# Acceptance of Brownies *Suweg* (*Amorphophallus paeoniifolius*) Substituted with Mung Bean (*Vigna radiata*)

Bela Monica Anggraeni[1] and Setyaningrum Rahmawaty[1*]

[1]*Department Of Nutrition Science, Faculty Of Health Science, Universitas Muhammadiyah Surakarta*
*Jl. A Yani Tromol Pos 1 Pabelan Kartasura, Surakarta, Central Java 57162, Indonesia.*
**Corresponding author, Email: setyaningrum_r@ums.ac.id*

**ABATRACT**
*Suweg*, Indonesian name for Elephant foot yam (*Amorphophallus paeoniifolius*) is a local root crop of Indonesia that rich in carbohydrate with low glycemic index and high fiber that potentially developed as healthy food product by adding source of protein, e.g. mung bean (*Vigna radiata*). The aim of this study was to determine the acceptability of steamed brownies made from combination of *suweg* flour and mung bean flour. The research used a completely randomized design, consisting of formulation for making the brownies with the percentage ratio of *suweg* flour and mung bean flour as follows: 100%:0%, 90%:10%, 80%:20%, and 70%:30%. The results of the acceptability test showed that the ratio of adding *suweg* flour and mung bean flour affect color (p=0.036), texture (p=0.001), taste (p = 0.035), and overall organoleptic test (p=0.019) of the brownies. The formulation ratio of *suweg* and mung bean flour of 70%:30% was the most preferred brownies by the panelist. The higher addition of mung bean flour, the more preferred brownies suweg by the panelists.

***Keywords****: Acceptability, suweg tubers, mung beans, steamed brownies.*

## 1. INTRODUCTION

Indonesia's dependence on imports of wheat is quite high. The Indonesian Wheat Flour Producers Association (Aptindo) reported that estimates that in the next decade the demand for wheat will increase 10 million tons annually [1]. The executive director of the Aptindo mentioned that in 2019-2000, Indonesian's wheat flour consumption increases around 70% compared to the previous year [2]. One effort to overcome this is by optimizing the potential of local food that can be used as an alternate for flour such as mocaf or cassava flour and *suweg* flour. *Suweg*, the Indonesian name for Elephant foot yam (*Amorphophallus paeoniifolius*) is a tuber plant that usually thrives under other plants and have been widely cultivated in Indonesia with a fairly large production.

*Suweg* has the potential to be developed as a food diversification substitute for wheat flour, because the energy and carbohydrate content is almost the same as wheat. In 100 g of *suweg* flour contains 332 calories of energy and 76.1 g of carbohydrates; while wheat contains 333 calories of energy and 77.2 g of carbohydrates; however the protein content of *suweg* is lower (5.7 g) than wheat (9 g). *Suweg* is also that classified as a low glycemic index food (<55) of 42 and high in fiber of 13.71% [3]. Hence, it can be used as an alternative food for someone in low glycemic index diet, such as diabetic people and obesity.

*Suweg* tuber traditionally processed by steaming and then served with grated coconut in Indonesia. Apart from steaming, there have not been many variants of processing suweg tubers [4]. Utilization *suweg* bulbs in providing products will be easier if used as flour. Materials used in the form of flour will be easily processed into a variety of processed products and the relatively long storage [5].

Variations in food processing from *suweg* flour that have been carried out are biscuits and brownies. However, the use of *suweg* flour in some

 

foods as a substitute for wheat flour in its processing has been unable optimal. Therefore, it is still necessary to develop formulations processed products *suweg* by substituting other food to increase the nutritional value of protein. The benefits of this substitution is to supplement deficiencies in each of the ingredients [6]. For example, based on calculations using the Indonesia Food Composition Tables, the addition of 100 g of green beans in food products of *suweg* will increase the protein content of 22.9 g and fiber 7.5 g [7].

Brownies are a type of wet cake that does not require the development of gluten and suitable for processing *suweg* flour which has a low protein content [8,9]. The manufacturing process is also simple from using the oven or just by simple steaming. Processing of brownies by steaming can also produce a soft texture because the steaming process does not remove a lot of water in the ingredients [10].

This study aimed to test the acceptability of steamed brownies from *suweg* flour substituted with mung bean flour. The use of these local ingredients is expected to add variety to the processing of *suweg* that is nutritious and acceptable to the community.

## 2. RESEARCH METHODS

### *2.1. Research Design*

A completely randomized design with 4 formulations consisting of 1 control and 3 different formulations was performed to produce the acceptable steamed brownies made from *suweg* and mung bean flour. A preliminary test was conducted on May 26, 2021 to find out whether *suweg* flour can be made into brownies. The ratio of *suweg* flour and mung bean flour used in the preliminary study refer to the manufacture of *suweg* biscuits [11]. Other ingredients were added to make brownies such as margarine, egg, sugar, emulsifier and chocolate bar (Table 1).

### *2.2. Brownies Production*

#### *2.2.1. Ingredients*

The ingredients for making the brownies were *suweg* flour, mung bean flour, margarine, eggs, sugar, emulsifiers, and chocolate bars (Table 1). *Suweg* flour and mung bean flour were bought online from Bantul Yogyakarta. Other materials were bought from a local grocery store in Kudus.

#### *2.2.2. Utensils*

The equipment used in the study included digital scales, basins, pans, steamers, trays, dough mixers, stirrers, spoons, and baking sheets.

#### *2.2.3. Brownies Processing Stage*

Manufacture brownies follow the previous procedure [12]. The process of making brownies with substitution *suweg* flour and mung bean flour include preparing materials and equipment, weighing the materials in accordance with the treatment formulation as shown in Table 1. First, melted a piece of chocolate and margarine and set it aside. Other ingredients such as eggs, sugar, and emulsifier were mixed in a bowl, then added *suweg* flour and mung bean flour, then stirred until smooth. After that, added the melted chocolate and margarine into the bowl, then stired until the dough was mixed. Poured the dough into a pan and steamed for $\pm$30 minutes, then turned off the stove and removed the brownies from the pan. The *suweg* brownies were ready to be served (Diagram 1).

#### *2.2.4. Acceptance Analysis*

A hedonic test was used to determine differences in quality in several similar products by giving a score to certain properties of a product [13]. A preference form includes color, taste, aroma, texture, and overall organoleptic assessment with a scale level of 1: strongly dislike, 2: dislike, 3: slightly dislike, 4: neutral, 5: somewhat like , 6: like, 7: like very much on each indicator was used as an instrument to measure the brownies acceptance. Consumer panelists from local community in Kudus (n=50) were asked to provide feedback about the level of preference for the brownies in the form of hedonic scale. Consumer opinion on a new product needs to be done to determine which product is the most preferred by consumers and whether improvements are needed for the new product [14]. All panelists provided a signed consent before participating in this study.

| Ingredients | A | B | C | D |
|---|---|---|---|---|
| *Suweg* flour (g) | 100 | 90 | 80 | 70 |
| Mung bean flour (g) | 0 | 10 | 20 | 30 |
| Margarine (g) | 75 | 75 | 75 | 75 |

**Table 1. Steamed Brownies Formula**

| | | | | |
|---|---|---|---|---|
| Egg (grain) | 1 | 1 | 1 | 1 |
| Sugar (g) | 50 | 50 | 50 | 50 |
| Emulsifier (g) | 2 | 2 | 2 | 2 |
| Chocolate bar (g) | 50 | 50 | 50 | 50 |

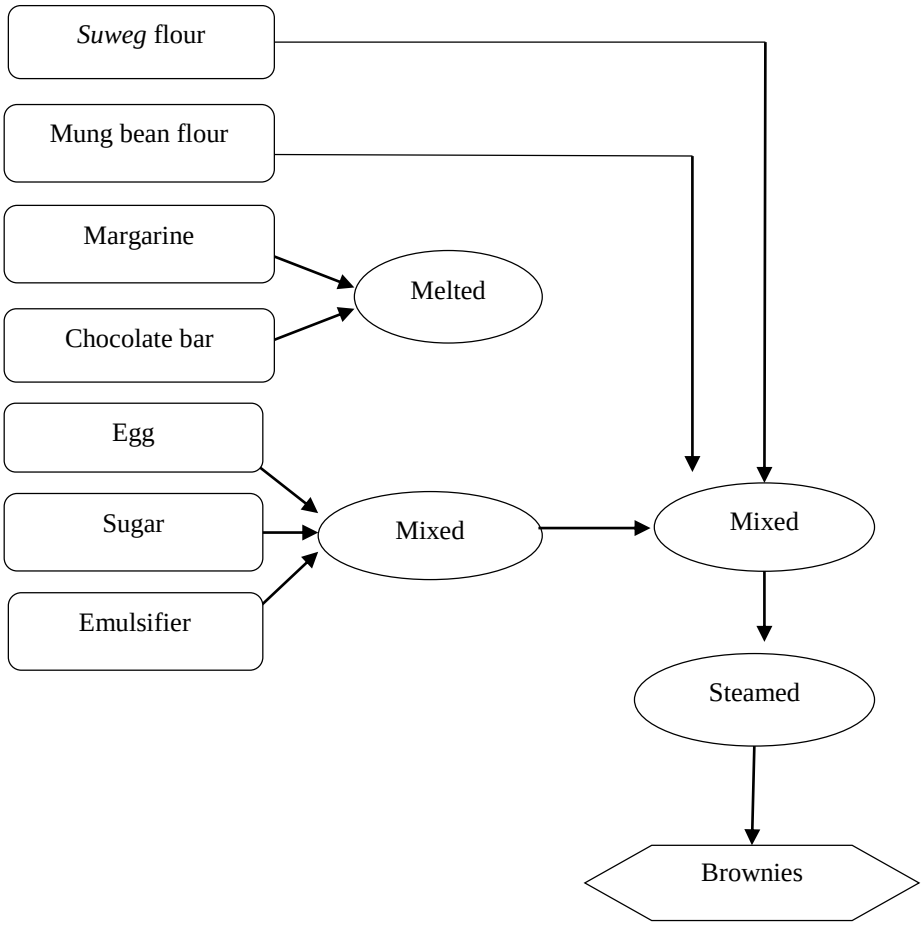


**Diagram 1 Brownies Processing Stage**

*2.2.5. Statistic analysis*

The data that has been collected was tested for normality using the *Kolmogorov Smirnov test* and showed not normally distributed. A *Kruskal Wallis* test was done to measure the effect on each treatment with the level of significancy (p-value) of <0.05.

## 3. RESULTS AND DISCUSSION

### *3.1. Brownies Acceptance*

Table 2 showed the acceptability of brownies suweg substituted with mung bean flour. In general, the brownies with the addition of suweg flour and mung bean flour showed a significantly different level of recipient. Mung bean flour substitution of 30% gives the highest preference level of the overall acceptability. In contrast, mung bean flour substitution of 0% indicates the lowest level of preference. The results of the overall acceptance of brownies include a bright brown color, the aroma still had a slightly distinctive smell of *suweg*, the texture was creamy and dense, the taste was quite good, but there was still a taste of *suweg* and mung beans. The higher the addition of mung bean flour, the overall acceptance of brownies was preferred by the panelists.

Statistical results using the *Kruskall Wallis* test showed that the ratio of addition of suweg flour and mung bean flour in making brownies influence the acceptability of color (p=0.036), texture (p=0.001), taste (p=0.035), and overall (p=0.019).

**Table 2.** Acceptability of Brownies Suweg Substituted with Mung Beans

| Assessment Aspect | Brownies Acceptance Score | | | | | | | | p= value* |
|---|---|---|---|---|---|---|---|---|---|
| | Formula A | | Formula B | | Formula C | | Formula D | | |
| | mean | median | mean | median | mean | median | mean | median | |
| Color | 5.26 | 1.337 [a] | 5.28 | 1.107 [a] | 5.56 | 1.146 [ab] | 5.88 | 1.003 [b] | 0.036 |
| Aroma | 5.12 | 1.438 | 5.40 | 1.161 | 5.60 | 1.050 | 5.82 | 0.983 | 0.071 |
| Texture | 4.96 | 1.324 [a] | 5.32 | 1.203 [ab] | 5.50 | 1,111 [b] | 5.98 | 0.820 [c] | 0.001 |
| Taste | 5.18 | 1.453 [a] | 5.74 | 1.209 [b] | 5.62 | 1.141 [ab] | 5.82 | 1.466 [b] | 0.035 |
| Whole | 5.42 | 1.279 [a] | 5.68 | 1.039 [a] | 5.64 | 1.083 [a] | 6.06 | 1.114 [b] | 0.019 |

*The ratio of suweg flour and mung bean flour for formula A, B, C and D were* 100%:0%, 90%:10%, 80%:20% and 70%:30%, respectively; **Kruskall Wallis test;* [a,b] Different notations represent significant differences in the results of data analysis.

The color produced in the brownies with subsitution of 30% mung bean flour showed the highest preference of the panelist. It was not too brown and not too bright too generated as brownies. The brown color produced in the brownies due to the Maillard reaction of stripping and drying during steaming and the addition of chocolate as well as green beans [15]. Making the brownies using green beans which have high amylose content (27-30%) can produce bright colors and products are not easily destroyed during cooking [16].

Aroma in brownies with substitution treatment with mung bean flour with a percentage of 0%, 10%, 20%, and 30% indicate that the received power level of preference were not significantly different. Based on Table 2, the aroma ratings ranged from 5.12 to 5.82 and belonged to the category of moderately preferred. The distinctive aroma produced tend to be strong on *suweg* tuber flour so that it can affect the panelist assessment to the aroma indicator [17]. Enzymatic browning reactions that occur in tuber starch *suweg* can trigger changes in product aroma, it relates to the amount of volatile compounds contained in the flour [18]. Unpleasant odor found in green beans due to the activity of enzymes that attack liposigenase unsaturated fatty acid chains and also produces a number of compounds such as aldehydes and ketones [19]. The attractiveness of a food can be measured from the aroma by using the sense of smell to stimulate and awaken the taste buds. The smell of food occurs due tue the formation of volatile compounds in reaction enzymes work or can also be formed without the help of an enzyme reaction [20].

The addition of mung bean flour substitution at each treatment scoring the different preferences of the acceptability of texture. Mung bean flour substitution of 0% indicates the least favorite. Meanwhile, mung bean flour substitution of 30% provides the highest acceptance of the brownies texture. The steaming process does not remove a lot of brownie's moistures; hence the brownies have a soft texture. The protein contained in flour are the main components that affect the texture. Texture of the food can be tested using a hand palpation, easy of chewing, tenderness and crispness, which may affect the suitability of a food product [21].

The addition of mung bean flour in each treatment gives different levels of preference for the taste attributes in this study. The provision of *suweg* tuber flour in the manufacture of steamed brownie products gives more *suweg* flavor than mung bean flour, so it can reduce the panelists' preference level, this is because the distinctive taste of suweg tubers is getting more pronounced.

### *3.2. Nutrition content of the Brownies*

The nutrient contents including energy, protein, fat and carbohydrate of the brownies produced in this project were calculated based on the Indonesia Food Composition and showed that the energy, protein, fat and carbohydrate of the all the formulation nearly the same. However, when compared to the formulation with flour, the protein content of our brownies was lower 13.61 g. (Table 3).

**Table 3.** Nutrition contents of Brownies Suweg Substituted with Mung Beans

| Formulation | Energy (kal) | Protein (g) | Fat (g) | Carbohydrat (g) |
|---|---|---|---|---|
| A | 1417.2 | 13.97 | 82.19 | 155.14 |
| B | 1420.4 | 13.85 | 82.23 | 155.49 |
| C | 1432.6 | 13.73 | 82.27 | 156.62 |
| D | 1426.8 | 13.61 | 82.31 | 157.36 |

The ratio of *suweg* flour and mung bean flour for formula A, B, C and D were 100%:0%, 90%:10%, 80%:20% and 70%:30%, respectively; all the nutrient contents were calculated using The Indonesia Food Composition Tables [7].

## 4. CONCLUSION

There are differences in the substitution of mung bean flour on the acceptability of color (p=0.036), texture (p=0.001), taste (p=0.035), and overall (p=0.019) in making brownies. Meanwhile, for aroma acceptance (p = 0.071) there was no effect on the substitution of mung bean flour in making brownies. The brownies most favored by the panelists were brownies with 30% mung bean flour substituted. The organoleptic results for the brown color are rather bright, the aroma still smells slightly typical of *suweg* tubers, the texture is soft and dense, the taste is quite appropriate, and overall it is like brownies in general but still smells and tastes typical of the *suweg* tubers and mung beans themselves. The overall acceptance of steamed brownies showed that the higher the addition of mung bean flour, the more preferred by the panelists.

## AUTHORS' CONTRIBUTIONS

Investigation, data curation & formal analysis: Anggraeni BM; Conceptualization, writing, review and editing: Rahmawaty S.

## A KNOWLEDGMENTS

We thank to the residents of Jati Wetan Village, Kudus who have been willing to participate as panelists in this study.

## REFERENCES

[1] Aptindo, *Overview of Indonesian National Wheat Flour*, Jakarta, 2013.

[2] Abdillah H, 2021. APTINDO Ensures Stable Wheat Flour Prices Amid the Pandemic. Available on APTINDO *make sure the price of the flour is stable in the midst of the pandemic* (infoindonesia.id). Accessed on December 6th, 2021

[3] Faridah, D.N., Physicochemical Properties of Suweg Flour (*Amorphophallus campanulatus B1*) and its Glycemic Index, *Jurnal Teknologi dan Industri Pangan*, 2005, vol. 16, pp. 254–259.

[4] Dwikandana, Ida Ayu Satya, Damiati, Ni made Suriani, Experimental Study of Suweg Bulb Flour Processing, *Jurnal Bosaparis: Pendidikan Kesejahteraan Keluarga,* 2018, vol. 9(3), pp. 166-177.
DOI: http://dx.doi.org/10.23887/jjpkk.v9i3.22143

[5] Pitojo, S., *Suweg*. Yogyakarta: Kanisius, 2007.

[6] Astawan, M., *Stay Healthy with Processed Food Products*, Surakarta: Tiga Serangkai, 2004.

[7] Direktorat Gizi Masyarakat, Indonesian Food Composition Table, Jakarta: Kementerian Kesehatan RI, 2017.

[8] Regawati, *Aneka cokelat.* Jakarta: Puspa Swara, 2003.

[9] Paran, S., *100+ Anti-Fail Tips for Making Bread, Cake, Pastry, and Pastries*, Jakarta: Kawan Pustaka, 2009.

[10] Kristianingsih, Z., The Effect of Pumpkin Substitution on the Quality of Steamed Brownies, Semarang: Universitas Negeri Semarang (UNES), 2010.

[11] Marissa, D., Formulation of Corn *Cookies and shelf-life prediction of the product with the critical water content approach, Thesis,* Faculty of Agricultural Technology, Bogor, IPB, 2010.

[12] Sri, A., *Cookies & Pastries Lezat Dan Sehat*. Jakarta: Puspa Swara, 2013.

[13] Stone, H., Joel, L., Sensory Evaluation Practices, Third Edition. Elsevier Academic Press, California, USA, 2004.
[14] Susiwi, S., *Organoleptic Assessment*. Universitas Pendidikan Indonesia. Bandung, 2009.
[15] Agustini, S., Gatot Priyanto, Basuni Hamzah, Budi Santoso, Rindit Pambayun. 2014. The Effect of Steaming Time on the Sensory Quality of Eight-Hour Cake, *Jurnal Dinamika Penelitian Ind*ustri, vol. 25, no. 2, pp. 79–88. DOI: http://dx.doi.org/10.28959/jdpi.v25i2.513
[16] Piyachomkwan, K., K. Sriroth, K. Chinsamran, K. Laohaphattanalert, C.G. Oates, Development of a standard protocol for the processing of high quality sweetpotato starch for noodle making. In K.O. Fuglie and M. Hermann (eds). Sweetpotato post-harvest research and development in China. *Proceedings of an International Workshop held in Chengdu*, Sichuan on November 7-8, 2001. CIP, Bogor, pp. 140–160.
[17] Hasbullah, Asy'ari U.H., Sensory Properties and Principal Component Analysis of Suweg Flour in Surakarta, *Jurnal Ilmiah Teknosains*, 2016, vol. 2. DOI: https://doi.org/10.26877/jitek.v2i2/Nov.120 1
[18] Ioannou, I., M. Ghoul, Prevention of enzymatic browning in fruit and vegetables, European Scientific Journal, 2013, vol. 9(30), pp. 310-341. DOI :10.1016/j.postharvbio.2007.08.
[19] Wieser, H., Determination of Gliadin and Gluten in Wheat Starch by means of alcohol extraction ang gel permeation chromatography. In Stern.M.ed. Proceedings of the 17th Meeting of The Working group on Prolamin Analysis and Toxicity. Zwickau Verlag Wissenschaftliche Sripten, 2003, pp. 53-57.
[20] Zuhrina, The Effect of Adding Banana Peel Flour (Musa Paradisiaca) on the Acceptability of Donuts, Thesis, Medan: Universitas Sumatra Utara, 2011.
[21] Meilgaard, M., Civille G,V., Carr B.T., Sensory Evaluation Techniques. CRC Press. Boca Raton, 2000.