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Utilization of Bambara Bean (*Vigna subterranea* L.) Flour As a Substitution of Wheat Flour in Making Cookies

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Abstract.

Bambara (*Vigna subterranea* L.) has a fairly good carbohydrate and protein content of 56.61% carbohydrates and 20.6% protein. The purpose of this study was to determine the proximate content of adding Bambara bean flour in making cookies and panelists' acceptance of bambara bean cookies. The experimental design used was Completely Randomized Design (CRD) with 3 treatments and 3 replications. The treatment given are : P1 (75% of Bambara flour: 25% wheat flour), P2 (50% of Bambara flour: 50% wheat flour), P3 (25% of Bambara flour : 75% wheat flour). Bambara bean flour and Bambara bean cookies are tested proximate content and hedonic tests. Bambara bean flour contains of 7.13% water content, 22.64% protein, 8.09% fat, 3.75% ash and 58.46% carbohydrate. The addition of Bambara bean flour to cookies significantly affected the water content, ash, fat, protein and carbohydrates in cookies. The addition of Bambara bean flour to cookies significantly affected the aroma and flavour but did not affect the color and crispness of the cookies. P1 treatment cookies are preferably by the panelists of the aroma and flavour parameters. P1 treatment contains of 3.49 % water content, 2.07 % ash, 24.42 % fat, 11.21 % protein and 59.08 % carbohydrates.

1. Introductions

Bambara beans are bean original plant from West Africa (Wicaksana et al., 2013). Bambara beans are often referred to as Bogor beans in Indonesia and many are processed into snacks such as boiled beans and fried beans. Bambara beans are easily obtained because there are quite a lot available in several regions, especially on the islands of Java such as Bandung, Garut, Sumedang, Gersik, Lamongan and Majalengka (Kuswanto et al., 2012 in Adhi, 2018). Bambara beans have high nutritional content and source of important nutrients especially protein for the body. Bambara beans contain 20.6% protein, 6.6% fat, 6.3% fiber, 3.25% ash, and 56.61% carbohydrate in 100 grams of material (Adhi, 2018).

Types of legumes can be used as flour to substitute wheat flour in the manufacture of food preparations. Bambara beans can be used as flour because they contain high levels of carbohydrates. Bambara bean flour can be used as a substitute for making cookies. The use of Bambara bean flour can reduce the needs for flour and flavor enhancers in making cookies. Cookies are one of the food products that are almost in great demand by various groups ranging from children to adults, both from the lower economic community to the upper economy. Cookies are a type of biscuits

made from soft dough, high in fat, relatively crispy and when broken the cross-section of the cutter is less dense textured. Cookies are baking products with high sugar and fat content relative to flour and less water (SNI, 1992; Faridi 1994). The addition of Bambara flour in making cookies can be an alternative diversification of cookies products.

2. Methodology

2.1. Material and Tools

Ingredients used in making Bambara bean cookies were Bambara flour, wheat flour, vanilla, salt, cooking oil, cornstarch, refined sugar, and egg yolks. The tools used in making Bambara bean cookies were digital scales, spoons, plates, pans, blenders, spatulas, sieves, basins, small plastic cups, pans, cookie molds, wooden rolls, brushes, and oven.

2.2. Experimental design

The experimental design used was a completely randomized design (CRD) with 3 treatments and 3 replications as follows:
P1: 75% Bambara bean flour: 25% Wheat flour.
P2: 50% Bambara bean flour: 50% Wheat flour.
P3: 25% Bambara bean flour: 75% Wheat flour.
There are 9 samples for proximate analysis and 29 panelist for organoleptic test.

2.3. Data Analysis

The cookies' contents of water, fat, protein, carbohydrate, and ash were measured by proximate analysis. The organoleptic testing (preferred level) used the hedonic method with the parameter tested were color, aroma, flavor, and crispness of cookies. The results of the panelist preference level assessment range using a Likert scale with the following criteria :

Tabel 1. Level of respondent statement

Interval	Level of respondent statement
1,0 – 1,8	Dislike very much
1,9 – 2,6	Dislike moderately
2,7 – 3,4	Neither like
3,5 – 4,2	Like moderately
4,3 – 5,0	Like very much

Source : Suryono & Ningrum, 2018

The data obtained was analyzed using ANOVA and if it shows a real effect it proceed with the Duncan test.

3. Results and Discussion

3.1. Nutritional content of Bambara flour

Bambara bean flour has the same physical characteristics as wheat flour in general, has a white color and powder type. Bambara bean flour with characteristics similar to SNI flour used as food ingredients can be used as local ingredients to substitute wheat flour in the process of making cookies. The results of the proximate analysis of the Bambara bean flour used in making cookies were as follows:

Table 2. Nutritional content of Bambara bean flour

Nutritional Contain	Total (%)
Water content	7.13
Ash	3.70
Protein	22.64
Fat	8.09
Carbohydrate	58.46

* 5 g of flour samples

Bambara bean flour contains 7.13% water content, 3.70% ash content, 22.64% protein, 8.08% fat and 58.46% carbohydrate. This is in accordance with the opinion of Sobari & Wicaksana (2017) who stated that Bambara beans in 100 grams contain nutrients, namely 20.6% protein, 6.6% fat, 6.3% fiber, 3.25% ash and 56.61 % carbohydrates (Adhi, 2018). Each dried seed has 16-21% protein, 50-60% carbohydrate and 4.5-6.5% fat (Sobari & Wicaksana, 2017).

3.2. Nutritional Content of Cookies

The nutritional content of cookies based on the results of the proximate analysis are shown in Table 3.

Tabel 3. Nutritional content of 100 g cookies

Nutritional Contain	Cookies (%)		
	P1	P2	P3
Water Content	3.49c	2.82a	3.07b
Ash content	2.07a	2.10b	2.14b
Fat	24.41c	23.31b	21.38a
Protein	11.21b	10.01a	8.07c
Carbohydrate	59.08b	57.11a	64.71c

Note:
P1: 75% Bambara flour: 25% Wheat flour; P2: 50% Bambara bean flour: 50% Wheat flour;
P3: 25% Bambara bean flour: 75% Wheat flour.

Water content

Based on the results of a proximate analysis conducted from each treatment, it was found that the treatment of Bambara flour gave a significant affect of water content of the cookies (P <0.05). P1 has the highest water content of 3.49%. The water content of P1 cookies is still in accordance with the Cookies Quality Requirements (SNI No. 01-2973-1992) a maximum of 5%. Adding 75% of Bambara flour will affect the water content of cookies. Proximate analysis results show that the Bambara bean flour contains as much as 7.12% water content per 100 g of material.

Ash Levels

Ash content describes the mineral contained in an analyzed product. The addition of Bambara bean flour to cookies has a significant effect on the ash content. The highest ash content was found in P3 of 2.14%. The amount of ash in food products depends on the amount of mineral content of the material used. It's believed that ash level roughly describes the mineral content of a food ingredient (Nisar et al. 2018).

Fat

The given treatment had a significant effect on the level of fat produced (P <0.05). The highest fat content produced by P1 was 24.41% and the lowest was P3 of 2.14%. The more additions of Bambara bean flour cause higher levels of fat in cookies. The Bambara flour used has a fat content of 8.08% per 100 g of material. This statement accordance with the opinion of Ratnasari and Yunianta (2015) who stated that the fat content in cookies increases with the higher proportion of pumpkin flour in the cookies produced.

Protein

It was found that the treatment of Bambara bean flour added to cookies has a significant effect on the protein contained in cookies (p <0.05%). P1 has the highest protein content of 11.21%. This is due to the amount of the addition of Bambara flour as much as 75% in the treatment of P1, thereby increasing the levels of protein cookies in P1. The more additions to Bambara bean flour cause a higher protein content of the cookies.

Carbohydrate

The treatment of adding Bambara flour to cookies has a significant effect on the carbohydrate content of cookies. The highest carbohydrate content is in the P3 treatment. The more additions to the Bambara bean flour the less wheat flour is added to cookies. The proportion of added flour will affect the carbohydrate content of cookies. Wheat flour contains a lot of starch which produced from wheat seeds. Wheat seeds have a high nutritional content, including carbohydrates 60-80% (Sramkovaa et al. 2009).

Hedonic Test

The hedonic test is the most widely used test to measure the degree of preference for food products. The hedonic test results can be seen in Table 3.

Tabel 4. Hedonic test

Sample	Parameters			
	Color	Aroma	Flavor	Cripness
P1	3.55a	3.72b	3.83b	3.52a
P2	3.21a	3.28ab	3.38a	3.48a
P3	3.52a	3.45a	3.45a	3.83a

Note: 1.0-1.8 (Dislike very much); 1.9-2.6 (Dislike moderately);
2.7-3.4 (Neither like). 3,5-4,2 (Like moderately). 4.3-5.0 (Like very much).

Color

Color has the most important role in the selection of a product, because if the color of the food is not attractive it will reduce consumer acceptance on the product (Mustika, 2016). Based on the results of the hedonic test, it was found that the treatment did not have a significant effect on the color of the cookies produced (P <0.05). Bambara bean flour has almost the same color as wheat flour so that there are no color differences in the cookies produced.

Aroma

It was found that the treatment of adding Bambara bean flour to cookies gave a significant effect of the aroma produced by cookies (P <0.05). P1 was preferred by the panelists with an average value of 3.72 (like moderately). The aroma in Bambara beans cookies can be influenced by the fat content in Bambara beans. According to Pertiwi & Khasanah, (2018), the aroma that comes out of cookies can be caused by the reaction of fat in the cookie dough when baking.

Flavor

Based on the results of hedonic tests, the treatment of adding Bambara bean flour significantly affected the flavor parameters (P <0.05). The highest taste score found in treatment P1 is 3.83 (like moderately). Taste is one of the factors that determine a product can be accepted or not by consumers. The taste of food is a mixture of taste and odor responses, where the determination of taste using the taste buds. According to Putri (2018), the taste can be influenced by several factors including chemical compounds, concentration, temperature and interactions with other taste components. The addition of Bambara bean flour adds the flavor of the cookies produced.

Crispness

The treatment of adding Bambara flour to cookies did not significantly affect the crispness parameters produced (P <0.05). Judging from the average value produced, P3 has a higher level of preference than other treatments. Giving more flour will provide a high content of amylopectin. The crispness of cookies can be influenced by differences in the composition of the basic ingredients, especially in the amylopectin (Lestari & Yusuf, 2018).

4. Conclusions

The addition of bambara bean flour to cookies gave a significant effect to the content of water, ash, fat, protein and carbohydrates in the cookies. The addition of Bambara bean flour to cookies give a significant effect of the aroma and flavour but did not affect the color and crispness of the cookies. P1 treatment cookies (75% Bambara bean flour: 25% wheat flour) were preferred by the panelists from the aroma and taste parameters. P1 treatment cookies contained water content (3.49%), ash content (2.07%), fat (24.41%), protein (11.21%) and carbohydrates (59.08%).

References

Adhi, W. (2018). Pertumbuhan Dan Hasil Kacang Bogor (Vigna subterranea (L.) Verdc.) Varietas Lokal Lembang Di Kalimantan Selatan. ZIRAA'AH, 43(2355–3545), 192–197.

Faridi H. (1994). *The Science Of Cookie and Cracker Production*, New York: Chapman & Hall.

Lestari, N., & Yusuf. (2018). Kadar Protein, Tekstur, Dan Sifat Organoleptik *Cookies* Yang Disubstitusi Tepung Ganyong (Canna edulis) Dan Tepung Kacang Kedelai (Glycine max L.), *Jurnal Pangan Dan Gizi*, vol. 8(April), pp. 53–63.

M. Nisar, Z. Syed, A. Sawate, and S. Hashmi. (2018). Studies on development of technology for preparation of cookies incorporated with quinoa seed flour and its nutritional and sensory quality evaluation, *International Journal of Chemical Studies*, vol. 6(2), pp. 1-5.

Mustika, N. (2016). Kajian sifat organoleptik biskuit berbahan baku tepung jagung, *Jurnal Dinamika Penelitian Industri*, vol. 27(2), pp. 110–118.

Pertiwi, K., & Khasanah. (2018). Formulasi Crispy Cookies Berbahan Baku Tepung Kacang Koro Pedang (Canavalia ensiformis) Termodifikasi, *Jurnal Agroindustri Halal*, vol. 4(1), pp. 68–78.

Putri, M. (2018). Uji Hedonik Biskuit Cangkang Kerang Simping (*Placuna placenta*) Dari Perairan Indragiri Hilir, *Jurnal Teknologi Pertanian*, vol. 7(2), pp. 19–29.

Ratnasari dan Yunianti. (2015). Pengaruh Tepung Kacang Hijau, Tepung Labu Kuning, Margarin Terhadap Fisikokima Dan Organoleptik Biskuit, *Jurnal Pangan dan Agroindustri*, vol. 3 No 4, pp.1652-1661.

SNI cookies 1992. (1992). SNI 01-2973-1992 (Departemen Perindustrian). Jakarta.

Sobari, E., & Wicaksana, N. (2017). Keragaman Genetik Dan Kekerabatan Genotip Kacang Bambara (*Vigna subteranea* L.) Lokal Jawa Barat, *Jurnal Agro*, vol. IV(2), pp. 90–96.

Sramkova, Zuzana, Gregováb E & Sturdík, E. (2009). Chemical composition and nutritional quality of wheat grain, *Acta Chimica Slovaca*, vol.2, No.1, pp. 115 – 138.

Suryono, C., & Ningrum, L. (2018). Uji Kesukaan Dan Organoleptik Terhadap 5 Kemasan Dan Produk Kepulauan Seribu Secara Deskriptif, *Jurnal Pariwisata*, vol.5 no.(September), pp. 95–106.