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The Effect of Wheat Flour Substitution with Sorghum Flour (Sorghum bicolor, L) on Consumers' Preference Levels for Cookies

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ABSTRACTS

Cookiesor pastries are food products made from flour as basic ingredients which are baked to have a water 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 formulation in 4 treatments, namely 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 a substitution of 50 percent sorghum flour obtained from the mean values of 4.55 control formulations (T0), 4.34 (T1), 3.97 (T2), and 3.70 (T3). 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 a substitution of 50 percent sorghum flour obtained from the mean values of 4.55 control formulations (T0), 4.34 (T1), 3.97 (T2), and 3.70 (T3). 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 a substitution of 50 percent sorghum flour obtained from the mean values of 4.55 control formulations (T0), 4.34 (T1), 3.97 (T2), and 3.70 (T3).

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1. INTRODUCTION

Wheat flour is a semi-finished product that is highly recommended because it is flexible, easy to mix and fortify to improve its nutritional quality, is durable and saves storage and distribution space. According to Choudhury, et al (2015) Wheat flour with low protein content can be used as 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. In addition to being resistant to environmental stresses, sorghum also has a high nutrient content, so it is good for use as a source of food. Every year the productivity of sorghum in Indonesia has increased. In 2007 the productivity of sorghum was 1.79 t/ha, in 2008 it increased to 1.88 t/ha, and in 2009 it reached 2.73 t/ha (Directorate General of Food Crops, 2010).

Sorghum flour is flour derived from sorghum seeds. The process of making flour from cereal materials such as sorghum is similar to the process of making rice flour (Suarni, 2009). According to Suarni (2000), the ability of sorghum to substitute for 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 carbohydrates 70.7 percent; 10.4 percent protein; 3.1 percent fat; fiber 2.0 percent; and energy 329 Cal.

According to Diachanty, et al (2021) in meeting the quality of a product, the main factors that must be considered are indicators of color, taste, aroma and texture values. Organoleptic tests were 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 cookies substituted with sorghum flour.

2. METHODS

2.1. Tools and materials

The materials used in this research are materials for the manufacture of sorghum flour and the manufacture of cookies. Making sorghum flour requires sorghum rice that has been grinded, then for the manufacture of 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 grinding 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 organoleptic tests are white plastic plates, labels, and pens.

2.2. Research Types and Variables

This research is an experimental research which consists 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 further research. The stages of this research can be seen in **Figure 1**.

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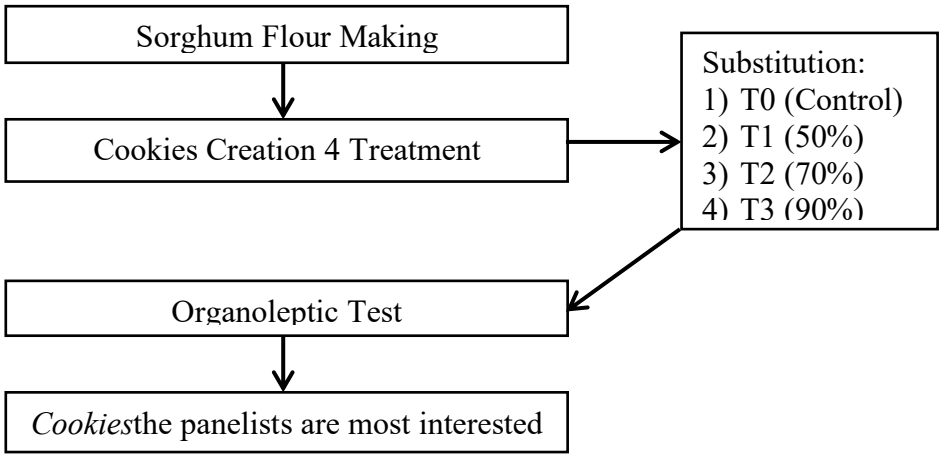

Figure 1. Research Stage Flowchart

2.4. Data Collection Techniques

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

2.5. Data analysis technique

Organoleptic test results data were analyzed descriptively using the percentage of consumer acceptance of the cookies served. The concentration of the best cookies or the ones most accepted by consumers was 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, sorghum flour was made. Sorghum flour is made by grinding the sorghum seeds first and then soaking it in a water ratio of 2:1 from the sorghum seeds. The next stage is to drain and dry at a temperature of 600C or drying in the sun. After the sorghum seeds are dry, it is continued with the grinding stage and then sieved with a size of 80 to 100 mesh (Cahyadi, et al. 2020).

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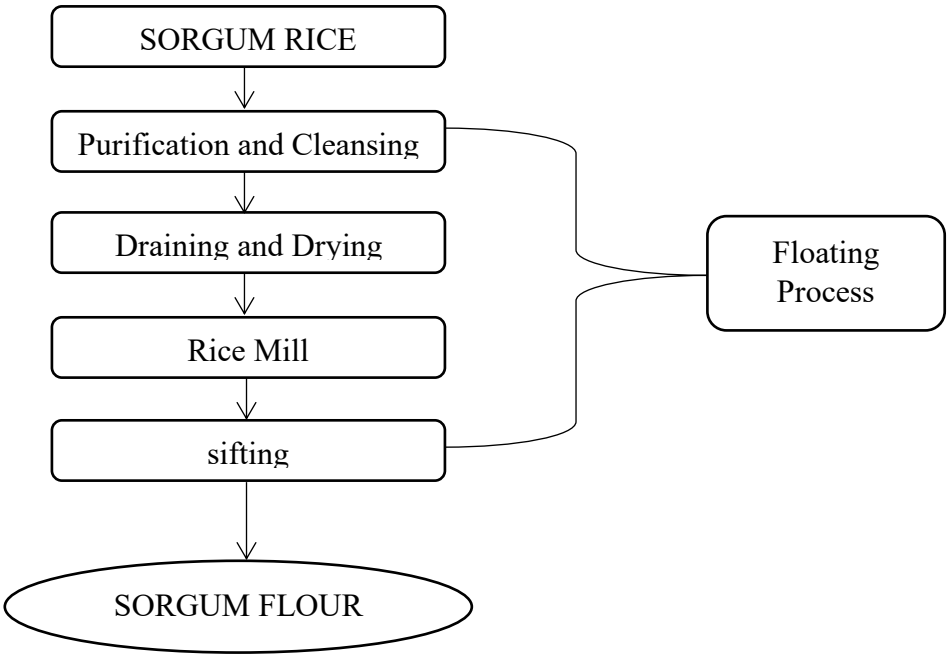

Figure 2. Flowchart of Making Sorghum Flour

3.2. Advanced Research

In this further 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 cookies in the oven for 20 minutes at a temperature of 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 stage of making cookies is complete, it will be continued with organoleptic tests on 30 panelists who are willing to participate in the study. The formula for making cookies can be seen in **Table 1**.

Table 1. Cookies Raw Material Formula

Material Composition	Grammar of 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	tsp	tsp	tsp	tsp

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3.3. Organoleptic Test

3.3.1 Color

According to Widyanti (2011) Color assessment is a subjective assessment that is the easiest to assess and gives an impression on the panelists' interest in consuming the products offered.

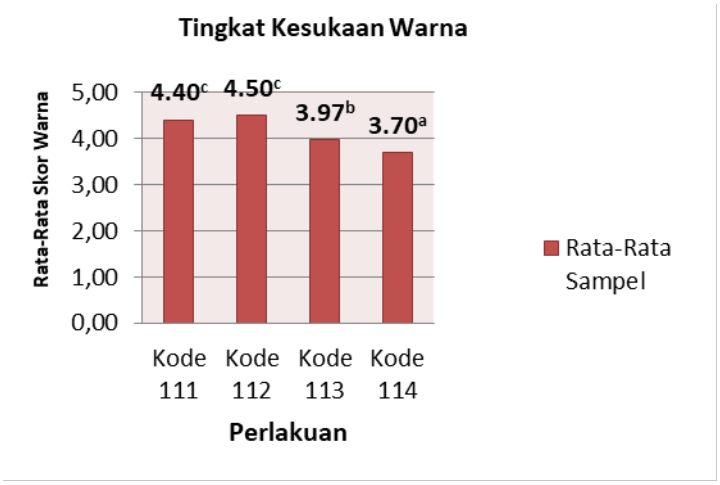

Figure 3. Average Color Likeness

The average preference score for the color value of cookies which can be seen in the picture above shows that the color of cookies that are most favored by consumers are cookies with a sample code of 112 which are cookies with a substitution of 50 percent sorghum flour, which is 4.50. Meanwhile, control cookies with 100% wheat flour treatment were in second place, which was 4.40. Cookies with a sample code of 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. While the last order favored by consumers is cookies with a sample code of 113 which is a treatment of 70 percent sorghum flour and 30 percent wheat flour getting a value of 3.97.

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

3.3.2 Flavor

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

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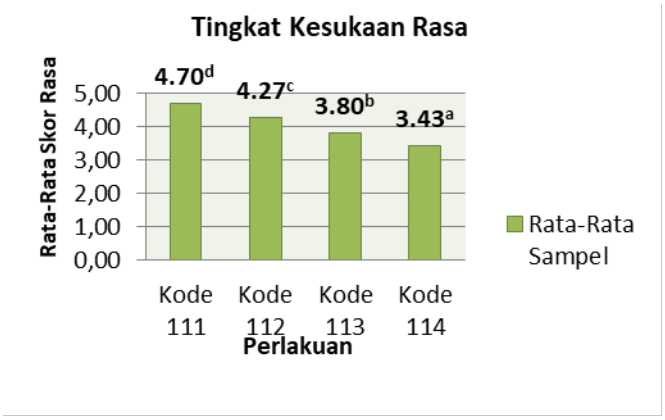

Figure 4. Average Taste Level

The average consumer preference score for the taste of cookies states that control cookies are the most preferred cookies by consumers with an average percentage of 4.70 and are ranked first. Cookies with code 111 (control) are cookies that are processed with 100 percent wheat flour and without the addition of sorghum flour. Cookies with code 112 are in the second rank favored by consumers with the average value obtained is 4.27. Cookies with code 113 are cookies made by substituting 70 percent sorghum in cookie dough and got the third rank favored by panelists with an average value of 3.80. Meanwhile, cookies with code 114 are in the last order, namely 3.43 percent for the level of taste preference.

The results of the ANOVA analysis are seen from the F distribution table, the F table value is 0.05, which is 2.71. So it was concluded that F Count > F Table, 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 for the taste of cookies with sorghum flour substitution (α = 0.05). Thus, it was continued with Duncan's Test and the results were obtainedcookiescodes 114, 113, 112, and 111 are significantly different.

3.3.3 Aroma

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

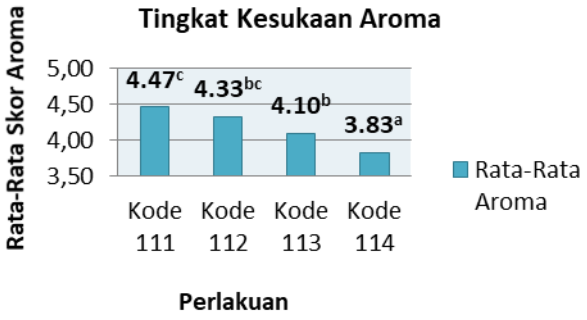

Figure 5. Average Aroma Level

The average score of consumer preference for the taste of cookies states that control cookies are the most preferred cookies by consumers with an average percentage of 4.47 and are ranked first. Cookies with code 111 (control) are cookies that are processed with 100 percent wheat flour and without the addition of sorghum flour. Cookies with code 112 are in the second rank favored by consumers with the average value obtained is 4.33. Cookies with

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code 113 are cookies made by substituting 70 percent sorghum in cookie dough and got the third rank favored by panelists with an average value of 4.10. Meanwhile, cookies with code 114 are in the last order, namely 3.83 percent for the level of aroma preference.

ANOVA, analysis resultsseen from the F distribution table, the value of F table is 0.05 which is 2.71. So it can be concluded that F Count > F Table 11.2 > 2.71 states that the substitution (50%, 70%, and 90%) of sorghum flour in cookies is very significantly different from the organoleptic test of the aroma of cookies substitution of sorghum flour (α = 0.05), so from the results The results were continued with Duncan's test and the results were thatcookiescodes 114 and 113 were significantly different, cookies coded 114 and 111 were significantly different, cookies coded 113 and 112 were not significantly different, cookies coded 112 and 111 were not significantly different.

3.3.4 Texture

Texture assessment is an assessment carried out through touch and touch by panelists. This assessment is very important because it has an important role in the acceptance of food in the mouth (Setyaningsih, et al. 2010).

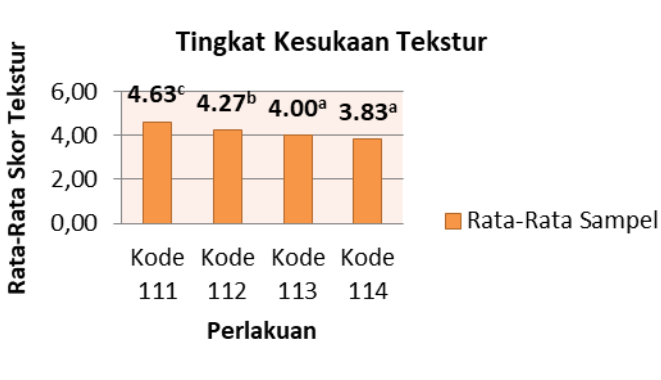

Figure 6. Average Texture Likeness

The average score of consumer preferences for the taste of cookies states that control cookies are the most preferred cookies by consumers with an average percentage of 4.63 and are ranked first. Cookies with code 112 are in the second rank favored by consumers with the average value obtained is 4.27. Cookies with code 113 got the third rank favored by the panelists with an average value of 4.00. Meanwhile, cookies with code 114 are in the last order, namely 3.83 percent for the level of texture preference.

ANOVA test resultsseen from the F distribution table, the value of F table is 0.05 which is 2.71. So it can be concluded that F Count > F Table i.e. 18.25 > 2.71 states that the substitution (50%, 70%, and 90%) of sorghum flour in cookies is very significantly different from the organoleptic test of texture of cookies with sorghum flour substitution (α = 0.05), then with the results The results were continued with Duncan's test and the results were thatcookiescodes 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.

3.3.4 Best Formula

Determination of the best substitution cookies is done by ranking test using the percentage method. Based on the ranking test conducted, 50 percent substitution cookies are the most

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popular cookies by panelists because they are in second place from control cookies with an average value of 4.34.

4. CONCLUSIONS AND SUGGESTIONS

4.1. Conclusion

CookiesT1 with the addition of 50 percent sorghum flour is the cookies with the best formulation 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 substituted with 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 was a significant difference in terms of preference for color, taste, aroma and texture of cookies substituted with sorghum flour (fcount > ftable).

4.2. Suggestion

From the results of the research that has been obtained, it is better to be able to do further research related to the shelf life test and the addition of raw materials to increase the nutritional value of sorghum flour substitution cookies.

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