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Development of local food *Suweg* (*Amorphophallus Paeoniifolius* Dennst) as a high nutritional value snack

Sugeng Maryanto ✉; Indri Mulyasari; Adelina Sari Widya Wardhani

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Development of Local Food *Suweg* (*Amorphophallus Paeoniifolius* Dennst) as A High Nutritional Value Snack

Sugeng Maryanto[1, a)], Indri Mulyasari[1, b)], and Adelina Sari Widya Wardhani[1. c)]

[1]*Department of Nutrition Universitas Ngudi Waluyo, Semarang, Indonesia*

[a)]*Corresponding author: sugengmaryanto99@gmail.com,*
[b)]*imulgizi@gmail.com,*
[c)]*prodigizi.nw@gmail.com*

Abstract. *Suweg* is a local tuber plant easily found in various regions in Indonesia, commonly consumed by the local people as a daily snack. *Suweg* had been processed for snacks, such as brownies and cookies that have high nutritional value. This research was conducted to test the level of preference and analyse nutrient content. This study used an experimental design of 25 untrained panellists. The *suweg* brownies and cookies were made in 3 formulations with a ratio of wheat flour and *suweg* flour F1 (25:75), F2 (50:50), and F3 (75:25). The most preferred brownie formulation was F2 (95.5%), and the most preferred cookie was F3 (89.1%). The nutritional content of brownies in 100 grams is carbohydrates (32.56 g), fat (24.54 g), protein (6.79 g), crude fibre (19.02 g), and energy (378.26 kcal). The nutritional content of cookies in 100 grams is carbohydrates (40.53 g), fat (45.25 g), protein (5.99 g), crude fibre (28.74 g), and energy (583.33 kcal). The highest level of preference for *suweg* brownies is F2, and cookies are F3. *Suweg* as a local food can develop into functional food and processed food originating from the local area, therefore able to support food security in SDGs.

INTRODUCTION

Suweg is a plant that can grow well throughout Indonesia, including in Gunungpati, Semarang City, Central Java province [1]; the tubers have enormous potential in producing plants as a source of starch and fibre [2]. Suweg tubers have been used as alternative flour sources [3, 4, 5]. Flour, as a food ingredient commonly consumed by Indonesian people, was generally made from wheat flour. Processed products made from wheat flour include noodles, brownies, cookies, bread, and biscuits. These products have become a daily menu for some people as snacks [6, 7, 8, 9, 10]. The very high consumption of wheat flour-based processed products makes wheat flour a staple food equivalent to rice. However, most of the fulfilment of domestic wheat flour comes from imports. To solve this problem by seeking alternative local food for food security.

Diversification of staple foods based on local food is one of the efforts that have been done to reduce dependence on imported wheat flour. The local food that Indonesian people commonly consume is tubers. The tubers group had great potential as an alternative food ingredient that could develop as a substitute for wheat flour. The group of tubers that have the potential to be developed as processed food, for example, is suweg [5, 11, 12]. Suweg tubers can be processed into flour as a substitute for wheat flour [13]. However, suweg tubers have a low glycemic index. Therefore, they can be used as low-sugar snacks [14, 15]. Generally, people consume suweg tubers processed by steaming or just boiling. Based on this condition, an idea was raised to create food products made from suweg tubers [16]. The nutrients contain suweg tubers generally as a source of carbohydrates and fibre [17]. In addition, suweg also has a phytochemical function because it contains antioxidants such as ascorbic acid, alpha-tocopherol, beta carotene, and lycopene [18].

The utilization of suweg tuber was still not optimal. Therefore, it is necessary to increase its utilization in order to produce a high value. Suweg tubers were processed into various processed products to increase nutritional value, extend shelf life, add variety to food product processing, for example, brownies and cookies. This product processing provides business opportunities to develop functional food products based on local food [7, 11, 12, 20].

The importance of developing local food products from suweg tubers is raised since the community has not used

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them optimally. The lack of information received by the public regarding the nutritional content of suweg tubers had initiated the research on "Development of local food suweg as a high nutritional value snack ". This study aimed to test the level of preference and analyze the nutritional value of processed brownies and cookies from suweg tubers.

MATERIAL AND METHOD

This research was conducted in August 2020. The manufacture of suweg flour and its formulation was carried out at the Food Laboratory of the Department of Nutrition, Ngudi Waluyo University, Semarang, Indonesia. This study uses an Experimental Design [21], using three comparisons of brownie and cookie formulations [22, 23]. Formula 1 (F1) with a ratio of wheat flour: suweg flour (25%:75%), formula 2 (F2) with a ratio of wheat flour: suweg flour (50%: 50%) and formula 3 (F3) with a ratio of wheat flour: suweg flour (75%: 25%).

The processing of suweg brownies had been done by steaming, while the processing of cookies had been done by baking in the oven. Brownies and cookies products were tested hedonic on untrained 25 panellists aged 25-45 years, male and female, consisting of lecturers and staff at Ngudi Waluyo University. The components of the test were taste, colour, aroma, and texture. The next step is to analyze the nutrient content of carbohydrates (titration method), fat (Soxhlet method), protein (Kjeldahl method), and fibre (enzymatic method) [24].

Data analysis was carried out by calculating the average level of preference data based on the hedonic test. This analysis was used to describe the level of preference of the panellists to the three formulas of brownies and cookies with the addition of suweg tubers.

RESULTS AND DISCUSSION

The Preference Level of *Suweg* Brownies

The results of the preference test for suweg brownies are presented in Table 1; the highest score in all formulas is in the like domain, respectively F1 (89.9%), F2 (95.5%), and F3 (93.1%), the level of highest likes on F2. Based on Table 1, the preference level for taste, colour, texture, and aroma at F1, F2, and F3 obtained different results. Formula 1 has a slightly bitter taste, F2 has a good taste, and F3 does not taste a brownie.

TABLE 1. The level of preference for brownies with added *suweg* flour.

Food quality	***Suweg* brownies preference test**																				
	Formula 1 (F1)							**Formula 2 (F2)**							**Formula (F3)**						
	0	1	2	3	4	5	Σ	0	1	2	3	4	5	Σ	0	1	2	3	4	5	Σ
Taste			3	7	12	3	25	1			7	14	3	25		1	1	7	12	4	25
Color		1	2	4	14	4	25			1	8	15	1	25			2	9	10	4	25
Aroma	1		1	7	14	2	25		1		10	13	1	25				11	13	1	25
Texsture		1	2	8	10	4	25	1	1	1	8	14	1	25		1	1	9	13	1	25
Score	1	2	8	26	50	13		1	2	2	33	56	6		0	2	4	36	48	10	
	dislike			like				dislike			like				dislike			like			
Preference	11			89				5			95				6			94			
	(11%}			(89%}				(5%}			(95%}				(6%}			(94%}			

Note:
0 = dislike, 1= neutral, 2= somewhat like, 3= like, 4= like very much; 5= very much likeF1= 25% wheat flour 75% *suweg* flour
F2= 50% wheat flour 50% *suweg* flourF3= 75% wheat flour 25% *suweg* flour

The colour of F1, F2, and F3 looks different due to the flour ratio. Formula1 was a darker colour, F2 was neither too dark nor too light, F3 was slightly lighter than the other formulas. Colour is one of the determinants qualities of a food product, similar to the taste, texture, and aroma. Colour plays a role in the acceptance of food. Based on the statistical tests from the three formulations, F2 is the most favoured by the panellists. There were 15 panellists (60%)

who gave a value of very fond of colour compared to F1 with 14 panellists (56%) and F3 as many as ten panelists (40%). This is because the resulting colour is not too brown and not too bright also because the resulting suweg tuber flour is light brown. When stripping and drying, the suweg tubers changed to brown colour. In addition, the brown colour of the brownies is due to the Maillard reaction during steaming [25].

Aroma is sensory with smell; aroma plays a vital role in evaluating a product in the food industry. Based on the highest level of liking for the aroma in F1, 14 panellists (56%) gave a value of very like to F1 (score 4). However, for the level of liking for formulas 2 and 3 obtained the same score (4), like several 14 panellists, most of the subjects liked F2 (Table 1). Formulation 2 had not had a distinctive aroma, but it still felt that the brownie product contained suweg tubers was due to the addition of 50% or 50 grams of flour. In general, the aroma of F1 had a powerful aroma, F2 had a less pungent aroma but is typical of brownies with suweg, and F3 had a not too strong aroma.

Based on the level of preference for the taste of suweg brownies, the F2 formulation was the most favoured by the panellists; most panellists gave a very like score (score 4) as many as possible 14 panellists (56%). Most panellists stated that they liked formula two because the taste of suweg brownies was equivalent to the taste of brownies in general. Another thing is also influenced by the addition of margarine and eggs and the fat and protein contained in the dough, which helps improve the taste of the resulting product.

The texture is one of the determinants of the quality of a food product, based on the results of the level of preference. There are differences in texture in the three formulations; F1 had a less soft texture, F2 had a softer texture, and F3 had the softest texture. The soft texture of the processed brownies has been caused by the presence of moisture that drips back into the preparation. Fourteen panellists (56%) were very like; most of the panellists liked the texture of F2 brownies due to the softness. The texture of suweg brownies results in the cooking process and the release of water bound in the starch gel at a specific temperature and time interval. The increase in temperature during cooking results in the evaporation of water. The high-pressure steam pushes and forces the gel tissue. As a result, emptying occurs in the tissue and forms air cavities in the brownies, and affects the texture of the brownies. Steamed brownies have a soft texture because the brownies steaming process does not remove much moisture. After all, the steaming process uses water vapour.

The Preference Level of Suweg Cookies

The results of the preference test for processed suweg cookies are presented in Table 2; the highest score in all formulas is in the like domain, F1 (77.3%), F2 (80.0%), and F3 (89.1%), respectively, and the level of highest preference on F3.

TABLE 2. The level of preference for cookies with added suweg flour.

Food quality	***Suweg* cookies preference test**																				
	Formula 1 (F1)							**Formula 2 (F2)**							**Formula (F3)**						
	0	1	2	3	4	5	Σ	0	1	2	3	4	5	Σ	0	1	2	3	4	5	Σ
Taste		2	3	7	9	2	25		1	4	7	6	7	25	1	1	1	9	10	4	25
Color		1	7	9	4	3	25		1	5	8	9	2	25		1	2	8	10	4	25
Aroma		1	4	10	10		25		2	3	9	9	2	25		1	2	11	10	1	25
Texsture		1	3	9	12		25	1		3	10	8	3	25	1		1	13	7	3	25
Score	0	5	17	35	35	5		1	4	15	34	32	14		2	3	6	41	37	12	
	dislike			like				dislike			like				dislike			like			
Preference	22			75				20			80				11			90			
	(22%}			(75%}				(20%}			(809%}				(11%}			(90%}			

Note:
0 = dislike, 1= neutral, 2= somewhat like, 3= like, 4= like very much; 5= very much likeF1= 25% wheat flour 75% *suweg* flour
F2= 50% wheat flour 50%
suweg flourF3= 75% wheat
flour 25% *suweg* flour

Taste is the most critical component or profile in food menu planning. The components that play a role in determining food taste include aroma, seasoning and flavouring, tenderness, crispness, level of maturity, and food temperature. Based on the results, the highest level of preference for the taste of cookies was for formulation 3; 40% of panellists very like the formula three taste. That was just right and delicious. The amount of 25% suweg gives the

taste a little bitter that does not like by panellists.

Colour is one of the determinants of the quality of a food product. The level of product development generally influences the level of panellists' preference for colour. Along with taste, texture, taste, aroma, and colour play a role in accepting food. The highest preference for cookies tastes in formula 3; 40% of panellists like formula 3. The panellists stated that the resulting colour was not too brown/scorched because the ratio of suweg tuber flour and wheat flour was 25%:75%. Suweg flour is added only by 25%, so it does not affect the colour of cookies but is also influenced by processing time. Baking time affects the colour of cookies; the longer the baking time of the product, the browner due to non-enzymatic browning reactions caused by caramelization and the Maillard reaction [25].

Based on table 2, it was known that the level of preference for the aroma of cookies, 11 panellists stated that the F3 had a not too unique aroma, the aroma produced was delicious and did not produce a bad smell. This is due to the addition of 25% or 25 grams of suweg tuber flour. The aroma will arise and feel more potent during processing, such as roasting, boiling, or frying. The components that give the aroma are organic acids in the form of esters and volatiles and the presence of starch content, which is degraded when baking cookie dough. The starch content undergoes extensive changes with the elimination of water molecules. The fragmentation of sugar molecules, where the carbon bond is broken, produces carbonyl and volatile compounds, which induce the distinctive aroma of cookies. Sukri et al. [11] stated that wheat flour can replace 100% with walur flour (another type of suweg) but has a different aroma.

The texture is one of the determinants of the quality of a food product. Based on the level of preference for the texture of cookies, 12 panellists liked the texture of F1, and seven panellists liked F3. This was caused by the texture produced by F3 cookies being less crispy. This less crispy texture was caused by the suweg tuber flour that does not contain gluten and has low starch content [26].

The Nutrients of Suweg Brownies and Cookies

The analysis of nutrients was carried out on the formulation with the highest level of preference, F2 for brownies (Table 1) and F3 for cookies (Table 2). Table 3 presents the results of the analysis of nutrient content; it was found that the fat, protein, and crude fibre and energy content of processed brownies and cookies were higher than that of fresh suweg tubers and flour. In contrast, the carbohydrate content of processed brownies and cookies was lower (Table 3). The analysis test results for F2 brownies showed that the carbohydrate content per 100 grams was 32.56 grams, while the F3 cookies were 40.53 grams.

The carbohydrate content of brownies produced by famous manufacturers was 82.5 grams and cookies 66.67 grams. Based on the 2019 Komposisi Pangan Indonesia (TKPI) Table, the recommendation for carbohydrate consumption for adult males was 415 grams and females 340 grams [27]. Suweg tuber brownies were able to contribute 7.85% carbohydrates for adult males and 9.57% for females. Cookies had contributed 9.76% carbohydrates for adult males and 11.9. 2% for adult females. The percentage contribution of carbohydrates from brownies and cookies with suweg tubers was not more than 10%; therefore, they can be used as snacks with low carbohydrate content.

TABLE 3. The analysis nutrients of *suweg* brownies and *suweg* cookies.

Nutrient Component	The Content of Nutrient per 100 grams			
	Suweg* Tuber	***Suweg* Flour***	***Suweg* Brownies**	***Suweg* Cookies**
Carbohydrate (g)	17.20	87.36	32.56	40.53
Lipid (g)	0.10	1.17	24.54	45.25
Protein (g)	1.40	1.13	6.79	5.99
Crude fiber (g)	1.40	3.45	19.02	28.74
Energy (Kcal)	74.00	364.49	378.26	593.33

*TKPI 2019

The fat content in brownies was 24.54 grams, while cookies contained 45.25 grams of fat. The fat content in brownies produced by famous manufacturers was 6.25 grams, and for cookies was 26.64 grams [27]. The fat content of suweg brownies and cookies was greater than that of popular manufacturer products. The addition of margarine and eggs is shortening and provides a softer texture to cookies and fat, improving physical texture such as expansion, the softness of texture, and aroma.

The protein content in F2 brownies and F3 cookies was 6.79 grams and 5.99 grams. The protein content in brownies produced by famous manufacturers was 5 grams and for cookies was 6.67 grams. The protein content of suweg brownies and cookies was greater than that of popular manufacturers. Therefore, brownies and suweg cookies could

be used as an alternative to high-protein snacks.

The fibre content of the F2 brownies and F3 cookies in 100 grams was 19.02 grams and 28.74 grams, respectively. Based on the 2019 Recommended Dietary Allowance (RDA), fibre consumption for adults male was 37 grams, and females were 32 grams [27]. Suweg brownies were able to contribute 51.4% fibre for adult males and 59% for females. Cookies were contributed 77.67% fibre for adult males and 89.81% for females. Thus, suweg brownies and cookies can be used as an alternative to high-fibre snacks for adults.

The analysis of the energy content of the brownies F2 was obtained from the calculated number of calories for protein, fat, and carbohydrates. Energy in brownies suweg for 100 grams was 378.26 kcal; this energy content was slightly lower than chocolate brownies made by famous manufacturers made from wheat flour, which was 400 kcal [28]. The energy in the suweg cookies F3 was 593.3 kcal, more significant than the energy content of cookies made by famous manufacturers of 533.3 kcal [28]. It proved that suweg cookies were able to be used as snacks because they have energy equivalent to factory cookies. Based on the 2019 RDA, the energy requirement for adult males is 2,650 kcal, and for females is 2,250 kcal [27]. Suweg brownies can contribute 14.2% energy for adults male and 16.8% for adult females, while suweg cookies can contribute 22.3% of energy for adult males and 26.3% for adult females. Therefore, suweg brownies and cookies able to be used as additional food to increase energy requirements.

CONCLUSION

The highest preference for processed brownies was the formula with the proportion of wheat flour compared to suweg of 50%: 50% (F2). The highest preference for processed cookies was formula with the proportion of wheat flour compared to suweg of 75%: 25% (F3). The nutritional content of brownies in F2 was carbohydrates: 32.56 grams, Fat: 24.54 grams, protein: 6.79, fibre was 19.02 grams, and energy was 378.26 Kcal. The nutritional content of cookies in F3 was carbohydrates: 40.53 grams, Fat: 45.25 grams, protein: 5.99, fibre was 28.74 grams, and energy was 593.33 Kcal. Suweg as a local food can be developed into functional food, processed food originating from the local area, and support food security.

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