

Purple Sweet Potato Biscuits with Different Margarine Usage

Siti Fathonah¹ and Dhiah Farida Sari²

^{1,2} Family Welfare Education, Engineering Faculty, Semarang State University, Semarang, Indonesia
 fathonah.unnes@gmail.com¹, dhiah_sari21@yahoo.co.id²

Abstract—Purple sweet potato which contains high carbohydrate with low IG can be used as main ingredients of biscuits. However, the low gluten content needs more margarine. This research aims at figuring out the difference of margarine usage to sensory quality and the degree of likeability of the biscuits on early childhood. The variant of the purple sweet potato which was used in this research was Ayamurasaki. The usage of margarine which was studied were 45%, 50%, and 55%. The sensory testing revealed that the biscuit with the best sensory quality was the ones with the 55% of fine quality margarine. The Anova test showed that the usage of the margarine gave difference on all aspects of sensory quality ($p < 0.05$). The degree of likability on all of the biscuits was the same which was they were likeable, with the highest likability on biscuits with 55% margarine with the score of 3,15% (max. score was 4). However, one of the aspects which got the low score was aspect of tastiness. Purple sweet potato biscuits containing energy 490 – 515 kkal, protein 5.8 – 6.0 %, fat 24.9 – 25.5 %, crude fiber 8.3 – 10.1 %, and anthocyanin 41,6 – 46,7 ppm. Nutrition content of the biscuits was increased by level of margarine usage.

Keywords—biscuits, purple sweet potato, margarine

I. INTRODUCTION

Purple sweet potato is the kind of potato which is preferable, has purple color and every 100 g of purple sweet potato contains 90 g of carbohydrate, 3,3 g of fiber, 20,7 g of protein and 8,4 g of sugar. Not to mention, purple sweet potato has low GL (*glycemix low*) 8,9 and medium GI 54 (medium *glycemix index*), so that it is suitable to become source of protein for those with diabetes [1]. The purple color indicates anthosinain.

Anthosianin is a pigment whose function is antioxidant and antibacterial. Anthosianin can function as the prevention of tumor cell development and of cardiac arrest [2]. The high content of carbohydrate makes it possible to be processed as flour which later becomes the raw material of biscuits.

Biscuits are snacks which are mostly consumed by children in Semarang and is only second to milk. The contribution of snacks to nutrient sufficiency is important which is 43.5% of energy, 62.3% of protein and 56,0% iron [3]. The results of research about purple sweet potato were 0 %, 25 %, 50 % dan 75 %, with other ingredients such as wheat. And the best percentage is 50%.

Biscuits with 50% of Purple sweet potato, 25% of margarine are preferable for people with the score 3.0 (4 is the maximum score). Their characteristics are sweet and crispy with the score 2,85 (good enough, with 4 is the

maximum score). The carbohydrate content is 47.8 g, 16.2 g of fat, 6.2 g of fiber and 83.9 mg of anthosianin [4]. The gluten content in purple yam flour causes low volume expansion which indicates the hardening biscuits [5]. The aforementioned results of research can be improved by adding margarine and more flour which contains amilosa which is tapioca starch

Margarine is a kind of fat. Fat plays pivotal role to produce tenderness of biscuit texture and makes high quality bread crumbs. [6]. The usage of fat as the shortening for the biscuits with wheat flour as their basic ingredients is 40% [7]. Maze flour is a flour to make the texture of the biscuits perfect.

The aims of the research are:

1. to find out the difference between the usage of the margarine to sensory quality of the purple sweet potato biscuits
2. to find out the degree of preference of purple sweet potato biscuits
3. to find out the energy, protein, fiber, and anthosianin content of the purple sweet potato biscuits.

II. RESEARCH METHODOLOGY

The ingredients of the biscuits are purple sweet potato flour from *Ayamurasaki* variant, which have high anthosianin, and the lowest water content among other variant. The composition of the flour that is used is purple sweet potato flour 50% and wheat flour 40% and maizena flour 10%. Fat that was used is vegetable fat (margarine) with brand of *blue band*. The margarine which was used in the research was 45%, 50%, and 55%.

THE INGREDIENTS OF PURPLE SWEET POTATO BISCUITS

Ingredients	Margarine Usage		
	45 %	50 %	55 %
Purple sweet potato flour	250	250	250
Wheat Flour	200	200	200
Maizena Flour	50	50	50
Margarine	225	250	275
Sugar Powder	175	175	175
Egg yolk	140	140	140
Baking powder	6	6	6
Skim Milk	50	50	50

The steps of making purple sweet potato biscuits consisted of four steps are ingredients mixing, casting, baking and finishing.

The ingredient mixing was to mix the ingredients homogenously. The steps of mixing the ingredients were as follows: mix the margarine and the sugar powder using mixer with medium speed for ± 10 – 15 minutes, until the dough was well – mixed and had densely bright color, add the egg yolk then mix again until it was well – mixed.

The next step was sieving all dry ingredients such as wheat flour, maizena flour, milk powder and baking powder, then pour them into the dough. Mix the dough until it was well – mixed. Then let the dough idle for ± 30 minutes.

The next step was pulverizing the dough using roll pin with plastic layer beneath the dough. Pulverize the dough 4 until 5 times until it was ± 4-5 cm thick. Then put the biscuits in the casting. Then put the results of the casting on the white – margarine – layered baking pan. After arranging the dough, then it is ready to be baked for ± 10-15 minutes on the temperature of 170-180°C.

In order to produce well – cooked biscuits, cool down the biscuits on open – air surface for ± 30 minutes. When the biscuits was in the phase of cooling down process, the biscuits still undergo the process of being well – cooked. Pack the biscuits inside hermetic package such as duck – taped jar or plastic with 0,5 mm thickness then press it. The following is the diagram of making purple sweet potato biscuits.

The stages of analyses in this study were conducted through 1) sensory testing by trained panelists with these indicators: color, texture, aroma of the purple sweet biscuits, aroma of the biscuits, sweetness and tastiness, and 2) preferability testing to early childhood, and 3) Energy content, protein, Fe, and anthocyanin. The energy testing was conducted using calorimeter bomb, the protein testing was completed using micro kjeldahl, fe using colorimeter, and anthocyanin using UV-Visible Spectroscopy method [8].

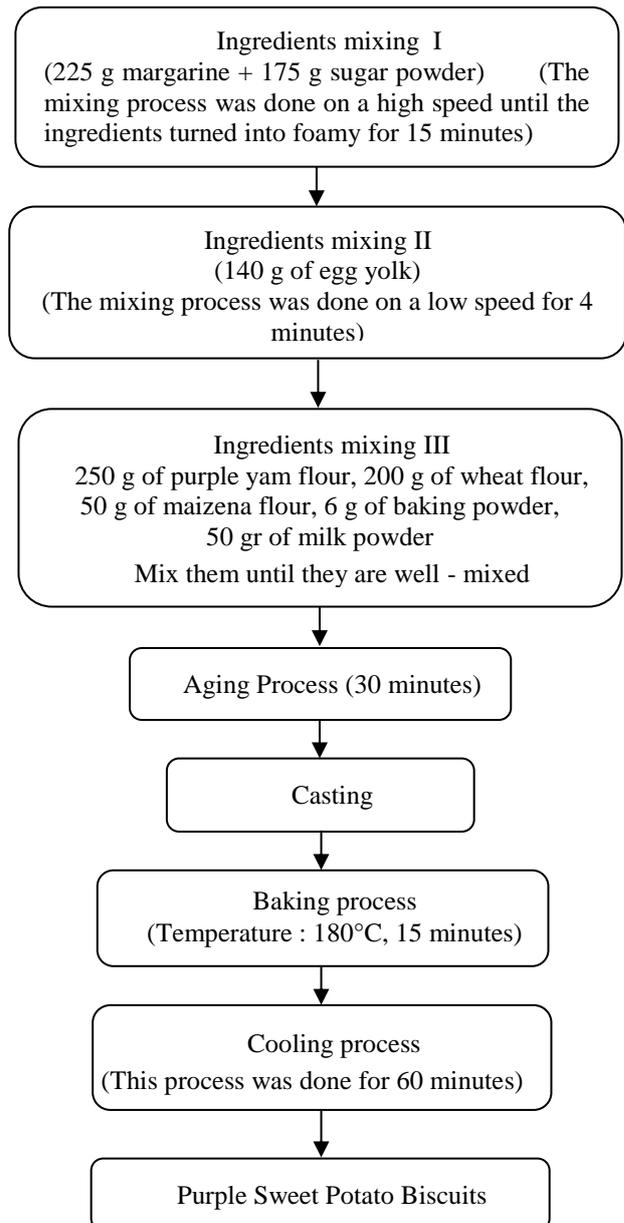


Figure 1. The Diagram of The Process of Making Purple Sweet Potato Biscuits

TABLE I. QUALITY SENSORY CRITERIA OF CORN / SWEET POTATO / GREEN BEAN BISCUITS

Score range	Criteria						
	Color	Flavor of sweet potato	Fragrant	Crispness	sweet taste	Taste of sweet potato	Overall
1,00 – 1,75	Brown (B)	Not tangible (NT)	Fragrantless (Fl)	not crispy (NC)	not sweet (NS)	Not tangible (NT)	Very poor (VP)
1,76 – 2,50	purplish brown (PB)	Less tangible (LT)	Less fragrant (LF)	Less crispy (LC)	Less sweet (LS)	Less tangible (LT)	Poor (P)
2,51 – 3,25	brownish purple (BP)	Quite tangible (QT)	quite fragrant (QF)	quite crispy (QC)	quite sweet (QS)	Quite tangible (QT)	Fair (F)
3,26 – 4,00	Purple (P)	Tangible(T)	Fragrant (Fr)	Crispy (C)	Sweet (S)	Tangible(T)	Good (G)

III. RESULTS AND DISCUSSION

The purple sweet potato biscuits had appetizing appearance, the purple color was still stable although the biscuits were baked for 15 minutes. It happened because during the process of making the purple sweet potato flour, the purple sweet potato was steamed first. The steaming process was able to hold the coloring agent, anthocyanin, in the purple sweet potato.

The results showed that the products of purple sweet potato is the ones who were able to hold their anthocyanin in the steamed purple sweet potato and the highest one was on the sweet potato cracker [9]. Although the biscuits were still purple, if they were compared to the color of the purple sweet potato flour, they showed that intensity of the color decreased. That decreasing intensity occurred due to instability and degradability of peonidin and cyanidin. The characteristic of anthocyanin is polar [10]. On the high temperature, the stability of the anthocyanin changes and instill damage on the anthocyanin [11]. The stability of the anthocyanin pigment is affected by light, temperature, and pH [12]. The results of the purple sweet potato biscuits can be seen on the figure 2.

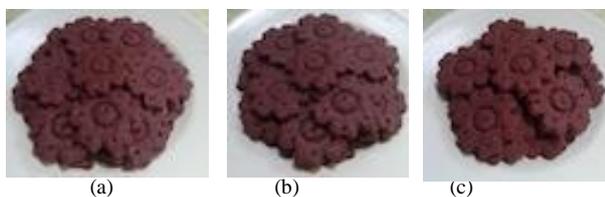


Figure 2. The purple sweet potato biscuits with 45 % margarine (a), 50 % margarine (b), and 55 % margarine (c)

The usage of the 50% purple sweet potato flour out of the total flour on the biscuits resulted in good sensory quality with an average score 2.52 – 3.15. It showed that the purple sweet potato flour can substitute wheat flour, even with the higher amount. The results of the study on the biscuits with 30% oat bran flour substitution and 20% barley bran substitution showed good quality and reception [13]. Biscuits with 15 g and 20 g/100g cashew apple and guava fruit powders showed the highest scores for sensory attributes, respectively. The supplementation seems to be suited for wheat flour substitution and it is possible to obtain cookies with value-added food ingredient within the standards [14].

The results of sensory testing on the purple sweet potato biscuits showed almost similar pattern on all sensory aspects, which were the more the margarine was used, the better the sensory quality would be. However, the more the margarine, the less aromatic would be. The study about the biscuit composition had strong effect especially in terms of fat interaction, aroma, and sweetness, both in vitro or in vivo [15]. The use of more margarine would give more volatile compound. Consequently, it would decrease the aroma of the purple sweet potato. The results of the sensory testing on purple sweet potato can be seen on the Table 2.

The usage of more margarine resulted in higher texture of the biscuits. It occurred due to the function of the margarine which was to soften the texture of the biscuits and make the quality biscuit crumbs. The function of the margarine is to cover maize flour and gluten from the flour with oily thin layer, so that it cuts the structure and prevents the formation of hard mass. It influenced the biscuit crumbs become soft and short. The higher the fat proportion in the dough, the higher the shortening effect would be [16]. Buckwheat (sorgum) enriched biscuits (30 – 50%) were rated higher regarding sensory attributes, softness and fracturability as compared to control (based on wheat flour) but lower compared to rye supplemented biscuits (30 – 50 %) [17].

TABLE II. THE RESULTS OF THE SENSORY TESTING ON PURPLE SWEET POTATO

Sensory Aspects	Margarine Usage		
	45 %	50 %	55 %
Color	2.45 ^a	3.00 ^b	3.38 ^c
Purple Sweet Potato Flavour	3.00 ^a	2.55 ^b	2.48 ^b
Fragrant Flavour	3.18 ^a	3.03 ^b	2.85 ^b
Texture	2.93 ^a	3.37 ^b	3.47 ^b
Sweetness	2.33 ^a	2.83 ^b	3.52 ^c
Tastiness	1.80 ^a	2.30 ^b	3.08 ^c
Average	2.62 ^a	2.85 ^b	3.13 ^c
Criteria	Fair	Fair	Fair

Information : Means followed by the same letter in a row are not significantly different at $p < 0.05$.

The almost similar results occurred on the testing of the preferability on children. The usage of more margarine, resulted in the high preferability, except on the aspect of tastiness (Table 3). It showed that margarine had positive effect on the organoleptic quality of the biscuits. The margarine had plasticity so it can mix with the dough and expand well if it is mixed with egg so that it resulted in the crispy texture. In addition, the mixing of margarine and sweet resulted in fragrant aroma and delicious taste

TABLE III. THE RESULTS OF PREFERABILITY OF PURPLE SWEET POTATO BISCUITS

Sensory Aspects	Margarine Usage		
	45 %	50 %	55 %
Color	2.34 ^a	2.96 ^b	3.38 ^c
Purple Sweet Potato Flavour	2.50 ^a	2.66 ^a	3.40 ^b
Fragrant Flavour	2.53 ^a	2.65 ^a	3.53 ^b
Texture	2.58 ^a	2.83 ^a	3.24 ^b
Sweetness	2.63 ^a	2.64 ^a	3.05 ^b
Tastiness	2.53 ^a	2.83 ^b	2.28 ^a
Average	2.52	2.76	3.15
Criteria	Like	Like	Like

Information: Means followed by the same letter in a row are not significantly different at $p < 0.05$

Interesting things occurred on the degree of preferability to the tastiness on the biscuits. The higher the margarine usage, the less preferable it would be for childhood. It happened because the high tastiness would cause over – tastiness which was less preferable.

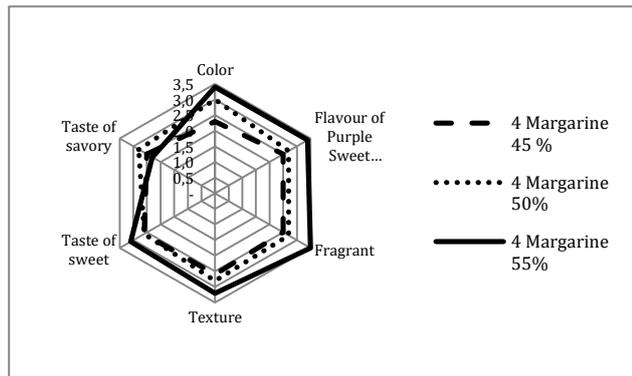


Figure 3. The graph of the degree of biscuits preferability

The energy content of the three biscuits 490-515 kcal exceeding the high-energy snack standard that is 400 kcal [18]. It is very good to support nutrition for Early Childhood. Non-nutritional substances that support the health of crude fiber and antocyanin. Crude fiber in sweet potato biscuits is very large can be contributed for 50 % of crude fiber needs (16 – 22 g/daily). Antocyanin an antioxidant compound that function to prevent oxidation of the body so as to improve the child's body, and anti-bacterial [2]

TABLE IV. NUTRITIONAL CONTENT OF PURPLE SWEET POTATO BISCUITS

Nutrition Content	Margarine Usage			SNI 01-2973-1992
	45 %	50 %	55 %	
Energy (kkal)	490	513	515	Min 400
Protein (%)	5.8	5.8	6.0	Min 9.0
Fat (%)	24.9	25.1	25.5	Max 9.5
Crude fibre (%)	8.3	9.3	10.1	Max 0.05
Antocyanin (ppm)	41.6	44.4	46.7	tad

ACKNOWLEDGMENT

Thank you for DP2M research competitive grants scheme for providing research funding. To Dhiah Farida Sari who helped research biscuit.

REFERENCES

[1] Hasim, A dan M. Yusuf. Ubi Jalar Kaya Antosianin" Pilinan Pangan Sehat. Sinar Tani. Edisi 20 - 26 Agustus 2008..
 [2] L. Lingga. The Healing Power of Antioxidant. 2012. Jakarta: Gramedia.
 [3] S. Fathonah, Rosidah, and Sarwi. "Nutritional Adequacy Level of Snack toward Nutritional Status of Early Childhood". Greener Journal of Epidemiology and Public Health. 2014. Vol. 2 (2), pp. 037-044
 [4] Sonia. 2015. Perbedaan penggunaan tepung ubi ungu terhadap kualitas organoleptik dan kandungan gizi biskuit. Skripsi. Semarang; FT Unnes

[5] Susilowati dan Medikasari. Kajian formulasi tepung terigu dan tepung dari berbagai jenis ubi jalar sebagai bahan dasar pembuatan biskuit non-flaky crackers. 2008. Lampung.
 [6] O'Brien et al. Influence Of Gluten Free Flour Mixes And Fat Powders On The Quality Gluten free Biscuit. 2003. Journal National Food and Nutritional Sciences. Hal 369-376. Irlandia
 [7] E. Gallagher, S. Kenny, and E.K. Arendt. Impact of dairy protein powders on biscuit quality. Eur Food Res Technol (2005) 221:237-243
 [8] M. M. Giusti, and R. E. Wrolstad, 2001, Characterization and Measurement of Anthocyanins by UV-Visible Spectroscopy, Current Protocols in Food Analytical Chemistry F1.2.1-F1.2.13.
 [9] N. E. Husna, M. Novita, S. Rohaya. Kandungan antosianin dan aktivitas antioksidan ubi jalar ungu segar dan produk olahannya. AGRITECH, Vol. 33, No. 3, Agustus 2013
 [10] Sri Winarti, Ulya Sarofa, Dhini Anggraeni. Ekstraksi dan Stabilitas Warna Ubi Jalar Ungu (Ipomoea batatas L.) Sebagai Pewarna Alami. 2008. Jurnal Teknik Kimia. Vol.3, No.1.
 [11] Winarno, F.G. Kimia Pangan dan Gizi. PT. 2004. Jakarta: Gramedia Pustaka Utama.
 [12] Yoshimoto , et al. (2001) . "Antimutagenicity of Deacylated Anthocyaninsin Purple-fleshed Sweet potato". Biosci. Biotechnol. Biochem., 6 5 (7) , 1652-1655 .
 [13] M.L. Sudha, , R. Vetrimani, K. Leelavathi. Influence of fibre from different cereals on the rheological characteristics of wheat flour dough and on biscuit quality. Food Chemistry. Volume 100, Issue 4, 2007, Pages 1365-1370.
 [14] A.M.A. Uchoa, J.M.C. da Costa, G.A. Maia, T. R. Meira, P.H.M. Sousa and I.M. Brasil. Formulation and Physicochemical and Sensorial Evaluation of Biscuit-Type Cookies Supplemented with Fruit Powders. Plant Foods Hum Nutr (2009) 64:153-159.
 [15] K. Burseg, R. S. T. Linforth, J. Hort, and A. J. Taylor. Flavor Perception in Biscuits; Correlating Sensory Properties with Composition, Aroma Release, and Texture. Chem. Percept. (2009) 2:70-78.
 [16] M.E. Lean. Ilmu Pangan, Gizi dan Kesehatan. Terjemahan. Yogyakarta: Pustaka Pelajar.
 [17] B. Filipčev, , O. Šimurina, M Sakač, I. Sedej, P. Jovanov, M. Pestorić, M.Bodroža-Solarov. Feasibility of use of buckwheat flour as an ingredient in ginger nut biscuit formulation. Food Chemistry, Volume 125, Issue 1, 1 March 2011, Pages 164-17
 [18] Astawan, M. 2009. Panduan Karbohidrat Terlengkap.Jakarta: Dian Rakyat.