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The Effect of Substitution of Wheat Flour with Sorghum Flour (Sorghum bicolor, L) on the Level of Consumer Preference for Cookies

Sondang Dhea Farrah, Esi Emilia, Erli Mutiara, Rasita Purba, Fatma Tresno Ingtyas, Marhamah

Nutrition Study Program, Medan State University, Indonesia

Correspondence: E-mail: sheafarrah@gmail.com

ABSTRACTS

Cookies or pastries are food products made from flour that are baked to have a moisture content of less than 5%. Usually the recipe for cookie products is enriched with fat and sugar and added developer ingredients. The use of wheat flour in Indonesia is still increasing, so by utilizing sorghum flour it will be able to help reduce the use of wheat and can help the government in food diversification programs. The main factor that is seen to assess the quality and quality of a product is based on the appearance of the product presented, the aroma, and the taste of the product. The purpose of this study was to analyze the level of consumer preference (color, taste, aroma, texture) through organoleptic tests. The design of this study used experimental research with the RAL method (Completely Randomized Design). Sorghum flour substitution formulations in 4 treatments were control (T0), 50% (T1), 70% (T2), 90% (T3). The research location is at Medan State University with 30 research subjects. Organoleptic test results data were analyzed descriptively using the percentage of consumer acceptance of each cookie formulation and continued with the one-way-Anova test and continued with the DMRT (Duncan) test. The results of this study indicate that the best formula is substitution of 50 percent sorghum flour obtained from the mean value of 4.55 for the control formulation (T0), 4.34 (T1), 3.97 (T2), and 3.70 (T3).

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1. INTRODUCTION

Wheat flour is a semi-finished form which is highly recommended because it is flexible, easy to mix and fortify to improve its nutritional quality, lasts a long time and saves space for storage and distribution. According to Choudhury, et al (2015) Wheat flour with low protein content can be used as a raw material for making cookies and other additives that form a formula such as cookies, then it can go through the stages of printing and baking. This allows the use of sorghum flour which has a low protein of 10.4 percent.

Sorghum is a cereal crop that has the potential to be cultivated and developed, especially in dry areas in Indonesia. Apart from being resistant to unfriendly environmental stress, sorghum also has a high nutritional content, so it is good for use as a food source. Every year the productivity of sorghum in Indonesia has increased. In 2007 sorghum productivity was 1.79 t/ha, in 2008 it increased to 1.88 t/ha, and in 2009 it reached 2.73 t/ha (Director General of Food Crops, 2010).

Sorghum flour is flour derived from sorghum seeds. The process of making flour from cereals such as sorghum is similar to the process of making rice flour (Suarni, 2009). According to Suarni (2000) the ability of sorghum to substitute flour for making pizza reaches 20-25 percent, for cakes 40-50 percent and pastries 70-80 percent. The chemical composition of sogum consists of 70.7 percent carbohydrates; 10.4 percent protein; 3.1 percent fat; 2.0 percent fiber; and energy 329 Cal.

According to Diachanty, et al (2021) in fulfilling the quality of a product the main factors that must be considered are the indicator values for color, taste, aroma and texture. Organoleptic testing was carried out to see the level of consumer preference for the products presented. Thus, this study aims to determine and analyze the level of consumer preference for sorghum flour substitution cookies.

2. METHODS

2.1. Tools and materials

The materials used in this study are materials for making sorghum flour and making cookies. Making sorghum flour requires milled sorghum rice, then for making cookies requires sorghum flour, wheat flour, margarine, butter, powdered sugar, egg yolks, and baking powder.

The tools used for the manufacture of sorghum flour are milling machines and flour milling machines. While the tools used for making cookies are oven, whisk, stove, baking sheet, spoon, fork, blender, plate, sieve, gloves and headgear to maintain the hygiene of the product to be served. The equipment used for the organoleptic test is a white plastic plate, a label, and a pen.

2.2 Research types and variables

This research is a type of experimental research consisting of two variables, namely the addition of sorghum flour as the independent variable and the organoleptic test (color, taste, aroma, texture) as the dependent variable.

2.3 Research procedure

This research was conducted in two stages, namely preliminary research and follow-up research. The stages of this research can be seen in Figure 1.

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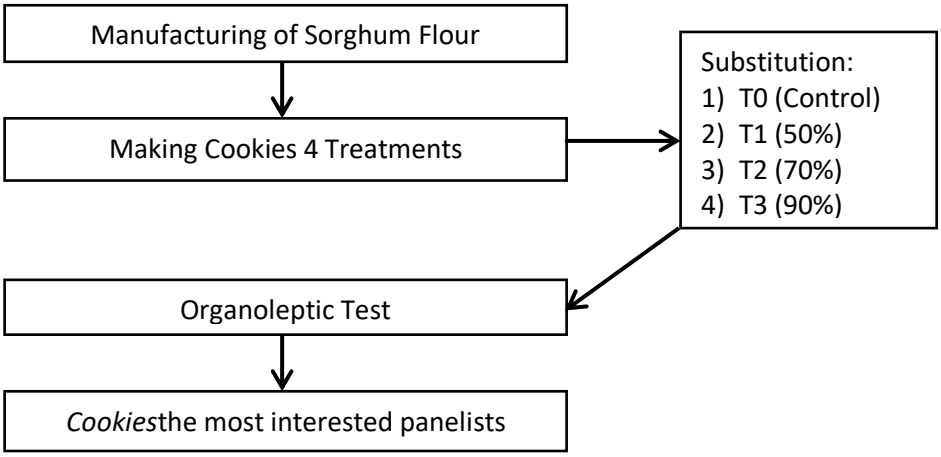

Figure 1. Research stage flowchart.

2.4. Data collection techniques

The experimental design of sorghum flour substitution cookies was carried out with 4 treatments, namely 0 percent as a control treatment, 50 percent, 70 percent, and 90 percent substitution. The placement of the treatment was done randomly. The steps taken were as follows: 1) coding cookies, 2) labeling, namely code 111, code 112, code 113, and code 114, 3) samples were placed randomly on each panelist. Panelists were asked to fill out an organoleptic form that was given with a numerical scale, namely very dislike (1) to like very much (5).

2.5. Data analysis technique

Organoleptic test results data were analyzed descriptively using the percentage of consumer acceptance of the cookies presented. Concentration of the best or most accepted cookies by consumers is assessed by ranking test, then statistically analyzed using one-way-ANOVA and followed by Duncan's test.

3. RESULTS AND DISCUSSION

3.1. Preliminary research

In the preliminary research carried out the manufacture of sorghum flour. Sorghum flour is made by first washing the sorghum seeds and then soaking them with a water ratio of 2:1 from the sorghum seeds. The next stage is draining and drying at 600C or drying in the sun. After the sorghum seeds are dry, then proceed with the grinding stage and then sifted with a size of 80 to 100 mesh (Cahyadi, et al. 2020).

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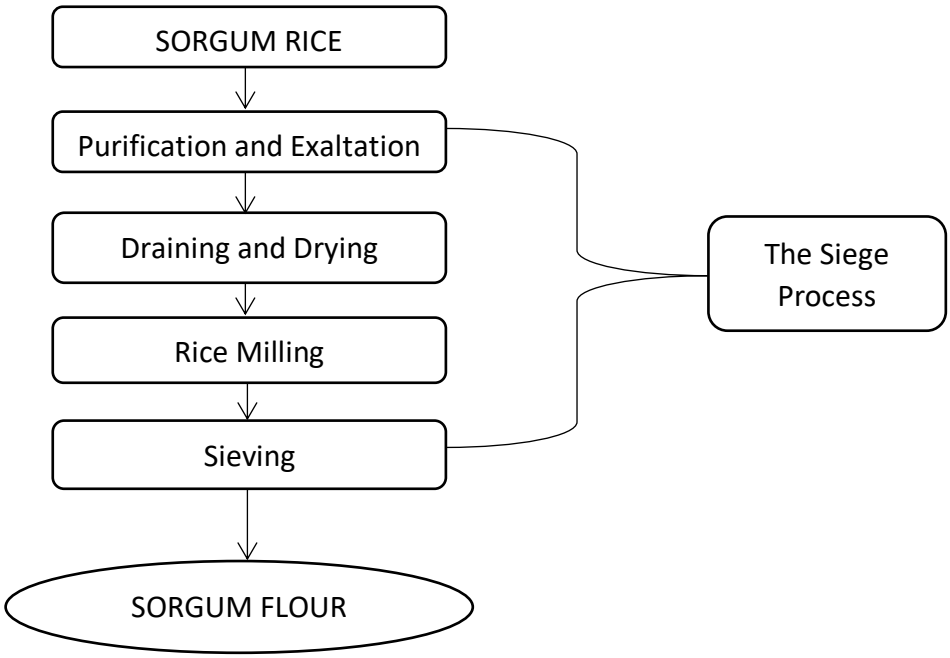

Figure 2. Sorghum flour manufacturing flowchart.

3.2. Advanced research

In this follow-up research, the process of making cookies with the addition of sorghum flour was carried out. The next stage is the process of preparing the ingredients, mixing the ingredients, printing and baking the cookies in the oven for 20 minutes at 1500C. The process of making sorghum flour substitution cookies is done by mixing low protein flour, margarine, butter, baking powder, salt, sugar and eggs. After the stages of making cookies are completed, it will be followed by organoleptic tests on 30 panelists who have agreed to participate in the study. The raw material formula for making cookies can be seen in Table 1.

Table 1. Cookies Raw Material Formula

Material Composition	Grammatical Materials used			
	T1	T2 (50%)	T3 (70%)	T4 (90%)
Flour	200 grams	100 grams	60 grams	20 grams
Sorghum Flour	0 grams	100 grams	140 grams	180 grams
margarine	150 grams	150 grams	150 grams	150 gr
butter	50 grams	50 grams	50 grams	50 gr
Fine granulated sugar	80 grams	80 grams	80 grams	80 gr
Egg yolk	2 items	2 items	2 items	2 items
Baking powder	¼ tsp	¼ tsp	¼ tsp	¼ tsp

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3.2. Organoleptic test

3.2.1. Color

According to Widyanti (2011) Color assessment is a subjective assessment that is the easiest to assess and gives an impression of the panelist's interest in consuming the product offered.

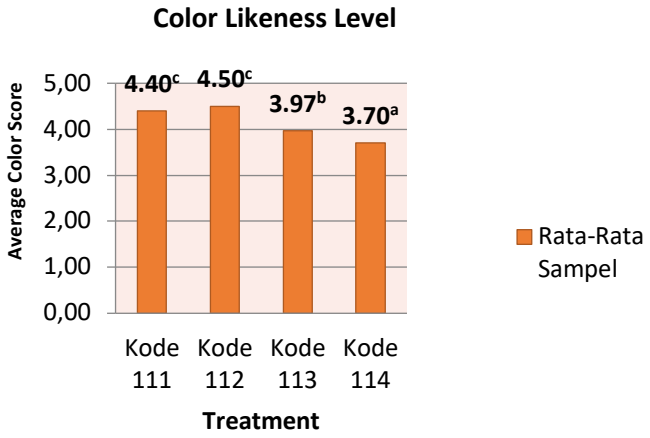

Figure 3. Average color favorite level.

The average preference score for the color value of cookies which can be seen in the picture above shows that the most popular cookie color by consumers is cookies with sample code 112 which is a cookie with 50 percent sorghum flour substitution, namely 4.50. While the control cookies with 100 percent wheat flour treatment were in the second rank, which was 4.40. Cookies with sample code 114 which is a treatment of 90 percent sorghum flour and 10 percent wheat flour get third place with an average value of 3.70. Meanwhile, the final sequence favored by consumers is cookies with sample code 113 which is a treatment of 70 percent sorghum flour and 30 percent wheat flour with a score of 3.97.

The results of the ANOVA analysis showed that sorghum flour substitution had a significant difference to the sorghum cookies color hedonic test ($\alpha = 0.05$) so that it was continued with the Duncan advanced test where the test results showed that there was a significant difference between (cookies code 114, cookies code 112), (cookies code 112), (cookies code 112) 114, cookies code 113), (cookies code 114, cookies code 111), (cookies code 113, cookies code 111) and are not significantly different from (cookies code 111, cookies code 112).

3.2.2. Flavor

Taste assessment is an assessment carried out through the taste buds of the panelists which are divided into 4 types, namely sweet, bitter, sour and salty tastes. Taste is a combination of the constituent ingredients that are in the product. This sense of taste is found in the oral cavity, tongue, and palate (Setyaningsih, et al. 2010).

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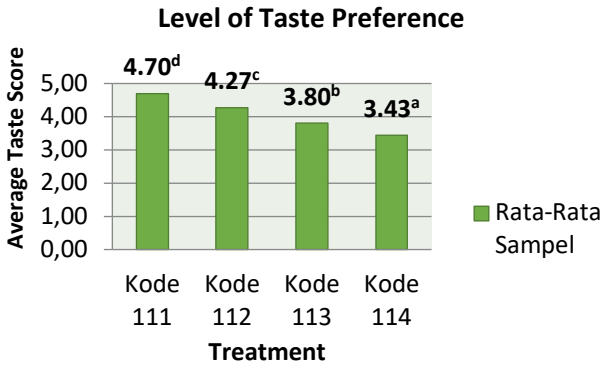

Figure 4. Average level of taste preference.

The average score of consumers' preference for the taste of cookies states that control cookies are the cookies most liked by consumers with an average percentage of 4.70 and is ranked first. Cookies with code 111 (control) are cookies that are processed with 100 percent wheat flour and no added sorghum flour. Cookies with code 112 are ranked second in favor of consumers with an average value of 4.27. Cookies with code 113 are cookies that are made by substituting 70 percent sorghum in the cookie dough and are ranked third in favor of panelists with an average value of 3.80. Meanwhile, cookies with code 114 are in last place, namely 3.43 percent for the level of taste preferences.

The results of the ANOVA analysis are seen from the F Table of Distribution, the F Table value is 0.05, which is 2.71. So it was concluded that F Count > F Table, namely 39.65 > 2.71 stated that the substitution (50%, 70%, and 90%) of sorghum flour in cookies was very significantly different from the organoleptic test of the taste of cookies with sorghum flour substitution (α = 0.05). That way it was continued with the Duncan test and the results were obtainedcookiescodes 114, 113, 112, and 111 are significantly different.

3.2.3. Aroma

Aroma assessment is an assessment carried out using the sense of smell, in this case it is also known as remote tasting. The food industry considers that odor testing is important because it will give results more quickly regarding consumer preferences for a product (Setyaningsih, et al. 2010).

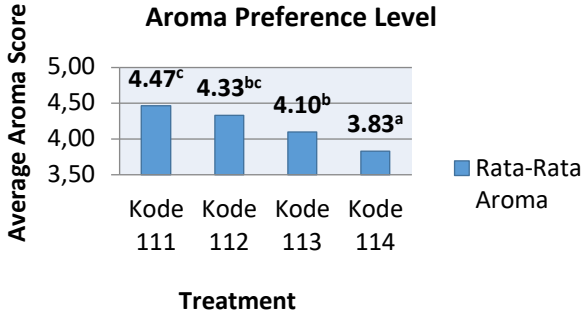

Figure 5. Average level of favorite aroma.

The average score of consumers' preference for the taste of cookies states that control cookies are the cookies most liked by consumers with an average percentage of 4.47 and is ranked first. Cookies with code 111 (control) are cookies that are processed with 100 percent wheat flour and no added sorghum flour. Cookies with code 112 are ranked second in favor

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of consumers with an average value of 4.33. Cookies with code 113 are cookies that are made by substituting 70 percent sorghum in the cookie dough and are ranked third in favor of panelists with an average score of 4.10. Meanwhile, cookies with code 114 are in last place, namely 3.83 percent for the level of preference for aroma.

Results of ANOVA analysis seen from the F Table of Distribution, the value of F Table is 0.05 which is 2.71. So it can be concluded that F Count > F Table, namely 11.2 > 2.71 stated that the substitution (50%, 70%, and 90%) of sorghum flour in cookies differed very significantly from the organoleptic test of aroma cookies substituted for sorghum flour (α = 0.05), then from the results This was followed by Duncan's test and the results were obtained cookies codes 114 and 113 are significantly different, cookies code 114 and 111 are significantly different, cookies code 113 and 112 are not significantly different, cookies code 112 and 111 are not significantly different.

3.2.4. Texture

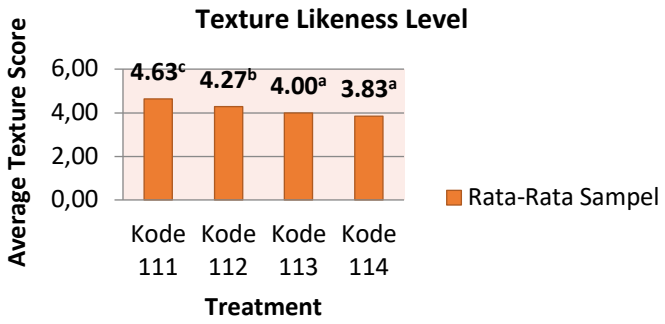

Figure 6. Average level of texture preference.

The average score of consumers' preference for the taste of cookies states that control cookies are the cookies most liked by consumers with an average percentage of 4.63 and is ranked first. Cookies with code 112 are ranked second in favor of consumers with an average value of 4.27. Cookies with code 113 get the third rank which is liked by the panelists with an average value of 4.00. Meanwhile, cookies with code 114 are in last place, namely 3.83 percent for the level of texture preference.

ANOVA test resultsseen from the F Table of Distribution, the value of F Table is 0.05 which is 2.71. So it can be concluded that F Count > F Table, namely 18.25 > 2.71 stated that the substitution (50%, 70%, and 90%) of sorghum flour in cookies was very significantly different from the organoleptic test of texture of cookies with sorghum flour substitution (α = 0.05), so the results This was followed by Duncan's test and the results were obtainedcookiescodes 114 and 113 were not significantly different, cookies coded 114 and 112 were significantly different, cookies coded 114 and 111 were significantly different, and cookies coded 112 and 111 were significantly different.

3.2. Best formulas

Determination of the best substitute cookies is done by ranking test with the percentage method. Based on the ranking test conducted, cookies with 50 percent substitution were the cookies that the panelists were most interested in because they were in second place from control cookies with an average value of 4.34.

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4. CONCLUSION

CookiesT1 with the addition of 50 percent sorghum flour is the best formulation of cookies based on the results of organoleptic tests that have been carried out on 30 panelists. Based on the results of the average percentage of cookies substituting sorghum flour, it was ranked second with an average value of 4.34. Based on the results of the one-way-anova test, it was stated that there were significant differences in terms of the level of preference for color, taste, aroma and texture of sorghum flour substitution cookies (fcount > ftable).

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