THE FORMULATION OF COOKIES USING SAGO AND MODIFIED CASSAVA FLOUR (MOCAL) FLOUR

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Abstract

The most common flour used for making cookies is wheat flour. It can be substituted with other flour such as sago starch (SS) and modified cassava flour (MOCAL). The purpose of this study was to get the best formulation of cookies made from sago starch flour and MOCAL. A completely randomized design (CRD) with five treatments and three replications was assigned. The treatments were SM0 (S 100%, MOCAL 0%), SM1 (SS 80%, MOCAL 20%), SM2 (SS 60%, MOCAL 40%), SM3 (SS 40%, MOCAL 60%), and SM4 (SS 20%, MOCAL 8 0%). The variables observed were amount of moisture, ash and protein in the cookies. Sensory evaluation (aroma, color, taste, texture and overall acceptance) of cookies was analyzed by Friedman test. The results show that some combination of SS and MOCAL had no significant effect (P> 0.05) on moisture and ash content between treatments cookies. The protein content of SM0 had no significant difference (P> 0.05) compared to SM1, SM2, and SM3 treatments, but it had significant difference (P <0.05) compared to SM4 treatment. Based on sensory evaluation, it can be concluded that the average level of consumer preferences for aroma, taste, texture and overall acceptance of cookies were from neutral to like it. While of the most popular color was the cookies in the SM4 (SS 20%, MOCAL 80%).

Keywords: sago starch, cassava flour, Cookies.

INTRODUCTION

Basic ingredients of cookies were wheat flour that can be substituted with sago flour and Modified Cassava Flour (MOCAL). According to Hidayat (2008) cookies can be made with any kind of flour such as sago starch. Substitution of wheat flour with sago starch can reduce the level of wheat flour needs. The purpose of this substitution is to get the cookies that contain good nutrition and indirectly reduce dependence on imported flour. When evaluated from the aspect of nutrition, sago starch has the advantage over other flour from tubers of plants or other cereal. It contains starch that was undigested, because it is resistant to enzymes compared to cereal starches (Haska and Otha (1992). and important for digestive health. Karim et al (2008) concluded that sago starch is resistant to microbial and enzyme digestion.

Alternative materials that can be used for flour substitution was MOCAL, flour from cassava (*Manihot esculenta Crantz*) that was fermented using the principle of modifying cassava cells. The lactic acid bacteria (BAL) dominated this fermentation. The advantage of using MOCAL was its availability so the possibility of scarcity can be avoided because the product does not depend on imports. MOCAL can be applied to products that are made from raw rice flour or wheat flour with added tapioca. However, the utilization of sago starch with a combination of MOCAL for making cookies has not been studied. The purpose of this study was to get the best formulation of cookies made using sago starch and MOCAL flour .

RESEARCH METHOD

This research was carried out using a completely randomized design (CRD) consisting of five treatments and three replications. The treatments were the ratio of sago starch (SS) and the MOCAL into the cookies formulas, among others SM0 (SS 100%, 0% MOCAL), SM1 (SS 80%, 20% MOCAL), SM2 (SS 60%, 40% MOCAL), SM3 (SS 40%, MOCAL 60%), and SM4 (SS 20%, 80% MOCAL). Formulation and content of the nutrients of cookies dough can be seen in Table 1 and 2. The variables observed were moisture, ash and protein content of cookies. Sensory evaluation (aroma, color, taste, texture and overall acceptance) of cookies was analyzed by Friedman test. Analysis of variance was carried out for each variable to assess differences among the cookies samples. If the F calculated was greater than or equal to the F table and followed by analysis DNMRT test anywhere from 5%.

Table 1. Chemical content of cookies raw materials

Items	Chemical content (%)				
	Water	Ash	Protein	Fiber	fat
Sago Starch	12	0,10	0,62	2,03	3,03
MOCAL	11,3*	0,3*	1,7*	1,7*	1,4*
Margarine	15,5	2,5	0,6	-	81
Sugar	5,4	0,6	-	-	-
Egg Yolk	49,4	1,7	16,3	-	31,9

Source: Mahmud, et al., (2008) and *Subagio (2009b)

Table 2 Cookies formulation made from sago starch and MOCAL flour (%)

Items	SM0	SM1	SM2	SM3	SM4
Wheat flour	52,14	41,71	31,28	20,86	10,43
MOCAL	0,00	10,43	20,86	31,28	41,71
Margarine	20,86	20,86	20,86	20,86	20,86
Sugar	20,86	20,86	20,86	20,86	20,86
Egg yolk	5,21	5,21	5,21	5,21	5,21
Baking powder	0,68	0,68	0,68	0,68	0,68
Salt	0,26	0,26	0,26	0,26	0,26
Total	**100,00**	**100,00**	**100,00**	**100,00**	**100, 00**

Source: Mahmud, dkk., (2008)

Table 3. Nutritional cookies dough of treatments (%)

Nutrients	SM0	SM1	SM2	SM3	SM4
Moisture	13,82	13,12	13,04	12,97	12,90
Ash	0,69	0,81	0,83	0,85	0.87
Protein	1,30	1,41	1,52	1,63	1,75
Fiber	1,06	1,02	0,99	0,95	0,92
fat	20,13	19,96	19,79	19,62	19,45

RESULTS AND DISCUSSION

Moisture, Ash And Protein Levels

Results of the analyses of variance for the variables are summarized in Table 4

Table 4. Average moisture, ash and protein content of cookies (%)

Treatments	Average		
	Moisture	Ash	Protein
SM0	0,331[a]	1,369[a]	4,658[b]
SM1	0,281[a]	1,380[a]	3,991[b]
SM2	0,392[a]	1,330[a]	3,213[b]
SM3	0,389[a]	1,591[a]	3,289[b]
SM4	0,569[a]	1,610[a]	7,224[a]

Note: Values followed by the same superscript in the same column shows significantly different ($P < 0.05$), SE (standard error) = 0.025

The results showed that various combinations of SS and MOCAL were insignificantly different ($P > 0.05$) on moisture and ash content of cookies. It's resulted by the cookies dough using the same raw materials, and only ratio SS and MOCAL were different among the treatments (Table 2). However, both of them (SS and MOCAL) had moisture and ash content that were not much different (Table 3), so that the moisture and ash content of cookies produced no tangible impact. The average moisture content of cookies were from 0.281% to 0.569% and meet the quality cookies standards (SNI 01-2973-1992) that was a maximum of 5%, so was ash levels ranged from 1.330% to 1.610% , and meet the national standard quality (SNI 01-2973-1992) that was a maximum of 2%.

The protein content of cookies was ranged from 3.213% to 7.224% (Table 4). The protein content of SM0 had no significant difference ($P > 0.05$) compared to SM1, SM2, and SM3 treatments, but it had significant difference ($P < 0.05$) compared to SM4 treatment. The different of proteins content among the treatments were due to differences in protein content between sago starch (0.62%) and MOCAL (1.7%) as seen in Table 1. The highest protein content was 7.224% (SM4) that used the highest amount MOCAL (80%). This caused the cookies on this treatment had the highest protein content compared to other treatments.

The increased levels of cookies protein content also was caused by MOCAL processing through fermentation MOCAL is flour made by fermentation, where the growing microbes produce an enzyme that increases levels of protein. Meanwhile the protein from the microbe itself also contributed to the MOCAL protein Fermentation was the application of microbial metabolism to convert raw materials into valuable product, such as organic acids, single cell protein, antibiotics and biopolymer. Fermentation process with the appropriate technology can produce the protein product (Hutkins, 2006).

Table 4 shows that the value of protein content on SM0, SMI, SM2, and SM3 not meet the national quality standards of cookies (SNI 01-2973-1992) that contains at least 6% of protein. Meanwhile cookies on SM4 treatment (7.224% protein) meet the national quality standards.

Sensory Evaluation

The average results on sensory evaluation was shown at Table 5. The result of sensory evaluation showed that combination treatment of SS and MOCAL provide no significant effect ($P > 0.05$) on aroma, taste and texture of cookies among the treatments. This was because all cookies had the same level of the temperature treatment and the bake time. The aroma were stronger when well done cooked because of the number of molecules evaporating was higher. Belitz (2009) concluded that the presence of protein and carbohydrates caused Millard reaction, which produced volatile compounds that had a distinctive aroma..

The use of different SS and MOCAL in cookies formula did not affect the taste of cookies. The formation of a taste of cookies took place during roasting. Based on the research, MOCAL can be used as raw materials for varied pastries, such as cookies. Sensory evaluation data on the aroma and taste of cookies ranged from 3.04 to 3.4 and from 3.16 to 3.72, respectively. In average, panelist scored for aroma and taste of cookies were neutral. The results showed that the cookies had the characteristic that was not much different from the cookies made using flour, low-protein type found by Subagio (2009a).

Table 5. Mean descriptive ratings on a 1-5 scale by a panel of 25 judges for sensory properties

Treatments	Sensory Properties				
	Aroma	color	Taste	Tekstur	Overal accepten ce
SM0	3,40[a]	3,56[abc]	3,68[a]	3,84[a]	3,76[a]
SM1	3,40[a]	3,32[a]	3,72[a]	3,68[a]	3,72[a]
SM2	3,28[a]	4,08[d]	3,72[a]	3,68[a]	3,80[a]
SM3	3,04[a]	3,40[a]	3,16[a]	3,72[a]	3,48[a]
SM4	3,24[a]	4,20[d]	3,40[a]	3,68[a]	3,48[a]

Note: Values followed by the same superscript in the same column shows significantly different ($P < 0.05$), SE (standard error) = 0.025

In Table 5 showed that the combination of MOCAL and SS treatments had no significant effect ($P > 0.05$) on the texture of cookies among the treatments. Cookies texture was strongly influenced by the use of margarine. The use of margarine as cookies emulsifiers produced a crispy texture of the cookies. Fat of margarine coated the starch and gluten molecules of the flour and broke the chemical bonds between the two compounds. Marliyati, et al. (1992) stated that fat can make cookies having a crispy coating. The texture of cookies were also influenced by its fiber content. In this study, the use of sago starch and MOCAL flour which contained relatively the same of fiber content (2:03 and 1.7%), caused no significant effect on the texture of cookies.

The different results ($P < 0.05$) on sensory evaluation of the cookies colors was due to the addition of MOCAL. The MOCAL could cause color of cookies become slightly brownish due to its own slightly brownish yellow color. In addition, differences in the formulation of flour caused differences in protein and carbohydrate content of SS and MOCAL. According to Belithz (2009), Maillard reaction is a reaction between carbohydrates and protein, especially reducing sugars with amino groups of proteins that produce hydroxyl methyl furfural compounds. These compounds then continuously changed to be furfural. The furfural would be polymerized then to form melanoidine, a compound which is brown in color

Average color of cookies after statistical analysis of the non-parametric Friedman test was shown in Table 5. Table 5 shows that the average preferred level of cookies color ranges from 3.32 to 4.2 (neutral color). This shows that the resulting color is neutral. Cookies so favored by consumers. Color of cookies that was preferred (SM4) was brownish yellow.

Overall Acceptance Of Cookies.

The mean descriptive ratings for sensory properties of cookies is shown in Table 5. The results showed that various combinations of SS and MOCAL were insignificantly different ($P > 0.05$) on overall acceptance of cookies. The average mean ranged from 3.48 to 3.80 (neutral to like it). This was parallel with the result SS of sensory evaluation of the aroma, taste and texture are not significantly different to all treatment cookies. The overall acceptance of cookies was a function of all sensory properties that were evaluated in this study.

CONCLUSION

Based on the results, it can be concluded that

1. To produce sago MOCAL cookies in accordance with national cookies standards quality (SNI 01-2973-1992) is a SM4 formulation that contain 20% sago flour with 80% MOCAL.
2. The average level of consumer preferences for aroma, taste, texture and overall acceptance cookies was neutral and for the most popular color was the cookies with SM4 formulation, 20% sago flour and 80% MOCAL.

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