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Different Proportion of Mocaf (*Modified Cassava Flour*) and Soy Flour (*Glycine Max* L.) towards Chemical and Organoleptic Quality of Cookies

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ABSTRACT

Cookies are snacks made by the basic ingredients of Mocaf and soy flour. The usage of both expects higher content of protein and fibre, compared to the general cookie. This research aims to understand the influence of both flour's proportion towards cookies' chemical quality and organoleptic. This research utilises Factorial Randomised Design using two factors such as proportions of Mocaf and soy flour. Every treatment is conducted three times. The determination of the best treatment off all parameters are performed through effectivity test. Factors aforementioned are each divided by three levels, which are Mocaf flour proportions as many as 55%, 50%, and 45% and soy flour proportions as many as 10%, 15%, and 20%. Every treatment is conducted three times. The treatment of the combination of 55% Mocaf flour and 20% soy flour (M3K3) is the best treatment, according to the effectivity test of Result Value (RV) which is 0.57. It is also supported by the testing of parametric criteria such as protein content (3.74%), fibre content (1.91%), water content (2.27%), ash content (1.92%), flavour (5.4, somewhat like), aroma (5, somewhat like), colour (5.3, somewhat like), and crunchiness (5.5, like).

Keywords: *cookies; Mocaf; soy flour*

INTRODUCTION

The necessity of wheat flour in Indonesia increases annually due to the diverse wheat flour-based food products. The limited availability of wheat flour actually can be overcome by using local ingredients available.

One of the ways to establish food independence is minimising wheat flour consumption by utilising local foodstuffs. Foodstuffs that can be used for the flour making process is the cassava, which is one of Indonesia's abundant food commodities. It can be treated by the fermentation process conducted by lactic acid bacteria (LAB) that contains the pectinolytic and cellulolytic enzyme, which later produces the Modified Cassava Flour (Mocaf) that has the similar character and quality of wheat flour. Mocaf flour has the fibre content of 2.7%, which is not contained in the wheat flour, and 0.2% of ash content, which is higher than wheat flour. Therefore, this type of flour can be used as the main or substitute foodstuffs of wheat flour in the cake-making process (Subagyo, 2007).

Cookies product is one of the dry cake types that can be made from Mocaf, which can enhance nutrition values on the snacks and can be enjoyed by people of every age. Mocaf is a type of flour which contains a high level of fibre and ash. Therefore, to enhance the nutrition, Mocaf can also be combined with soy flour as the protein source, Soy flour used as the wheat flour's substitutes generally can be as much as 15-20% (Indriyani, 2007).

Mudjajanto and Yulianti (2013) stated that the usage of wheat flour in the pastry making could be substituted with other types of flour such as Mocaf, cornflour, arrowroot flour, and soy flour. Mustofa (2015) explains that the usage of Mocaf as many as 50% and combined with the black glutenous rice flour can produce good brownies. Based on the previous experiments, the author intended to research the utilisation of Mocaf and soy flour as the cookie ingredients.

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METHODS

The main ingredients of this research are Mocaf and soy flour. The mocaf is purchased in the Heathy Corner Sby, using the brand name of Ladang Lima, located in San Antonio Road No. 20, Surabaya. Other materials used for chemical analysis are Selenium mix, sulfuric acid solution 96%, NaOH, H_2SO_4, MM indicator, HCl, aquades, Kjedhal tablet, Chloroform (CH_3Cl), mix/knwei indicator, and H_3BO_3/boric acid 4 % (contains methylrot indicator and Brom cresol green).

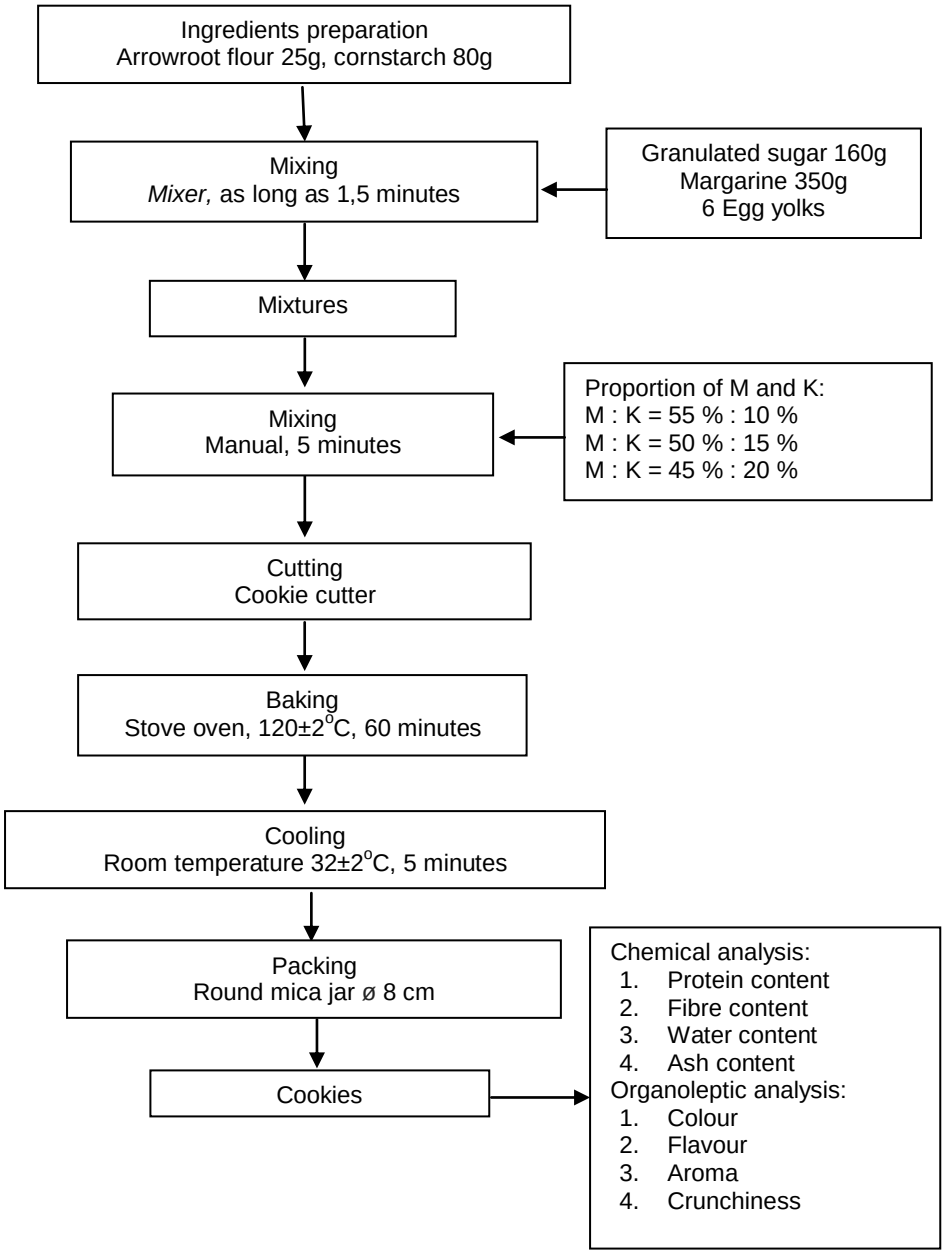

Figure 1. Cookie making process flowchart
Source: FaKurahman (2012), modified

This research conducts the laboratory experiment using the Factorial Randomised Design which contains two factors as follows: Factor 1: Three levels of Mocaf proportions (M1: 55%; M2: 50%; and M3: 45%) and Factor 2: Three levels of soy flour (K1: 10%; K2: 15%, and K3: 20%). The flowchart of this research can be seen in Figure 1.

This research observes protein content (method of Macro-Kjeldahl Tecator-Foss Modification), water content (Gravimetric method), ash content (Mineral Total method), and fibre (Gravimetric method) (Ayustaningwarno, 2014).

Organoleptic analysis (colour, taste, and crunchiness) will be gathered through Hedonic test by 30 panellists using the likeness levels of 1 (very dislike), 2 (dislike), 3 (somewhat dislike), 4 (neutral), 5 (somewhat like), 6 (like), and 7 (very like) (Setyaningsih *et al*, 2010).

Observation results of protein, ash, water, and fibre content then analysed based on parametric statistics by using Variance Analysis (ANOVA), utilising Statistic Product and Service Solution (SPSS) version 20. If the result shows the significant difference influence between the treatment, it will be continued to test further using the Turkey Test on the confidence level set on α = 95 % (Kusriningrum, 2008). The observation results of the organoleptic test are based on the likeness level of each panellist. To understand the influence of particular treatment towards the Organoleptic test, the Friedman Test will be conducted. Determination for the best treatment is obtained through the effectivity test towards all research parameters.

RESULTS AND DISCUSSIONS

ANOVA results that cover protein, fibre, water, and ash contents show that different proportions of Mocaf are intangibly influencing the fibre, water, and ash contents and tangibly influences the protein content of the cookies. Interactions between the different portions of Mocaf and soy flour is intangibly influencing all observed contents of the cookie. The significance of the chemical test can be seen in Table 1 below.

Table 1. Significance of chemical parametric test on cookies

Test Parameter	Treatments			Best criteria	Treatment (*)	Score (%)
	Mocaf	Soy flour	Mocaf*Soy flour			
Protein content	NS	S	NS	Highest	M2K3	4,41
Fibre content	S	NS	NS	Lowest	M1K1, M2K1	1,57
Water content	NS	NS	NS	Lowest	M1K1	2,25
Ash content	NS	NS	NS	Lowest	M2K2	1,62

Note: S = Significant NS = Non Significant
(*) = Treatment code can be seen in Table 4.

The results of non-parametric data of the cookie's organoleptic test from its taste, aroma, colour, and crunchiness show the score of 5.4 from cookie's taste and aroma, which means the panellists quite like its taste and aroma. Meanwhile, its colour and crunchiness obtain the score of 5.5 and 5.6, which means the panellists like its colour and crunchiness.

Protein content

Based on Table 1, the treatment that shows the tangible difference is the treatment towards the soy flour proportions. The observation results on the cookie's protein content on the different portion of soy flour are in Table 2 below.

Table 2. Average protein content of cookies on the different portions of soy flour

Treatment code	Treatment	Average protein content (%)
K1	10 % soy flour portion	3,42[a]
K2	15 % soy flour portion	3,59[a]
K3	20 % soy flour portion	4,10[b]
Turkey Test (TT) 5 % = 0.412 %		

Note: The same small letters behind the number on the average protein content show that there is no difference in the Turkey Test of 5%.

ANOVA test shows that p= 0.000 ≤ α= 0.05. This means there is a tangible influence on the different soy flour proportion towards the cookie's protein content. The more proportion of soy flour in the cookie mixture increases the protein value. In opposite, the lower portion of soy flour can result in the lower protein value. Winarno (2004) stated that the high nutritious components in foodstuffs could provide nutrition for the end products, even though during the processing that involves heating lower the nutrition value. Diana (2016) also stated that the food processing stage that includes heating could reduce several nutrition components, mainly the one which cannot stand the heat and soluble.

Fibre content

Table 1 illustrates the significance different is the Mocaf portion. Observation result on the fibre content of cookies on the different portion of Mocaf is shown in Table 3.

Table 3. The average fibre content in the cookie on the different Mocaf proportions

Treatment code	Treatment	Average protein content (%)
K1	45 % Mocaf proportion	1,63[a]
K2	50 % Mocaf proportion	1,64[a]
K3	55 % Mocaf proportion	1,82[b]
Turkey Test (TT) 5 % = 0.198 %		

Note: The same small letters behind the number on the average protein content show that there is no difference in the Turkey Test of 5%.

Table 3 shows that large Mocaf proportion can produce a high fibre content of the Mocaf. In opposite, smaller proportions will result in the lower fibre content. It is in accordance with Sunarsi *et al*. (2011), who stated that Mocaf is a fermented product of cassava that provides high fibre content of 3.4%. Therefore, if this flour used as an ingredient of a food product, it will enhance the fibre content, so it is beneficial for health.

Water content

ANOVA results on cookie's water content show that Mocaf portion, soy flour portion, and different proportion interaction of Mocaf and soy flour are intangibly influenced water content in the cookie (Table 4).

Table 4. The average water content of the cookie

Treatment code	Treatment (Mocaf proportions : Soy flour proportion)	Average water content (%)
MIKI	45% : 10%	2,25
MIK2	45% : 15%	3,05
M1K3	45% : 20%	3,17
M2K1	50% : 10%	2,98
M2K2	50% : 15%	2,94
M2K3	50% : 20%	2,51
M3K1	55% : 10%	2,46
M3K2	55% : 15%	2,44
M3K3	55% : 20%	2,27

ANOVA test shows that p= 0.216 ≥ α= 0.05. This means there are no tangible influence on all treatments. The low water content is due to the flour used in the cookie making process, which has a low water content of 6.9% and 6.6% for Mocaf (Sunarsi *et al*. 2011) and soy flour, respectively (Napitupulu, 2012). Therefore, the cookie making process will produce low water content cookies. Furthermore, its making process involves oven baking in the high temperature of 120^{o}C, which broke the cookie's cell walls. Thus pushed out water and reduce its water content. Sitoresmi (2018) also stated that the longer baking process is conducted, the water content in the cookie tends to be reduced due to the heat from the oven that evaporates the water of the baked mixture.

Ash content

ANOVA results on cookie's ash content show that Mocaf portion, soy flour portion, and different proportion interaction of Mocaf and soy flour are intangibly influenced ash content in the cookie. The results are illustrated below on Table 5.

Table 5. **The average ash content of the cookie**

Treatment code	Treatment (Mocaf proportions : Soy flour proportion)	Average ash content (%)
MIKI	45% : 10%	1,86
MIK2	45% : 15%	1,70
M1K3	45% : 20%	1,89
M2K1	50% : 10%	1,64
M2K2	50% : 15%	1,62
M2K3	50% : 20%	1,65
M3K1	55% : 10%	1,71
M3K2	55% : 15%	1,78
M3K3	55% : 20%	1,92

ANOVA test shows that p= 0.764 ≥ α= 0.05. This means there are no tangible influence on all treatments. Table 5 shows low water content, ranging from 2.25% to 3.17%. Table 6 shows the high ash content, ranging from 1.62% to 1.92%. This ash content is considered high, because, during the water evaporation in the baking process, nutritious soluble matters also evaporates so it leaves insoluble organic matters which, after the ash forming process, its ash content will increase.

Organoleptic test of flavour

Organoleptic test towards the cookie's taste concludes that the average number obtained is between 4.8 and 5.4. This means that the panellists somewhat like the cookie's flavour. Cookie's average test shows that the larger Mocaf and soy flour proportion, the likeness value also becomes higher, and vice versa, demonstrated by the number of 4.8 as a result of the lowest proportion. Nonetheless, 4.8 still means that the panellists somewhat like this type of treatment (Figure 1).

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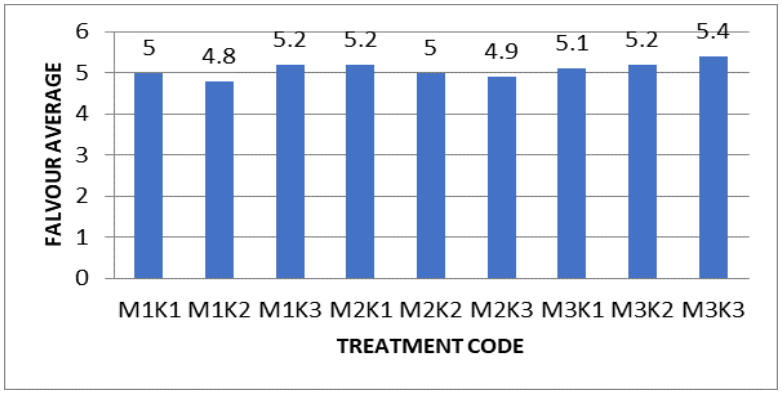

Figure 1. Histogram of cookie's organoleptic test on flavour

The combination between the pleasant-smelling Mocaf as the result of cassava fermentation (Dahlia, 2012) and soy flour that contains high fat of 27.1% (Napitupulu, 2012) can generate a taste that somewhat liked by the panellists. Fat is a product that generally added to food products to enhance food's flavour because it gives savoury flavour. Therefore, the combination of pleasant aroma and savoury flavour can produce cookies that are somewhat liked.

Organoleptic test on the aroma

The result of the organoleptic test regarding the aroma of the cookie shows that the different proportion between the Mocaf and soy flour towards the chemical quality and cookie's organoleptic results in the aroma score ranging from 4.9 to 5.4. This means that the panellists rather like the cookie's aroma (Figure 2).

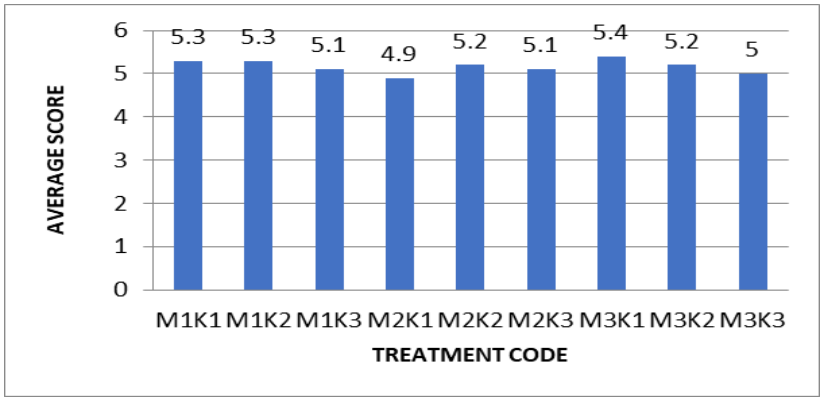

Figure 2. Histogram of cookie's organoleptic test on aroma

Figure 2 illustrates that the large portion of Mocaf and a small portion of soy flour can enhance the cookie's aroma, due to the pleasant smell nature of Mocaf. As stated by Dahlia (2012), Mocaf has a pleasant smell due to the fermentation process of the bacteria, either spontaneous or specific.

Organoleptic test of colour

The result of the organoleptic test regarding the colour of the cookie can be seen in Figure 3 below:

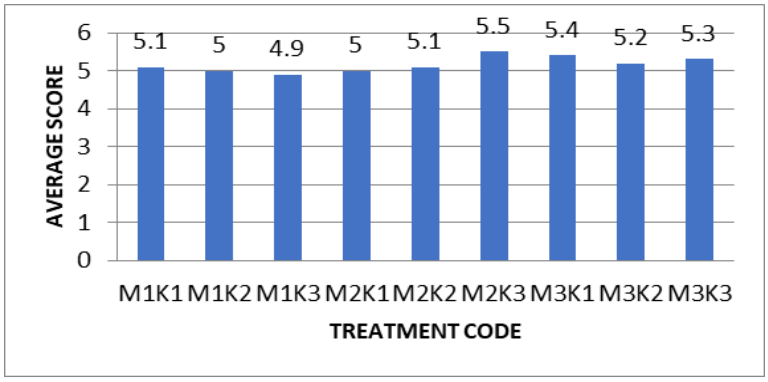

Figure 3. Histogram of cookie's organoleptic test on colour

Referring to the cookie quality requirement set in Indonesian National Standard No. SNI 2973-2011 (BSN, 2011), it stated that the normal colour of the cookie is set between 4.9 to 5.5 in the organoleptic test, and should be in accordance with the set requirements.

Friedman test on the colour results shows that p=0.000 ≤ α= 0.05, which means there is a significant difference between each treatment. This means that the different portion of Mocaf and soy flour influence the acceptable level of the panellists towards the cookie's colour parameter.

Organoleptic test on the crunchiness

The crunchiness is one of the parameters in the test of biscuit product. The crunchiness in food product related to the water content, due to the more water evaporates in the baking process, some air cavities will form, so it results in a crunchy product (Izzafarm, 2011).

The result of the organoleptic test regarding the crunchiness of the cookie shows that different portion of Mocaf and soy flour towards the chemical and organoleptic quality results in the crunchiness score between 5 to 5.6, which means the panellists have somewhat liked the cookie's crunchiness (Figure 4).

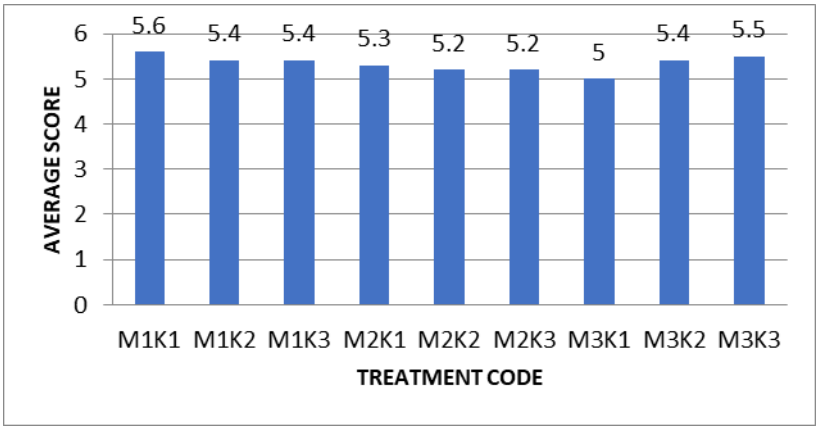

Figure 4. Histogram of cookie's organoleptic test on crunchiness

Friedman test on the colour results shows that p=0.000 ≤ α= 0.05. This means that the treatment between the portion of Mocaf and soy flour has different influence towards the acceptance level of the panellists on cookie's crunchiness parameter.

Effectivity test

The result of effectivity test of all research variables that include chemical and organoleptic test are described in Table 6.

Table 6. Results of Effectivity Test on all research variable

Variable	Result Value of Treatment (NH)								
	M1KI	M1K2	M1K3	M2K1	M2K2	M2K3	M3K1	M3K2	M3K3
Protein content	0	0.02	0.13	0.01	0.04	0.1	0	0.02	0.05
Fibre content	0	0.02	0.05	0	0.04	0.04	0.07	0.09	0.13
Taste	0.04	0	0.09	0.09	0.04	0.02	0.07	0.09	0.13
Crunchiness	0.13	0.09	0.09	0.07	0.04	0.04	0	0.09	0.11
Aroma	0.11	0.11	0.05	0	0.08	0.05	0.13	0.08	0.03
Colour	0.04	0.02	0	0.02	0.04	0.12	0.1	0.06	0.08
Water content	0	0.02	0	0.02	0.03	0.08	0.09	0.09	0.12
Ash content	0.08	0.03	0.09	0.01	0	0.01	0.03	0.05	0.1
Total	0.4	0.26	0.32	0.21	0.24	0.33	0.42	0.46	**0.57**

Note: Result Value of effectivity test towards research variables

Based on the determination of effectivity test of all research variable that covers chemical quality and organoleptic test, it shows that the ideal portion for the cookie is 55% Mocaf and 20% soy flour, with the result value (NH) of 0.57. This result value covers test parameter criteria such as 3.74% protein content, 1.91% fibre content, 2.27% water content, 1.92% ash content, likeness score of 5.4 (somewhat like), aroma score of 5 (somewhat like), colour core of 5.3 (somewhat like), and crunchiness score of 5.5 (like).

CONCLUSIONS

Mocaf and soy flour can be used as the ingredients of cookie making, as an effort to reduce wheat flour consumption. Based on the effectivity test, the best cookie is obtained from the portion treatment of 55% Mocaf and 20% soy flour, with the result value (NH) of 0.57. This result value covers test parameter criteria such as 3.74% protein content, 1.91% fibre content, 2.27% water content, 1.92% ash content, likeness score of 5.4 (somewhat like), aroma score of 5 (somewhat like), colour core of 5.3 (somewhat like), and crunchiness score of 5.5 (like).

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