

Wheat Bran Substitution and Different Soaking Time on Chemical and Organoleptic Quality Chocolate Chip Cookies

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Abstract. Cookies are a popular snack enjoyed by many people. One of the favored cookie types is chocolate chip cookies. Cookies are made from flour, eggs, fat, sugar, water, and salt. Wheat flour itself is made from wheat which has high fiber. The addition of wheat bran in making cookies is considered to be a good source of fiber. So, cookies can be a healthy food. This study aimed to determine the substitution concentration and soaking time on the chemical and organoleptic quality of chocolate chip cookies. The research used a randomized block design with 2 different wheat bran flour concentrations and soaking times of 5, 10, and 25 minutes each. The results showed that the soaking time had no significant effect on the crude fiber content and water content of chocolate chip cookies, but had a very significant effect on the protein content. An organoleptic test based on Friedman showed that the substitution of wheat bran flour and different soaking times significantly affected the parameters of taste, aroma, and mouthfeel. The best treatment was chocolate chip cookies with 25 grams of wheat bran flour substitution and 5 minutes of soaking time with the highest Yield Value (NH) of 0.45 with the criteria of protein content 5.650%, water content 2.352%, crude fiber content 3.287%, taste 4, 09 (like), aroma 3.63 (rather like), mouthfeel 3.44 (rather like).

Keywords: Chocolate Chip Cookies, Wheat Bran Flour, Soaking Time.

1 Introduction

One of the snacks favored by the public is cookies. Cookies can be consumed at any time and are often referred to as snacks. The main ingredients for making cookies consist of flour, sugar, and fat [1]. According to [13], wheat flour results from milling wheat seeds. Wheat flour used in making cookies has a protein of 8-9% [2]

Protein contains fiber, which is good for the body. Lack of fiber can cause obesity due to excessive energy consumption, and it is stored in the form of fat tissue [3]. In maintaining health, dietary fiber functions to control body weight from obesity, manage diabetes, prevent gastrointestinal disease and colon cancer, and reduce blood cholesterol levels to prevent cardiovascular disease [4]

People's fiber consumption is very low these days, so people are starting to switch to functional food. According to [6], foods that are included in functional food are fresh food products, processed food products, and food supplements. Wheat bran is one of the ingredients included in functional food and is high in fiber. Wheat bran has a protein content of 14-18%.

The excellence of these cookies is their high amount of protein and fiber content, which can facilitate digestion, can be a great snack, and taste and texture like regular oatmeal cookies.

2 Research Method

2.1 Material

Materials are used for research on wheat bran, wheat flour, eggs, butter, margarine, and sugar. Materials also used for chemical analysis of the proximate test included Kjeldahl tablets, concentrated H₂SO₄, 40% NaOH, boric acid, methyl red indicator, bromine cresol green indicator, H₂SO₄ 0.01 N, H₂SO₄ 0.3 N, NaOH 1.5 N, HCL 0.3 N, acetone, H₂O, and Aquadest.

2.2 Tool

The tools used in this study consisted of mixers, scales, spoons, bowls, spatulas, pans, ovens, and gas cylinders. The tools used for the chemical analysis of the proximate test include a porcelain cup, crass pliers, triangular wire, analytical balance, oven, busen / stove exicator, electric furnace, 100 cc Kjeldahl flask, Kjeldahl flask heater, measuring cup, 250 cc volumetric flask, 100 Erlenmeyer cc and 1000 cc, fume hood, digestor, Soxhlet flask, reflux condenser, suction Erlenmeyer, Buchner funnel, ashless filter paper (Whatman 54,41 or 541), and spatula.

2.3 Experimental Design

The experimental design used in this study was a completely randomized design (CRD) which was arranged in a factorial manner with 2 factors. Factor 1: concentration of wheat bran flour substitution/A consisting of 2 levels (A1 = 25 gr, and A2 = 50 gr) and factor 2: Soaking time/L consisting of 3 levels (L1 = 5 minutes, L2 = 10 minutes and L3 = 25 minutes). There were 6 treatment combinations. Each treatment was repeated four times. With the same oven time and temperature, as well as the quality of ingredients.

2.4 Chemical Analysis and Organoleptic Test

The chemical parameters measured in this study were crude fiber, moisture, and protein content. Organoleptic tests include mouthfeel, taste, and aroma using 32 panelists with a scale of preference level, namely 1 = dislike, 2 = dislike, 3 = neutral, 4 = like, and 5 = very much like.

2.5 Data Analysis

The parametric data (crude fiber content, water content, protein content) were analyzed using the Analysis of variance / two-way ANOVA using the SPSS application. If the analysis results in a significant and/or very significant difference between treatments, a further 20 tests are conducted using the Least Significant Difference Test (BNT)/Duncan Significant Difference (BNJ)/Duncan depending on the value of the Correlation Coefficient/KK at the confidence level $\alpha = 95\%$. If the KK value is less than 5, use the LSD difference test. If the KK value is between 5-10, use the BNJ different test. And if the KK value is more than 10, then use Duncan's different test [1].

Non-parametric data which includes color, aroma, and mouthfeel organoleptic tests were tested based on the panelist's preference level, to determine whether or not a treatment affected the organoleptic test carried out by the Friedman test [3].

3 Result and Discussion

3.1 Crude Fiber Content

The results of the analysis of variance in crude fiber content stated that the concentration of substitution of wheat bran flour, different soaking times, and their interactions had no significant effect on the crude fiber content of chocolate chip cookies. It is suspected that the concentration interval of wheat bran flour substitution and soaking time was too close.

Table 1. Average Crude Fiber Content (%) of Chocolate Chip Cookies on Wheat Bran Flour Substitution and Different Soaking Times.

Treatment Code	Treatment	Crude Fiber Content (%)
A1L1	Concentration of wheat bran flour 25 gr, Soaking time 5 minutes	3,287
A1L2	Concentration of wheat bran flour 25 gr, Soaking time 15 minutes	3,282
A1L3	Concentration of wheat bran flour 25 gr, Soaking time 25 minutes	3,322
A2L1	Concentration of wheat bran flour 50 gr, Soaking time 5 minutes	3,360
A2L2	Concentration of wheat bran flour 50 gr, Soaking time 15 minutes	3,365
A2L3	Concentration of wheat bran flour 50 gr, Soaking time 25 minutes	3,380

The table above shows that at the same wheat bran flour concentration, the longer the soaking process, the higher the sample's crude fiber content. Likewise, at the same soaking time, the higher the wheat bran flour concentration, the higher the sample's crude fiber content. This is because wheat bran is included in the cereal group which contains quite high fiber [14], [10]. But wheat bran is less desirable, therefore its refinement is assisted by wheat flour.

Crude fiber is a plant fiber that is insoluble in water and its content in food can be used as an index of dietary fiber content. The yield of crude fiber is used as an index of the presence of fiber in foodstuffs because generally there are 0.2 – 0.5 parts of the amount of dietary fiber in crude fiber yields [14], [10].

Crude fiber consists of 20-50% cellulose, 80% hemicellulose, and 50-90% lignin which is not easily soluble in water. The main role of crude fiber in food is to bind water, cellulose, and pectin. Crude fiber is very important in assessing the food ingredients' quality because it is an index that determines the nutritional value of the food [8]. According to SNI chocolate chip cookies, the maximum content of crude fiber is 0.5%, this study has a higher crude fiber content than the applicable.

3.2 Water Content

The analysis of variance in water content stated that the concentration of substitution of wheat bran flour, different soaking times, and their interactions had no significant effect on the moisture content of chocolate chip cookies. It is suspected that the concentration interval of wheat bran flour substitution and soaking time was too close.

Table 2. Average Water Content (%) of Chocolate Chip Cookies on Wheat Bran Flour Substitution and Different Soaking Times

Treatment Code	Treatment	Water Content (%)
A1L1	Concentration of wheat bran flour 25 gr, Soaking time 5 minutes	2,352
A1L2	Concentration of wheat bran flour 25 gr, Soaking time 15 minutes	2,511
A1L3	Concentration of wheat bran flour 25 gr, Soaking time 25 minutes	3,454
A2L1	Concentration of wheat bran flour 50 gr, Soaking time 5 minutes	2,466
A2L2	Concentration of wheat bran flour 50 gr, Soaking time 15 minutes	2,717
A2L3	Concentration of wheat bran flour 50 gr, Soaking time 25 minutes	3,725

The increase in water content is related to the presence of crude fiber content and water activity in chocolate chip cookies. The higher the crude fiber content in the chocolate chip cookies, the more water content in the product will increase. This is because crude fiber has a high ability to bind water. The crude fiber's ability to bind water is related to the presence of water activity in food ingredients, the more water that is bound to the crude fiber, the higher the water content in the material. This is due to the bound water contained in the crude fiber which takes longer to evaporate. [2]. Coarse fiber has a high water absorption capacity due to the large size of the polymer, has a complex structure, and contains many hydroxyl groups that can bind large amounts of water [2]. The cookies have higher water content when wheat bran flour is soaked for 25 minutes compared to 5 minutes, making the test results valid.

3.3 Protein Content

The analysis result of variance in protein content showed that the concentration of wheat bran flour substitution and the interaction of the different soaking times had no significant effect on the protein content of chocolate chip cookies, while the different soaking times had a very significant effect on the protein content of chocolate chip cookies. It is suspected that the concentration interval of wheat bran flour substitution and soaking time was too close.

Table 3. Average Protein Content (%) of Chocolate Chip Cookies on Wheat Bran Flour Substitution and Different Soaking Times.

Treatment Code	Treatment	Protein Content (%)
A1L1	Concentration of wheat bran flour 25 gr, Soaking time 5 minutes	5,650
A1L2	Concentration of wheat bran flour 25 gr, Soaking time 15 minutes	7,288
A1L3	Concentration of wheat bran flour 25 gr, Soaking time 25 minutes	9,582
A2L1	Concentration of wheat bran flour 50 gr, Soaking time 5 minutes	5,903
A2L2	Concentration of wheat bran flour 50 gr, Soaking time 15 minutes	6,879
A2L3	Concentration of wheat bran flour 50 gr, Soaking time 25 minutes	9,207

Samples A1L3 and A2L3 were soaked for 25 minutes in wheat bran flour with concentrations of 25 grams and 50 grams, respectively. The highest protein content was obtained, with 9.582% and 9.207%, respectively. The higher the crude fiber in the product, the higher the protein contained in these cookies. Based on [4] this fiber is made of Arabinosyl (19-25%), Starch (17-29%), Protein (14-18%), Lignin (3%), β -glucans (1-3%), Phytic acid (3-5%), Ferulic acid (0.3-5%). In the flour used for making cookies, the protein content is 8%-9% [5]. The addition of wheat bran flour was deemed excellent for treating the skin, as shown by the following Code of Treatment Protein Content (%) results: A1L1 with a wheat bran flour concentration of 25 gr and soaking time of 5 minutes had a protein content of 5.650; A1L2 with a wheat bran flour concentration of 25 gr and soaking time of 15 minutes had a protein content of 7.288; A1L3 with a wheat bran flour concentration of 25 gr and soaking time of 25 minutes had a protein content of 9.582; A2L1 with a wheat bran flour concentration of 50 gr and soaking time of 5 minutes had a protein content of 5.903; A2L2 with a wheat bran flour concentration of 50 gr and soaking time of 15 minutes had a protein content of 6.879; and A2L3 with a wheat bran flour concentration of 50 gr and soaking time of 25 minutes had a protein content of 9.207. The oats contain high levels of protein, with 26% protein content. This is because the coarse fiber in wheat bran has an important role in the formation of structure, functionally it can increase the value of baking expansion because fiber is hydrophilic. The fiber present in the wheat bran can loosen the intermolecular bonds that water will enter the fiber molecules, resulting in an increase in volume and the development of fiber granules during the product roasting process. As well as the ability of wheat bran fibers to bind water molecules with strong hydrogen bonds can increase the swelling power of the final product [12].

3.4 Taste Organoleptic Test Results

Based on the results presented in Table 4, the optimal taste of chocolate chip cookies was achieved through a substitution of 25 grams of wheat bran flour and a soaking time of 25 minutes, resulting in a taste preference rating of 4.16 from the panelists. In terms of aroma, a soaking time of 15 minutes and a substitution of 25 grams of wheat bran flour produced the highest preference value of 3.75, indicating that the cookies were found to be enjoyable. Lastly, the preferred mouthfeel value of 3.69 was attained through the substitution of 25 grams of wheat bran flour and a soaking time of 25 minutes, signifying that the texture of the cookies was deemed pleasing by the panelists.

Table 4. Average Organoleptic Test Results for Taste, Aroma, and Color of Chocolate Chip Cookies

Treatment		Average taste value	Average aroma value	Average mouthfeel value
Concentration wheat bran substitution (A)	Soaking time (L)			
25 gr (1)	5 minutes (1)	4.09 ^a	3.63 ^{ac}	3.44 ^a
	10 minutes (2)	3.75 ^{ac}	3.75 ^{ac}	3.53 ^a
	25 minutes (3)	4.16 ^a	3.59 ^{ac}	3.69 ^a
50 gr (2)	5 minutes (1)	2.16 ^{bc}	3.25 ^{ab}	3.03 ^{ac}
	10 minutes (2)	2.75 ^b	3.25 ^{ab}	2.66 ^{bc}
	25 minutes (3)	3.09 ^{bc}	3.34 ^{ab}	2.97 ^{ac}

3.5 Taste Organoleptic Test Result

The taste of a product determines the level of consumer and panelist acceptance. The results of the Friedman test showed that the value of $p = 0.00 < \alpha = 0.05$ indicated that the taste value was significantly different between each treatment. Differences in the concentration of wheat bran flour substitution and soaking time affected the organoleptic taste of chocolate chip cookies as assessed by the panelists. The taste of chocolate chip cookies depends on how long wheat bran is soaked and how much water is used to soften it. As a result, the taste of the epidermis is not too prominent, just like oatmeal cookies in general. When connected with the quality requirements for chocolate chip cookies based on SNI stipulated by the Indonesian National Agency No. 01-2973- 2011, the resulting chocolate chip cookie taste with a value of 4.16 (likes) is still stated to be by the quality of cookies, which is a normal typical of cookies.

3.6 Aroma Organoleptic Test Results

Based on the data above, a soaking time of 15 minutes and a substitution concentration of 25 grams gave the highest preference value for the aroma of 3.75, which means that chocolate chip cookies were preferred by the panelists whilst the concentration of 50 grams with 5 minutes and 15 minutes soaking time gave the lowest preference value of 3.25.

The aroma of a product determines the level of consumer and panelist acceptance. The results of the Friedman test showed that the value of $p = 0.00 < \alpha = 0.05$ indicated that the aroma value was significantly different between each treatment. Differences in the concentration of wheat bran flour substitution and soaking time affected the level of panelist acceptance of the chocolate chip cookies' organoleptic aroma. The difference in the aroma is still considered somewhat liked by the people. The unpleasant smell of wheat bran is still acceptable to some people. When connected with the quality requirements for chocolate chip cookies based on SNI stipulated by the Indonesian National Agency No. 01-2973- 2011, the resulting chocolate chip cookie aroma with a value of 3.75 (rather preferred) is still stated to be by the quality of chocolate chip cookies.

3.7 Mouthfeel Organoleptic Test Result

Based on the data, the substitution concentration of 25 grams of wheat bran flour and 25 minutes of soaking time gave the highest mouthfeel preference value of 3.69, which means that chocolate chip cookies were considered neutral by the panelists, whilst the treatment of 50 grams of wheat bran flour substitution concentration and soaking time of 15 minutes gave the lowest score of 2.66 which means that chocolate chip cookies were disliked by the panelists.

The mouthfeel of a product determines the level of consumer and panelist acceptance. The results of the Friedman test showed that the value of $p = 0.00 < \alpha = 0.05$ indicated that the value of mouthfeel was significantly different between each treatment. Differences in the concentration of wheat bran flour substitution and soaking time affected the level of panelist acceptance of the organoleptic mouthfeel of chocolate chip cookies. The difference in the mouthfeel of the chocolate chip cookies is still considered somewhat liked by the panelists. When connected with the quality requirements for chocolate chip cookies based on SNI stipulated by the Indonesian National Agency No. 01-2973- 2011, the resulting mouthfeel of chocolate chip cookies with a value of 3.69 (rather preferred) is still stated according to the quality of cookies.

3.8 Effectiveness Test Results

The results of the effectiveness test on all research parameters are presented in Table 5 below.

Table 5. The Value of the Effectiveness Test Results on the Research Parameters

No	Parameter	Quality	Result Value (NH) Treatment					
			A1L1	A1L2	A1L3	A2L1	A2L2	A2L3
1.	Coarse Fiber	9	0,09	0,05	0,02	0,04	0,00	0,00
2.	Water	9	0,11	0,13	0,17	0,14	0,15	0,17
3.	Mouth eel	9	0,06	0,04	0,01	0,03	0	0
4.	Aroma	8	0	0	0,00	0	0,00	0,02
5.	Taste	8	0,05	0,03	0	0,04	0,03	0,01
6.	Protein	7	0,14	0,14	0,14	0,14	0,14	0,14
Total		50	0,45	0,38	0,35	0,39	0,33	0,34

The table shows that the treatment with the concentration of 25 grams of wheat bran flour substitution and 5 minutes of soaking time with the treatment code (A1L1) is the best treatment with the highest Yield Value (NH), namely 0.45 with the criteria for protein content 5.650%, moisture content 2.352%, crude fiber content 3.287%, taste 4.09 (like), aroma 3.63 (rather like), mouthfeel 3.44 (rather like).

4 Conclusion

The results of the research on the Substitution of Wheat Flour and the Different Soaking Times on the Chemical and Organoleptic Quality of Chocolate chip Cookies can be concluded as follows:

- a. There was no correlation between wheat bran flour substitution and soaking time on chemical quality, whereas there was a correlation between wheat bran flour substitution and soaking time on chocolate chip cookie organoleptic.
- b. The best treatment obtained from the results of the study, namely the concentration of 25 grams of wheat bran flour substitution and 5 minutes of soaking time with the treatment code A1L1. The treatment has the highest Yield Value (NH) of 0.45 with the criteria of 5.650% protein content, water 2.352%, crude fiber content 3.287%, taste 4.09 (like), aroma 3.63 (rather like), and mouthfeel 3.44 (rather like).

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