% Protein content} = \frac{V1 \times \text{Normalitas} \times 6.25 \times P}{\text{Weight of sample}} \times 100\%
\]

Information:

- \( V1 \): Titration volume
- \( N \): Normality of solution
- \( P \): Dilution factor

### 2.3.6 Fiber Content

As much as 2 grams and then put into a 250 ml Erlenmeyer. After that, added 50 ml of H\(_2\)SO\(_4\) solution and then heated for 30 minutes using a hot plate that has been fitted with a cooling device. Next, 50 ml of NaOH was added and then heated again for 30 minutes. Next, it was filtered using filter paper which had previously been dried in an oven for 1 hour. After that, it was washed using hot distilled water until the solution became clear and then washed again using 15 ml of 96% alcohol until a dry precipitate was obtained. The precipitate was baked for 1 hour at 105°C and then the fiber content was calculated using the formula:

\[
\text{Fiber Content} = \frac{\text{dry weight of residue}}{\text{weight of sample}} \times 100\%
\]

### 2.3.7 Carbohydrate Content

Calculation of carbohydrate levels using testing using rough calculations (proximate Analysis). Proximate Analysis is then calculated using the formula:

\[
\text{% Carbohydrate} = 100\% - (\text{% ash} + \text{% water} + \text{% fat} + \text{% protein})
\]

### 2.4 Research Design

The design of the study was carried out with a comparative treatment of green bean flour, wheat flour, and yellow pumpkin flour with the following ratio:

- \( A0 = 100\% \) wheat flour: 0% mung bean flour: 0% pumpkin flour.
- \( A1 = 50\% \) wheat flour: 20% mung bean flour: 30% pumpkin flour.
- \( A2 = 40\% \) wheat flour: 30% mung bean flour: 30% pumpkin flour.
- \( A3 = 30\% \) wheat flour: 40% mung bean flour: 30% pumpkin flour.
- \( A4 = 20\% \) wheat flour: 50% mung bean flour: 30% pumpkin flour.
2.5 Data Analysis

This study used a Complete Randomized Design (RAL) with 3 repeats. The observation data were processed using the SPSS application. The one-way ANOVA method (0.05) is used to determine the different tests in each treatment, then continued with the Duncan test if significant differences are found in each treatment.

3. Results and discussion

3.1 Organoleptic Test of Brownie Products Using Green Bean Premix Flour and Yellow Pumpkin

3.1.1 Color

The color was one of the first assessment impressions that appeared by the panelists. When organoleptic testing the first color parameters are seen in the presentation because they use the sense of sight [14]. The results of organoleptic testing of the color parameters of the steamed brownie products of mung bean flour and yellow pumpkin flour can be seen in the following Figure 1.

Fig. 1. The results of the steamed brownie product color organoleptic test.

Based on the Figure 1, it can be seen that the average degree of liking for the color parameters of steamed brownie products of mung bean flour and yellow pumpkin flour ranges from 4.41% to 5.00%. The results of the fingerprint analysis (ANOVA) showed that the treatment did not have a noticeable influence on the color parameters of the steamed brownie products of mung bean flour and yellow pumpkin flour. Additional ingredients such as eggs that contain protein will change if the heating process is carried out (steaming and roasting) which will change to brownish so that it can affect the change of warrants in brownie products [15]. The color of the resulting steamed brownies is influenced by the yellow-orange color pigment derived from the yellow pumpkin β-carotene. The more yellow flasks are added and the more intense the color, the higher the carotenoid pigments contained in the product [16]. The additives used in brownie products affect the color, texture, and distinctive aroma of the brownies. The black color tends to be brownish in brownie products will give a reinforcing indication that the product made is brownies, because the color of a product is also a parameter of the quality of the product being made. This is to the statement [17] that the blackish-brown color in brownie products is the typical color of brownies. According to [18] the increasingly brown color in the brownie products produced is influenced by
the maillard reaction. Maillard reaction is a non-enzymatic reaction between reducing sugars and proteins with heat that causes the color to turn brown.

3.1.2 Aroma

Aroma is one of the odor assessments obtained from the sense of smell, namely the nose. The aroma in a product is one of the important factors in determining the level of acceptance by consumers so that they can determine the deliciousness of a food ingredient [19]. The results of organoleptic testing of the aroma parameters of steamed brownie products of mung bean flour and yellow pumpkin flour can be seen in the following Figure 2.

![Figure 2](image)

**Fig. 2.** The results of the steamed brownie product aroma organoleptic test.

Based on the Figure 2, it can be seen that the average degree of liking for the aroma parameters of steamed brownie products of mung bean flour and yellow pumpkin flour ranges from 4.36% to 5.71%. The results of the analysis of variance (ANOVA) showed that the treatment had a noticeable influence on the aroma parameters of the steamed brownie products of mung bean flour and yellow pumpkin flour. Mung bean flour and yellow pumpkin flour produce a langu aroma that affects the aroma of the brownie product. The langu aroma in mung bean flour is caused by the activity of the lipoxygenase enzyme found in green beans [20]. Meanwhile, the langu aroma in yellow pumpkin flour is caused by the content of chemical compounds in yellow pumpkin, namely flavonoids [21]. In addition, the additional ingredients used also affect the aroma of the resulting steamed brownies such as powdered chocolate and dark chocolate influence brownie products. The onset of aroma is due to the presence of volatile (volatile) substances. The reaction between amino acids and sugars will produce an aroma, while the fats in the ingredients will be oxidized and broken down by heat so that part of the active ingredients caused by the breakdown of it will react with amino acids and peptides to produce aromas [22]. The aroma produced by each food ingredient is different. There are volatile compounds during the steaming process that produce aromas in brownies.

3.1.3 Texture

The texture is one of the parameters of the assessment of a product that affects the acceptability of panelists. texture in sensory testing using the help of the sense of touch or tasting [23]. The results of organoleptic testing of the texture parameters of the steamed brownie products of mung bean flour and yellow pumpkin flour can be seen in the following Figure 3.
The results of the analysis of variance (ANOVA) showed that the treatment had a noticeable influence on the texture parameters of the steamed brownie products of mung bean flour and yellow pumpkin flour. The resulting texture in brownies products is influenced by the use of mung bean flour and yellow pumpkin flour. This is to the statement [24] that the texture of food products is determined by water content, fat content, the number of carbohydrates (cellulose, starch and pectin) and their protein content. In the process of making steamed brownies, the flour used is wheat flour with a high amylopectin content and low amylose so that the texture of the steamed brownies becomes fluffy. According to [25] the content of amylose and amylopectin contained in wheat flour is the amylose content of wheat flour is 28% and amylopectin is 72%. While the amylose content of mung bean flour is 33% and amylopectin is 67%. So that the characteristics of steamed brownies from green bean flour and yellow pumpkin flour produced are that they have a smooth, soft, and fluffy texture.

3.1.4 Taste

Taste is one of the assessment parameters in a food product. taste has a specific effect on the selection of consumer food. The results of organoleptic testing of the taste parameters of steamed brownie products of mung bean flour and yellow pumpkin flour can be seen in the following Figure 4.

Based on the Figure 4, it can be seen that the average degree of liking for the taste parameters of steamed brownie products of mung bean flour and yellow pumpkin flour ranges from 3.41% to 5.48%. The results of the analysis of the analysis of variance (ANOVA) showed that the treatment
had a noticeable influence on the taste parameters of steamed brownie products of mung bean flour and yellow pumpkin flour. The resulting taste in brownie products is influenced by the use of mung bean flour and yellow pumpkin flour. The more addition of mung bean flour and yellow pumpkin flour, the more it will disguise the taste of wheat flour while the green beans and yellow pumpkin in the brownies will be more pronounced. The distinctive taste of yellow pumpkin comes from the content of flavonoid compounds found in yellow pumpkin [21]. In addition, the sweetness of the brownie product is obtained from the refined sugar used. The savory taste in brownie products is obtained from the margarine used. The chocolate flavor in brownie products is obtained from the use of chocolate powder and dark chocolate [15] which states that the taste from the organoleptic test results of brownies is a sharp brown taste. This is to the statement [26] states that a good brownie flavor is a combination of two elements of sweetness and chocolate flavor.

3.2 Proximate Brownies of Green Beans and Yellow Pumpkin

3.2.1 Moisture Content

Moisture content is the difference between the weight of the material before and after the heating process. High water content can reduce product durability caused by microbial growth [27]. The results of testing the water content of brownie products can be seen in the following Figure 5.

![Fig. 5. Result of moisture content of steamed brownie products.](image)

Based on the Figure 5, it can be seen that the average water content contained in brownie products ranges from 24.46% to 27.05%. The results of the analysis of variance (ANOVA) show that the treatment has a significant effect on the water content of brownie products. According to SNI 01-3840-1995, the maximum water content quality requirement for brownies is 40%. Based on the results obtained, the selected steamed brownie products have met the SNI, which ranges from 27.25% - 25.32%. As well as the treatment for wheat flour and mung bean flour and pumpkin flour used is different so that it affects the water binding capacity. This is in accordance with the statement [28] which states that this is thought to be because the water content contained in the material affects the ability of flour to absorb water. The difference in moisture content obtained in steamed brownie products is also influenced by several factors such as the raw materials used, the additives used and the processing process carried out.
3.2.2 Ash Content

Ash content is the remaining inorganic substances in food ingredients. In the process of ignition, the organic material will burn and the remaining organic substances will remain [29]. The results of testing the ash content of brownie products can be seen in the following Figure 6.

![Figure 6. Result of ash content of steamed brownie products.](image)

Based on the Figure 8, it can be seen that the average ash content contained in brownie products ranges from 0.94% to 2.89%. The results of the analysis of variance (ANOVA) showed that the treatments had a significant effect on the ash content of brownie products. According to SNI, the maximum ash content for brownies is 3%. Based on the results obtained, the selected products have met the SNI, which ranges from 2.16% - 1.64%. The difference in ash content obtained in steamed brownie products is influenced by the raw materials used, namely wheat flour, mung beans and pumpkin flour. According to [30] the mineral content in wheat flour is 16 mg of calcium, 106 mg of phosphorus and 1.2 mg of iron. The mineral content in wheat flour ranges from 0.3-1.5%. While pumpkin flour has a mineral content of 7.74% [31] and mung bean flour has a high mineral content compared to wheat flour. According to [32] mung bean flour has a fairly high mineral content such as Na, K, Ca, P, Mg, Fe and Mn. This is in accordance with the statement. This is in accordance with the statement [33] which states that mung beans contain many vitamins and minerals such as calcium, phosphorus, iron, sodium and potassium.

3.2.3 Fat Content

Fat is a source of energy other than carbohydrates needed by humans. The results of testing the fat content of brownie products can be seen in the following Figure 7:

![Figure 7. Results of fat content of steamed brownie product fat content.](image)
Based on the Figure 7, it can be seen that the average fat contained in brownie products ranges from 18.94% to 24.58%. The results of the analysis of variance (ANOVA) showed that the treatment had a significant effect on the fat content of brownie products. The results of fat content obtained were influenced by wheat flour, mung bean flour and pumpkin flour used. According to that the fat content of pumpkin flour is 3.28%, while the fat content of mung bean flour is 0.09. The fat content in the resulting product is obtained from the use of egg yolks and milk [34]. The addition of margarine to steamed brownie products affects the fat content of steamed brownies because margarine contains quite high fat. According to [35] margarine has a fat content of 80% because margarine is a fat-based ingredient.

### 3.2.4 Protein Content

Protein is one of the macromolecules that has an important role in biological systems. Protein is a complex compound with a large molecular weight consisting of amino acids connected by peptide bonds [36]. The results of protein content testing of brownie products can be seen in the following Figure 8.

![Protein Content Graph](image)

**Fig. 8.** Results of steamed brownie product protein content.

Based on the Figure 8, it can be seen that the average protein contained in brownie products ranges from 14.48% to 17.98%. The results of the analysis of variance (ANOVA) show that the treatment has a significant effect on the protein content of brownie products. The results of protein content obtained increased along with the addition of mung bean flour. This is because mung bean flour has a high protein content. According to [37] the protein content of mung bean flour is 19.09% the protein content of pumpkin flour is 3.74%. While the protein content of wheat flour is 8.9%. Meanwhile, treatment A0 (control) produced low protein levels due to the low protein content of wheat flour. According to [38] the protein content contained in wheat flour ranges from 8-12%. In addition, the factor that affects the protein content of brownie products in each treatment is the use of additional ingredients such as eggs, margarine and dark chocolate.

### 3.2.5 Carbohydrate Content

Carbohydrates are a source of calories that play an important role in human life. The carbohydrate analysis procedure in this study uses the carbohydrate by difference calculation method [39]. The results of testing the carbohydrate content of brownie products can be seen in the following Figure 9.
Based on the Figure 9, it can be seen that the average carbohydrate contained in brownie products ranges from 28.55% to 41.16%. The results of the analysis of variance (ANOVA) showed that the treatment had a significant effect on the carbohydrate content of brownie products. The carbohydrate content obtained tends to decrease along with the addition of mung bean flour used and the reduced composition of wheat flour. The results obtained are influenced by the carbohydrate content of the ingredients used. According to [40] wheat flour contains high carbohydrates of 84.32%. Meanwhile, mung bean flour contains carbohydrates as much as 72.86% [37]. And pumpkin flour contains 78.77% carbohydrates 78.77% [40].

### 3.2.6 Fiber Content

Crude fiber is a collection of all fibers that cannot be digested. This crude fiber component has health benefits, namely facilitating the digestive process in the body [41]. The results of the fiber content test on brownie products can be seen in the following Figure 10:

Based on the Figure 10, it can be seen that the average fiber contained in brownies ranges from 24.86% to 30.88%. The results of analysis of variance (ANOVA) showed that the treatment had a significant effect on the fiber content of brownie products. According to [40] wheat flour contains fiber content of 2-2.5%. Meanwhile, the fiber content in mung beans is 4.1% and according to [42] pumpkin flour contains 2.9% fiber. The difference in fluctuating results in the fiber content of steamed brownie products obtained is influenced by the steaming process carried out. This is in accordance with the statement that the use of heat in the cooking process greatly affects the nutritional value of the food.
4 Conclusion

The best formulation of steamed brownies using premix flour using mung bean flour and pumpkin flour is treatment A2 (40% wheat flour: 30% mung bean flour: 30% pumpkin flour). The nutritional content of steamed brownies using premix flour using mung bean flour and pumpkin flour is treatment A0 (100% wheat flour: 0% mung bean flour: 0% pumpkin flour), namely protein 14.49%, fat 18.94%, carbohydrates 41.16%, fiber 24.86%, A2 (40% wheat flour: 30% mung bean flour: 30% pumpkin flour) which is 15.54% protein, 22.50% fat, 33.11% carbohydrate, 28.87% fiber) and A3 (30% wheat flour: 40% mung bean flour: 30% pumpkin flour) which is 17.99% protein, 24.59 fat, 28.55% carbohydrate, 30.88% fiber.

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